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GLOBAL CHALLENGES TO DEVELOPMENT: AN ANALYSIS OF THE STRATEGIC INTEREST OF THE UNITED STATES IN SOUTH ASIA

Vibusha K. Madanayake¹, Kulani Wijayabahu²

ABSTRACT

This research intends to rethink the United States Defense Strategy towards South Asia after September 2001 terrorist attack to find out whether it was to combat terrorism as stipulated in US Documents or whether it had and continue to have other intentions. It was hypothesized that, the policy of the US was a complex item comprised of diverse objectives and emotions, although the declared policy was the prevention of terrorism. The method of the research was qualitative, multifaceted and ethnographic. In the process, the researcher made an interaction with the interviewees graded into their coverage and such information were juxtaposed against the documentary data available in relevant statistical analysis and literature review. The latter part of this research presents the relevant interventions and defense action that followed. Most international critics are of opinion that, the intervention in Afghanistan was not intended, only for combating terrorism. Rather, it was a strategic operation by the USA to expand their power in South Asia. Although, there were contradictions between preventing terrorist activities and promoting development simultaneously, this activity was in operation until today. Whenever the US felt that their interests were at risk, US policies became more aggressive. The world in the domain of International Relations is growing towards multi-polarity. The US and other super powers are in competition for power in order to preserve their own hegemonies. Applying currently accepted theories did not explain these complex motives. This research has traced the historical path of it

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implementation and presented the data that substantiate the hypothesis which indicate to the multiple nature of the intervention into South Asia. Some of the intentions do deem long term. In this way, this research has found that extending the political hegemony of continuing Super Power control in South Asia and, the parallel structural adjustment to capitalism as the world's economic ideology. This research has found that Political Equality, Social Opportunity, Economic Liberty, Acceptance of Human Rights for Self-advancement and Self-actualization were a part of the undeclared ideological change expected by the US in its broader objectives. This rethinking and reinterpretation of the US defense strategy over South Asia is very much relevant to policy makers of Sri Lanka.

Key Words: *Foreign Policy, Terrorism, Military Strategy, Hegemony, Globalization*

INTRODUCTION

Many International Relations scholars who investigated into this phenomenon of the modern world observed the US policy of 'War on Terror' in 2001 mainly concentrated upon the military strategy and its related documents such as National Security Strategy, 2015. This military strategy was associated with the objective of the development of South Asian Region in the political and the economic, social and psychological domains. Obviously their interests were to secure, a hold on Asia against the impact of globalization that had become dominant in the affairs of the world. (Stern, 2009) The current researcher looks at the behavior of super powers in a broader perspective than did theory explain the phenomenon which took place after Westphalia. The globalization converted the world into a village. A village meant that the world became a community where its members got close to each other almost brushing their shoulders together. This was the first time that it happened in the history of the world and different ideologies of cultures merged.

Historically, the world was evolving into a globe which was possible to be looked as a close-up network of relationships. Nationalism was being challenged through the global expansion of modernist education. Modernism became an ideology through a variety of agencies of communication, media, schools, non-formal relationships and formal institutional, international organizations. Development became the criterion of measurement to justify intervention in the politics of another country. Science and technology had facilitated this path towards the future. Being so, the super power objectives of the US necessarily adds to include the development of the countries they are interfering with, namely South Asia. These countries boarded the Indian Ocean. The coastlines of these countries were important for access to the Indian Ocean. By implication, it was the Indian Ocean that US was interested in. This was clearly seen in the declared policy objective of the US into these countries.

However, South Asia was not geographically integrated region; nor political, historical or cultural region. The different nation states that surfaced out after the Second World War were super power creations. For example, India as a currently functional nation state did not exist as a polity nor did Pakistan or Bangladesh previous to the post war super power military interventions. It is the perception of this scenario that prompted the researcher to inquire further through empirical supplications. The body of this research presented is an attempt to find an answer for this argument.

METHODOLOGY

The proposed hypothesis to be tested called for a multiple approach to data gathering and theorizing. This way the instruments adapted were multifaceted, subject area comprised of two distinct separate domains. That is “international

relations as a science” on one side and the applications of it technologically as Foreign Policy in scholarly perspective. The nature of International Relations in the new world global system had to be understood by application of currently prevailing theory. E.g. Offense Defense Theory and Hegemonic Stability Theory

On the other side, it is the policy factor in international relationships. These relationships are culture bound and are influenced by constructivist ideologies. Right from the beginning of human evolution the element of using the brain by humans dominated behavior which was understood as the ‘human’. In Russell’s perspective, it was do of things as different from how of things (Russell, 1918) It is this mix up of how of things with that of the do’s that demanded a method different from clearly compartmentalized in social science methodologies. This approach also carries the characteristic of an interdisciplinary study. Patti lather points out that all human behaviors are interpretative in research analysis and practically applicable for social change. This means that, developing insights from an ethnographic perspective is meaningful to understanding policy formulation. Marx and Engels once criticized all traditional research as meaningless if such research do not promote development to improve the lot of humankind. They brought in the example of male breasts as useless in for research. Research should tie up with policy formulation if it is to achieve the objective of improving living conditions. It is in this context this research used the viewpoints of Nation’s citizen who hold ideas about how nations should relate with other nations. The interviews conducted fulfilled this objective and made this research a combined effort in using substantiate empirical data in a methodological process of policy formulation. Policies are pre meditated and prior to implementation. In similar vein, Carr and Kemmis 1986 states that, research is meaningless unless it opens the door for policy implementation – policy based on theory. International Relations are the practical expression of policy

on one hand. On the other side, the discipline of International Relations believes in a science based approach and attempts to discover propensities, probabilities and tendencies in human behavior when involved in policy construction. This is the major complication in methodology that this research highlights and is faced with.

The idea and the concept of South Asia need explanation. What exist today in South Asia is not what it was right after the Second World War. An unexpected change occurred on the idea and the concept of South Asia. The South Asia at that time was a just a geographical reference when focusing attention on the Indian Ocean dominantly in relation to military strategies. However today, South Asia is a loosely knit community with both fission and fusion in relation to social and political change occurring in this geographical region. It had gone through a period of mooting for political and social regionality concerned with a variety of problems faced by this newly sprung independent Nation States. The background of South Asia is very different from that of the European Community. The South Asian region is evolving and is in massive social change. Exploring to understand the political and economic behavior of this region has to be within a methodology which will expose the researcher to hitherto unseen realities.

Taking into consideration this effect of globalization on international relations feature the researcher had to probe into viewpoints of previous scholars who researched on this area. It is with this objective the second part of the methodology developed insights by making ethnographic interviews at meeting the members of the citizenry at different levels and specializations.

DISCUSSION AND FINDINGS

The data gathered to arrive at the discussion of US policy for development meets with number of important challenges. South Asia of the present day thinking is very different from what was left in the hands of the super powers from the end of the European conflict among western nations generally referred to as end of the Second World War. An accelerated process of globalization occurred all over the world and International Relations between Nation States underwent consequential change. When taking into consideration, the result of nations getting closer was a significant factor that caused a challenge. The second was the problem of under-development stagnation and social change due to continuation and construction of traditionalism as against what these societies can achieve as modernity in the new world. Structural adjustments required to adapt into the capitalist economic system is not clearly visible and is a confused picture. International Globalization is a new phenomenon without preexisting models for application to understand how development takes place. One major factor is that research should refer to the moves taken up by the US to prevent the expansion of terrorism into this region. development takes place. One major factor is that research should refer to the moves taken up by the US to prevent the expansion of terrorism into this region. South Asia as a region bordering the Indian Ocean is complex and does not lend itself to analysis as a living community. In the historical process what we see as US interest is the prevention of terrorism within the Asian countries that border around the Indian Ocean. This is a major challenge posed against the development of these countries. Military strategies refer to the activities in operation within the Indian Ocean. These countries are generally referred to as South Asia. However, these countries exclude the African coastline which also borders the Indian Ocean.

This indicates that, US focus on the Indian Ocean is from the Asian side. Given this condition it appears that, what interests US is the region which is the sea line that opens into Asia.

The US policy of the Containment of the Chinese Power

Currently the US is at the crossroads with Asia. New situations arose after the Second World War and the conditions that existed at that time have changed. Structurally enemies to capitalism that existed in Asia at that time, is no more for now. The US still holds its hegemony. The strategies in the military areas in Asia have to be held with great care. Within Asia the possibility of spreading Soviet Communism or even Trotskyism seems diminished. Within the victorious capitalism, The US sees number of enemies. These enemies are openly diplomatic and are in constant contact with in trade and finance with US itself. But US Foreign Policy at the present moment is ambiguous. It is because of the suspicion that China may grow into a major power in Asia in the near future. In this context, the US fears that, China may control the economy in Asia. It is a complex condition on which US is trying hard to develop strategies to avert this catastrophe for US hegemony in Asia.

The US stand of their policy attitude was mooted in many media and otherwise discussions. The string of pearls strategy is a geo political interpretation of Chinese potential intentions in Asia. It refers to the network of Chinese economic facilities and relationships along its sea lines of communication. This term was originally coined by US scholars themselves to account for China's projected strategies. (Marantidou, 2014) As the map below indicates 'pearls' are widespread from the Strait of Hormuz to Strait of Malacca. The International Relations experts explains this as a purely commercial strategy of China towards South Asia funded and supported by China such as Gwadar Pakistan, Hambantota Sri Lanka, Chittagong

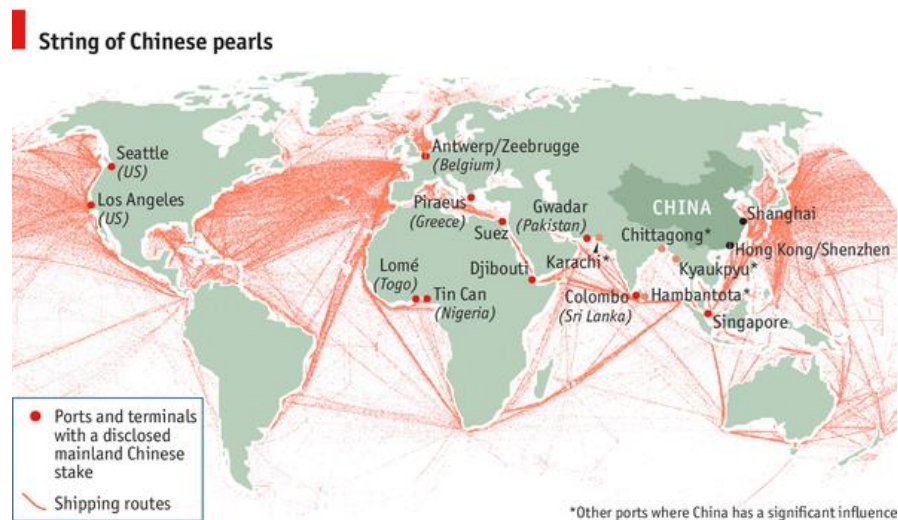
Bangladesh, Sittwe Myanmar and Maroa Maldives. In response to this, trade activity the US Obama Administration 2012 started a strategy called ‘Pivot to Asia’. According to this policy, the US experts to strengthen its ties with Asian states with the objective of gradually promoting Chinese expansion (Campbell and Andrews, 2013).

In this policy, the US intends to tighten their bonds with India and Pakistan. However, India is a country which conflicted with China regarding the border disputes. Alongside, US had long history of friendship with Pakistan. These two countries despite their friendships with US are having serious conflict regarding their borders. The research at an interview with an independent scholar by name Chapa Bandara stated that “enemy’s enemy is a friend”. This way he explains why US is friendly with both Pakistan and India, but separately. Other scholars interviewed hold different views. Some say that, US strategy is to contain China against Chinese expansion and maintain their continuity in economic hegemony.

According to the way how some scholars interpret the Chinese perspective, the China containment policy is controversial. Donald J Triumph 2016 competing for US presidency is of the stand that, “The US is not having any rivalry or competition with China. And the US considers China as the major economic partner to them”. The US intellectual and political elites are not agreed and present confused stand points regarding what policy US should adopt. There is a considerable support to Triumph 2016 to view China as a partner to them. The attitudes are mixed with party politics and election programs. According to public citizens’ viewpoint in Sri Lanka, which is an important South Asian country the researcher found out through questionnaires that nearly 56% held a partial view towards Chinese intervention in Sri Lanka. However, it was also found out that, nearly 90% of Sri Lankans

appreciated the American values and life styles. A fewer percentage about 20% believe that, both China and US interested in naval foot holding Sri Lanka because of the value of Singapore and Sri Lanka's strategic position command in out into Indian Ocean.

Map 1. Chinese Strategy of String of Pearls



Source: Clint, J. S. 2015, April 5. What is the String of Pearls theory? [Map] quora. Retrieved from <https://www.quora.com/What-is-the-String-of-Pearls-theory-1>

According to the below table, it is very clear that, China's economic relationship is important to any country which communicates with China. China represents the biggest share of the US market. In practice, US and China can be interpreted as partners on one hand, US scientific knowledge developing academic and research institutions is important to maintain Chinese trade all over the world. Findings in

modern science are difficult to be kept secret. The new technologies arising out of science can be copied bought over and spy systems can collect information needed to develop modern ways of replacing the old. Given this condition, technological objectives are linked with economic and hegemonic

interests of nations. National interest was justified within accepted principles of peace, cooperation and fairness in trade transactions.

Table 1. Value of Trade among US-China-India

Year	India-China Trade	India-U.S. Trade	U.S.-China Trade
2013	68,052	96,749	616,542
2012	68,869	93,794	585,071
2011	72,201	87,150	546,293
2010	58,689	74,048	492,294
2009	40,983	60,015	395,130
2008	41,680	66,430	437,696
2007	34,068	57,884	412,223
2006	23,468	45,344	364,776
2005	17,351	36,880	302,129
2004	10,150	28,920	245,842
2003	6,182	23,930	191,755
2002	4,152	21,002	158,145
2001	2,751	18,551	130,918
2000	2,212	19,084	124,897

Source; Bureau of Economic Analysis, US Department of Commerce, (May 2015).
Retrieved from <https://www.bea.gov/international/factsheet/>

Strategic Interest over Resources and Trade

The globalization process in the world, given the prevailing conditions, a new community is emerging for the world. The United Nations established alongside the globalization process was a challenge to many nation states. The challenge was in terms of how the super powers thought about the world. The super powers thought that world peace should be established through outright intervention into warring nations. This was indeed a challenge because behaviorally globalization meant working together considering each nation a complete national identity. Alongside, their developed with globalization the spread of political liberalization. The new ideologues developed a viewpoint that capitalism can lead to nazist authoritarianism or uncontrolled despotism.

The idea of liberalism introduced the thought that human identities are global and carry common affinities and attributes. Human beings are equal against nationalities in which race, religion and language currently dominate. This is a major challenge that the super powers face at intervention into other nations.

Given this condition, political views have to be examined against the way the resource of the world developed and traded in the common interest of human beings. It is this factor that leads US to define their intervention in Asia as an intervention to promote development. The 19th century did not evince any intellectual debate on development and the development was not included in reasons for intervention in other countries. Political institutions of the time did not double with the issue of development. It is with the logic of United Nations that introduced the development ideology and the development decades thereof. In consequence, any intervention by super powers was labeled as the development intervention. US Aid was conceived as help to develop and humanitarian because the under developed world needed humanitarian assistance almost all the time. Development has to do with resource and trade. US intervention in South Asian countries came to be defined as development interventions. This paper analyzes the US strategic military intervention in Indian Ocean in terms of the development objective. The experience of the two great world wars made the US elite think that it could bring continuing peace to the world.

The stipulated objective of combating terrorism implied that under development can cause terrorism. This strategy indeed carried strong element of US Aid PL 480, scholarships, and other forms of aid in large amounts intending that it could prevent terrorism by giving a hand to government development programs. American policy supported large NGO activities which helped in the development approved by the government. In different countries such programs had different names and had different departments

for their implementation. Each country had development programs through which these NGOs operated. However, this development approach has been revised and improved according to experience and evaluations made annually to find out whether the objectives have been achieved.

According to the viewpoint of a distinguished diplomat interviewed on 28th April 2016 stated that, “The United States more strategic and careful when it wants to manage contending powers like Indian and Pakistan. Both states are equally important for the US economy”. According to another viewpoint of a journalist by name Vijaya Dissanayake on 29th April 2016, “There is an economic motive of every action of the US. The invasion of Afghanistan was also part of the economic game. It is a large scale economic, political and strategic program. The main objective of this strategy is oil, in other words energy”. He refers to most of the wars after 1990 as Energy Wars. Energy today indeed plays a key role in international politics. The researcher finds that “Resource Politics” in South Asia as oil politics in the manner it happens in West Asia. A question is raised by the research as to whether South Asian countries agree with the continual strengthening of the military strategy in definitely. Currently available research has not this as of date.

Establishing Democracy and Human Rights

Democratic government is the major value emphasize in the US Foreign Policy. The US always calls for a high level of peoples' representation in the government. This is within the boundaries of the principles such as representative governments, public opinion, the constitution, ideology and education. Education is a technique to achieve this objective is given prominence by theoreticians. They emphasized values as equality, liberty and human rights. The US accepts the UN charter to respect the right of sovereignty in all states. However, if any state challenges on international peace and security, a super power may intervene and openly negotiate with the UN. The major states that hold the right to veto in the Security Council have often resorted to interventions. The veto has functioned as a rescue ground for the institution to continue even if other members' descent.

This facility is developmental for new attitudes to grow institutions must change and adopt because of this condition one can be very hopeful about the growth of these values through continued negotiation and application.

However, in the case of Sri Lanka some of the scholars, journalists and experts were not in the agreement with US intervention in the war partial to the terrorists. At the beginning they extended military training and strategic assistance to the government of Sri Lanka. However, around the time ending the war US supported diasporic and Indian intervention for a separate state within a vaguely defined sovereignty. At the beginning the US CIA was of view that the LTTE were one of the most dangerous and anti-social terrorist organization. Subsequently US changed its approach and demanded the safe extradition of the terrorist leader into their custody. Sri Lankan government was blamed for war crimes. The UNHRC is still of the view that Sri Lanka is guilty of war crimes

The research has not met with any data to conclude either view point. This situation has arisen because globalization has setting in motion a machine where information is made available to any interested person. The satellite system can provide operations to check and follow many things that happen on the ground. Media organizations covering detail every inch of the globe and keep watch on what's happening. However, it is not possible to prevent nation states or super powers using these machines to distort actual happenings. Against this picture of using modern technology super powers are capable of achieving public support to whatever intention they have in mind.

Running parallel to this, the publicity given to liberalism and economic equality these ideologies carry unresolved conflicts within defective institutions which have not been revised in accordance with new values as representative government. The question remains unanswered and that is, "has the institutions being revised in accordance with the new ideologies maximizing public representation?" This calls for evolutionary changes and this is another instance where globalization is making a demand on traditional institutions. US political institutions were created for internal government in 1776. It followed the principle 'no taxation without representation'. But over time taxes grew but not representation. The constitution stalwartly safeguarded the initial kind of representation with which US government began. The globalization process rationally and empirically has made the world a small place and have emphasized on the unity of the human identity as the characteristic global citizenship. There is in this process and undercurrent of humanity as a political value. This factor is definitely a challenge faced by the super powers or any power who wants to act in their own national interest. More globalization can surface this undercurrent and be a major challenge to 'national interest'.

Preventing Nuclear War and Inter-State Conflicts

According to recent statistics, it is reported that India has 100-120 nuclear warheads. Pakistan has 110-130 (Kronstadt, 2004) The US continually tried to convince both India and Pakistan to join the Nuclear Proliferation Treaty. This happened both within Clinton's administration and after. The US set forth non-proliferation benchmarks for Pakistan and India including the halting of any further nuclear testing. US also called for the Comprehensive Test ban Treaty (CTBT) halting the production of fissile material. A treaty for the control of fissile material is being negotiated. However, neither Pakistan nor India are signatories in CTBT opposed to this point of view. The reason for this criticism is that, US does not make a special effort to redeem conflicts between nations and an element of 'divide and rule' exist hidden behind US policy. While the US believes in world peace, it comes in conflict with the interest of the US at economic benefit. What is foremost in their South Asian activities are economic interest. It is an ambiguity. One cannot forget the fact that US could be interpreted as keeping South Asia within its national conflicts, interstate conflicts or under-development. What we see as the US Foreign Policy in South Asia, is to sustain South Asia within its conflicts and underdevelopment and in turn eventually swell their own hegemonic power. Asia is only one part of the globe and US can feel that Asia will not pose a threat to their hegemonic power. It is within this context that, we can arrive at a conclusion of this research.

CONCLUSION

Working for the defense and the protection of national interest is achieved in international relations by using multiple methods like the military, diplomacy intrigue, negotiation, persuasion etc. Militaristic methods are traditionally divided into two categories Defense and Offense. In practice and in historical

process, these activities are organized into the overall strategy of conducting statecraft. Nevertheless, if the overall defense strategy dominates, it also is a continuing readiness for war. It can contradict the rational national interest of the state which is the individual citizen. The world has come to a stage where the individual citizen is a key focus of all liberal political action, not only political action, but also the action of the international society, its community and the ultimate ideology of human progress. This is the dilemma that this research faced at concluding the observations made, and the insights that surface from it. The super power conflict and its methodology of hegemonic dominance are confusing. The US is one of the super powers interested in the Asian sea line.

At the beginning of the research, it was hypothesized that the declared objective of interfering in South Asia was an internationally impressive purpose. That was “combating terrorism”. However, after covering considerable area of accessible literature on the subject it was concluded that, the policy of combating terrorism or its activity may and could extend over the declared demarcation. It appears that US policy goes beyond combating terrorism. It does not mean that, US policy had hidden agenda with not so pleasant a flavor to the world community. ‘War against terrorism’ was instituted during the time of the president Bush. There was very little difference in this policy with the coming of President Obama. However, during the time of Clinton, in the previous time of presidency there was a difference. There were a signs of openness and willingness to negotiate during the time of Clinton. But, overall strategies of foreign policy were similar. This could be seen at each historical context of changing governments and difference in trade patterns and economic crisis.

Today, the world is in an accelerated process of International Globalization. This is a challenge that the history of the world of traditional directions face

as impediments to progress. A challenge carries obstacles wayward circumlocutions and confusion. This research surfaced out some of these manifestations of globalization. The researcher finds a need for a paradigm shift (Khun, 1962) to explain the phenomenon of these new emerging changes. US Defense Strategy in Asia meets with this challenge. US called their strategy a development aid for Asia. But, the proximity of men, women, children and nation in one whole under the process of Globalization disturb this scenario. The world is something like what a village was in traditional society. In the traditional societies of the past, and its continuing legacies into the 21st century, it is this village which possess this challenge. Development demands the transference into modernity from the vestiges of traditions that lay widespread in Asia. Globalization has created this new community which needs new structures of effective democratization, liberal economic and social equality. In this context, research raises a question. That is, “What has the super power done to make this new community democratic?” US has given a number of aid programs like US Aid, PL 480, concessions on wheat, milk etc. But, it is yet to find out, whether US strategies concentrated sufficiently to install a major attitudinal change to promote a spirit of sustainable development. Theoreticians believe that, the world will realize that if the producers are to sustain they will have to satisfy the consumer.

Unless they satisfy the consumer, the development of democracy and effective representation can overthrow the ruling elites. The ruling elites of USA are capitalists comprising those who dabble in maximizing profits. Globalization has brought in a social circumstance where everybody in the world can meet, will meet and strive to achieve more and more representation of common interest. Common interests reflect the wishes of the individual.

The individual is the global person who is a liberal, rational and empirical personality of world citizenship. They get together every day and get closer

and closer in their dealings. Getting together, they will be more and more powerful and constrain the directions of foreign policy in their interest. This can cause a major obstacle to super power intervention in South Asia. This is a major challenge from international globalization.

The researcher as a member of a South Asian country finds meaning in inquiring into this topic area. It should finally justify the way how it contributes to Foreign Policy. Foreign Policy today in this modern world affects almost everyone in the international community. Humanity is the total coverage of this foreign policy. Sri Lanka as one of the South Asian countries is relevant to this issue of US Strategy in Asia. More and more data can help produce a fruitful and active public interest and there by contribute to a public viewpoint basing on the realities discovered by the research. Public opinion can intern influence policy making at the level of political elites currently operating in Sri Lanka.

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USE OF INTERNET OF THINGS (IOT) FOR THE PEOPLE WITH DISABILITIES: A SRI LANKAN CASE STUDY

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ABSTRACT

Human with different form of disabilities and in specifically people who are working with the impairment are not having equal opportunities to accessing benefits compare to the non-disabled population in the world and it is common for Sri Lankan disabled community .Disability among young generation is high in Sri Lanka. The main reason for this cause is until the year 2009 Sri Lanka had 30 years of humanitarian operations in the country. Most of them were permanently disabled while working in the National security forces in the country. Though the authorized governing body of the Information Communication Technology (ICT) in the country which is, Information Communication Technology Agency (ICTA), develops infrastructure and facilities increases the country digital literacy rate but according to the preliminary research study statistically prove that still disabled community experiences difficulties in use of technology. This issue is known as the disability digital divide. The objective of this study is to overcome the difficulties faced by blind or visually impaired community in Sri Lanka using Internet of things (IOT) concept. The study is basically consisting with two phases. In the first phase of the study examined the current technology adaption among the differently abled community in Sri Lanka and problems faced by them. The second phase examines how the modern new technologies such as Internet of things (IoT) successfully solving the issues in globally and develop a model to overcome the Sri Lankan disability digital divide. First phase of these study two set of samples were interviewed to identify the current disability digital divide in the country. Initially 314 participants were interviewed and in the second set of communities,

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different disabled categories and different geographical locations. Findings indicated that basic level ICT technologies used by the differently abled community are low. For this purpose, the proposed architecture through the Internet of Things (IoT) is introduced. Different application scenarios are considered in order to illustrate the interaction of the components of the Internet of Things. Findings indicated that Network layer, Application layer and Presentation layer considerations are need to be importance to overcome the disability digital divide as a holistic model to overcome the disability digital divide in the country.

Key Words: *Digital Divide, Internet of Things, Disability Digital Divide*

INTRODUCTION

Background to the Study

In Sri Lanka many people disabled due to the civil war during the three decades. This makes a huge disadvantage for the Nation. Due to their disability many of them are having difficulties of using computers and internet like other non-disabled people. Therefore it makes deviation among the social life of disabled and non-disabled civilian in the country. Like most of the other countries many new technologies are daily introducing into the Sri Lanka due to the smart Nation concept implemented by the government. Infrastructure of the telecommunication was rapidly increases and many civilians advantage of getting high speed bandwidth. But the main problem is adoption on those tools and technologies are not high among the differently abled community. The lack of support services can make disabled people dependent on their assistants, which causes them from disadvantage of being economically, socially, politically and technologically isolated from the rest of the world.

With a concept of every object connected to internet is being created, generating an entirely new viewpoint of assistive technologies. The Internet

of thing (IoT) enables new means of communication between people, things and the environment. By using this technology differently abled people can also improve their life style to some extend as other people do. .As a result the Internet of Things can offer people with disabilities the assistance and support they need to achieve a good quality of life.

Overview of the Research

The overall objective of this study is to investigate the IoT based solutions to overcome the disability digital divide in Sri Lanka. In this research first research question is basically focuses to find out the current technology adoption in Sri Lankan disabled. Then find out how to overcome the disability digital divide issues through the internet of things technology. Outcome of the research propose a framework to overcome the disability digital divide through three different architectural solution including Network layer, Application layer and Presentation layer.

LITERATURE REVIEW

Definitions

According to the Charlton (1998) and Driedger (1989) study disability is complex, dynamic, multidimensional, and contested. Over recent decades, the disabled people's movement together with World report on disability numerous researchers from the social and health sciences (Barnes, 1991) – have identified the role of social and physical barriers in disability.

According to the Roger et.al(anon) Digital divide is the latest evocative term that refers to differences in access to and uses of information technology that are correlated with income, race and ethnicity, gender, age, place of residence, and other measures of socioeconomic status. According to them some people “have the most powerful computers, the best telephone service and fastest

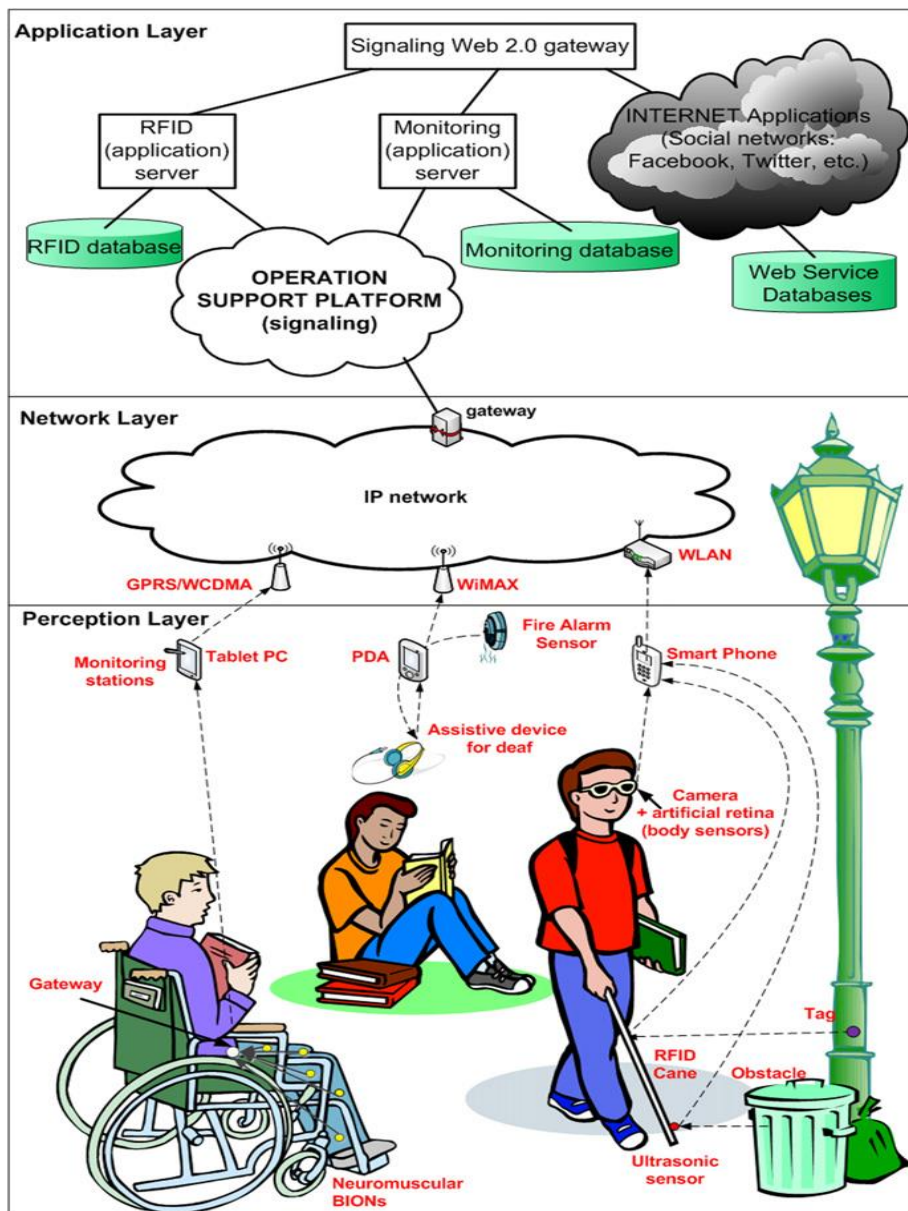
Internet service, as well as a wealth of content and training relevant to their lives. Another group of people don't have access to the newest and best computers, the most reliable telephone service or the fastest or most convenient Internet services. The difference between these two groups calls as Digital Divide."

Internet of Things (Iot)

The Internet of Things (IoT) is a technological revolution in computing and communications. It depicts a world of networked smart devices, where everything is interconnected (ITU Internet Reports, 2005) and has a digital entity (Pascual et al., 2011). Everyday objects transform into smart objects able to sense, interpret and react to the environment thanks to the combination of the Internet and emerging technologies such as Radio-frequency Identification (RFID) (Amaral et al., 2011), real-time localization and embedded sensors.

According to the Domingo (2012) shown in the figure 01, IoT solution for disabled are divided into three layer architecture. With analysing the three layers Perception, Network and Application Layer, solutions for three different types of disabled people, such as visually, hearing and physically impaired categories were discussed.

The components designed for the visually impaired are: (1) body micro-and nano-sensors and (2) RFID-based assistive devices.

Figure 1: Domingo's Three Layer Architecture

Visually Impaired

The RFID cane (see Figure 1) has a tag reader with an antenna that emits radio waves; the tags respond by sending back their stored data, hence identifying the location of the blind person. The tag reader (RFID cane) transmits via Bluetooth or ZigBee the data read from the RFID tag, which includes the tag ID string (D'Atri et al., 2007). This data is sent from the monitoring station through the network layer to the RFID server of the application layer. The blind person can record the destination's name as a voice message using the monitoring station. Directions are received by the monitoring station and played as voice messages (Shiizu et al., 2007).

Hearing Impaired- (Assistive Devices and Sensors.)

People who are hearing impaired can benefit from external or internal (implanted in the ear) assistive devices that improve hearing. Different types of sensors (such as doorbell or smoke detectors (see Fig. 1)) detect events or malfunctions that give rise to alarm conditions. Consequently, an alarm signal is sent from the sensors to the monitoring station, which forward sits to the assistive device as an amplified alarm signal. The deaf person can also be notified with visual (flashing light) or vibrio tactile signals (vibration motor) (Renetal, 2006).

An obstacle detection system based on an ultrasonic sensor can also be added.(Martin et al.,2009)The sensor is attached to the RFID cane to extend its coverage to detect the obstacles.

Body Sensors and Rfid Technology

Some paralysed patients must wear a diaper when they are in bed. A wetness sensor can immediately alert nurses and caregivers to replace the diaper as

soon as it becomes wet (Yangetal, 2008). The detected design a listen to wards is adder using an RFID reader.

Assistive Devices and Sensors

People who are having hearing impairment can have external or internal assistive devices which could detect doorbell or smoke detectors. The alarm signals station send from the sensors to the monitoring station, which forwards it to the assistive devise as an amplified alarm signal. (Ren et al., 2006)

Body Sensors, Actuators and Neurochip

Body sensors and actuators could use to perform functional reanimation of paralysed limbs. Sensors attached to the nerves can detect the user's intention to move certain muscles and actuators can stimulate these muscles to restore the ability to move.

METHODOLOGY

The empirical model used to examine the relationship between the level of adoption of ICT in a disabled community, associated factors and the methods used to collect and analyse data are discussed below.

Research Strategy

This study has been conducted using an empirical investigation. This research consists of two phases. In the first phase the study on Technology adoption in Sri Lankan for differently abled community is analyses using a survey. Second phase proposed some IOT related technologies to solve differently abled community issues using different technologies

Data Collection

Data is collected for first phase of this study based on two approaches. The primary data is collected through observation and interviews done at Sri Lanka Army CLI, unit Panagoda. Around 40 Information Technology undergraduate students participated to interview the participants. Structured interviews were conducted. This study interviewed 314 differently abled people using a non-probability sampling method such as convenience sampling. Age group of the participants was between 20 to 50. Participants for this study were selected from different communities, disabled categories and various geographical locations. Data is collected under different themes.

In the second phase of this survey conducted by interview 180 disabled employees at the Ranaviru Apprel Yakala Branch in Sri Lanka Army. Structured interviews were conducted. Participants for this study were selected from different Age categories, different gender, people who are in care homes with assistance, different levels of management area and different income.

Level of Adoption of Basic ICT (B Basic ICT Facilities ICT) = Basic ICT Facilities/ 3 (i)

Level of Adoption of Intermediate ICT (I Intermediate ICT Facilities ICT) = Intermediate ICT Facilities/ 4 (ii)

Level of Adoption of Advanced ICT (A Advanced ICT Facilities ICT) = Advance ICT Facilities/ 3 (iii)

Data Analysis

Table 2: Dependent Variables Used in the Empirical Model

Variable Name	Type of Accessibility	Variable Description	Type of Users	Dependent Variable	Range of the Digital Divide Index
B1	Basic	Telephone Use	1. ICT Innovators	DDI1	$0.8 < \text{DDI} > 1.0$
B2	Basic	Web Access – Information Search and Email use	2. Early ICT	DDI2	$0.6 < \text{DDI} > 0.8$
B3	Basic	Computer Use	3. Early Majority ICT Adopters	DDI3	$\text{DDI3 } 0.4 < \text{DDI} > 0.6$
I1	Intermediate	Office application Use	4. Late Adopters Majority ICT Adopters	DDI4	$\text{DDI4 } 0.2 < \text{DDI} > 0.4$
I2	Intermediate	Multimedia use	5. Laggards in Adopting ICT	DDI5	$\text{DDI5 } 0.0 < \text{DDI} > 0.2$
I3	Intermediate	Screen reader Software use			
I4	Intermediate	Social media use			
A1	Advance	IT Administration			
A2	Advance	S/W Design Development related			
A3	Advance	High-tech S/W Use (Eg. CAD/ CAM Operations)			

Source: Field Survey Data

In the first sample set differently abled community adopts 2 out of 3 ICT facilities listed under the Basic category, its BICT would be $2/3 = 0.66$. Similarly, if the same set adopts 2 Intermediate and 1 Advanced ICT facility, its IICT and AICT would be $2/4 = 1/2 = 0.5$ and $1/3 = 0.33$, respectively.

Table 3: The Sampling Framework Phase 02

Level of Disability	No of Participants
Eyes	53
Ears	05
Upper Limbs	06
Lower Limbs	06
Other-Simple disabilities	107
Reject	3
Total	180

Source: Field Survey Data

DISCUSSION

According to the descriptive statistics three main areas were taken into consideration such as current ICT knowledge, Relevance of IT for job related activities and Interest of ICT for future needs. Result of the study indicated that the level of Current ICT Knowledge is high among the age between 25 to 28. Reason for this could be that younger generation is using more smart phones and they are likes to incorporate new technologies. Adaption level is high among this community.

English language issues among this community can be considered as a significant issue. It is indicated that majority are having language barriers to use technology. 90 percent of the participant had English language issues and they are working in Sinhala language. Most of them are in the medium level. Most of the computer users are using office package in day today life at the same time some participants in young age like to use new innovative technology. But employees who are closer to retirement age do not like to learn new technologies. Their ambition is to have their pension and stay at home. But they are interested in giving IT education to their children rather than learning themselves. On the other hand according the findings social media usage is 0% among the community. Restriction of social media with in the office hours and office computer are cause for this result. Most of them

do not have a computer at home and as a result less usage of social media among the community.

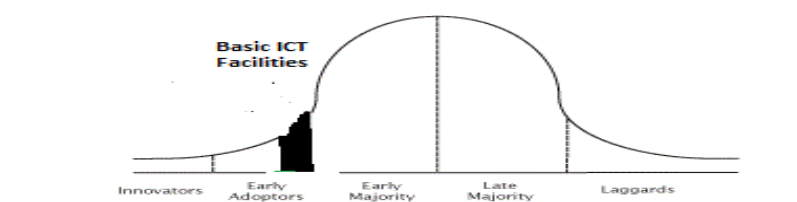
A. Level of Adoption

According to the Rodgers adoption theory discussed above following calculations were done to identify the level of adoption.

Level of Adoption of Basic ICT (B Basic ICT Facilities ICT) = Basic ICT Facilities/ 3

According to the formula values for adoption in basic ICT is 72 % .Therefore this study conclude that level of adoption among the use of basic ICT Facilities are between 0.8 to 0.6.Terefore it is proved that this community are early users for basic level of ICT facilities. This is shown in the figure 3.

Figure 2: Adoption on Basic ICT Facilities



Source: Field Survey Data

Table 4: Use of Technologies and Computer Applications

Variable	Description	Respondent	Percentage
B1	Telephone Use	252	98 %
B2	Web Access	150	58 %
B3	Computer Use	155	60 %
I1	Office application Use	131	51 %
I2	Multimedia use	28	11 %
I3	Screen reader Software use	4	0 %
I4	Social media use	10	0 %
A1	IT Administration	2	0 %
A2	S/W Design Development related	1	0 %
A3	High-tech S/W Use	0	0 %

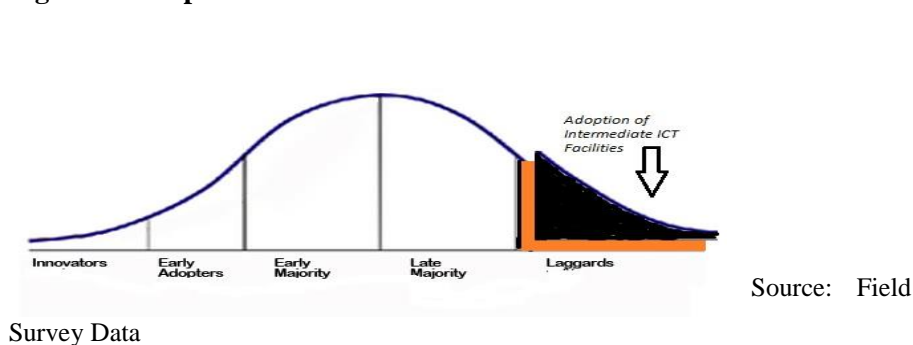
Source: Field Survey Data

Level of Adoption of Intermediate ICT ($I = \frac{\text{Intermediate ICT Facilities}}{\text{Intermediate ICT Facilities} / 4}$) =

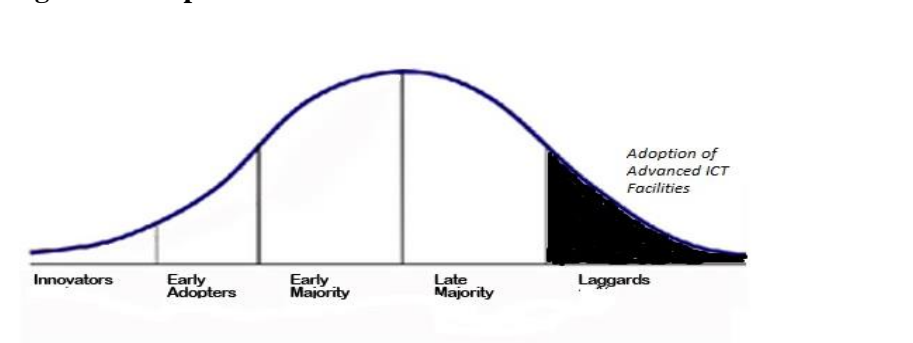
According to the formula, values for adoption in Intermediate ICT is 15.5 %. Therefore, this study concludes that levels of adoption among the users of basic ICT Facilities are between 0.2 to 0.0. Therefore, it proves that this community are Laggards in Adopting ICT for Intermediate level of ICT facilities. This is shown in the figure 3.

Level of Adoption of Advanced ICT ($A = \frac{\text{Advanced ICT Facilities}}{\text{Advanced ICT Facilities} / 3}$) =

=Advance ICT Facilities/ 3

Figure 3: Adoption of Intermediate ICT Facilities

According to the formula values for adoption in advance ICT is 0 % .Therefore this study concludes that level of adoption among the use of basic ICT Facilities is between 0.2 to 0.0.Terefore, it is clear that this community are Laggards in Adopting for advance ICT facilities. This is shown in the figure 5.

Figure 4: Adoption on Advance ICT Facilities

Source: Field Survey Data

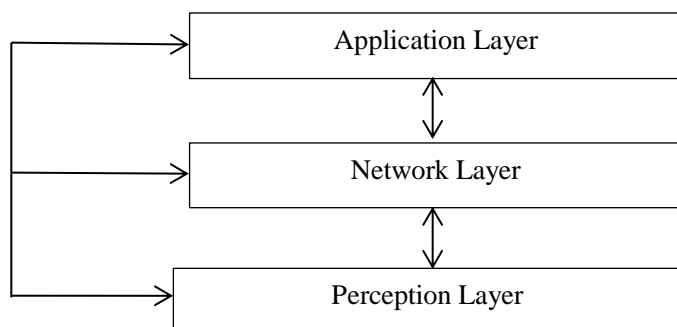
According to the analysis, 58 % are using web services including E-mail system, but it is noticeable that the usage of social media is 0%. Reason for this deviation is that this community does not have social relationships with the use of high technology.

Proposed Model

According to the above phase 1 finding indicated that technology adoption on different technologies and different facilities are diversifying in the spectrum. Therefore overcome the digital divide issues among the disabled community need to consider in multiple perspectives. To overcome the disability digital divide propose some IOT related three layer architectural solutions for visually, hearing and physically impaired people.

To overcome the issues identified solutions were recommended through this framework.

Figure 5: Improve the Quality Standards of life via IoT



Source: Field Survey Data

RFID Devices

The internet of things requires a few necessary components to enable communication between devices and objects. Objects need to be augmented with an Auto-ID technology. RFID Tag. Therefore, objects need to be uniquely identifiable. In addition to that objects need to wirelessly communicate certain types of information and ability to monitor data.

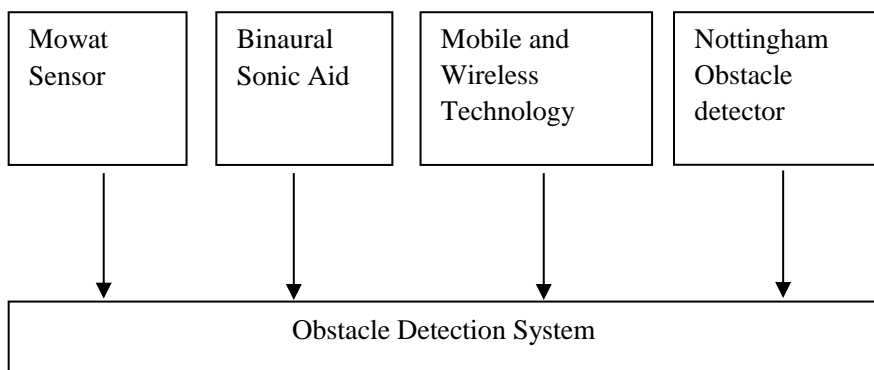
Perception Layer

This layer concern about the information concerning on the environment of disabled community according to the different disabled types. Three different types of disabled are discussed below. Such as visually impaired, hearing impaired and physically impaired.

Visually Impaired

There are many internets embedded assistive devices could be developing for visually impaired people. For example, the cane can use a mini camera and image processing system to detect if a nearby object is stored in its database. This cane can also be including sensors for detecting distances and obstacles. Equip walky with ultrasonic sensors could be select. Reasons for selecting this is readily commercially and compliance for walky. In addition to that with the support of it ultrasonic sensors waly can kept track of distance for the obstacle. In order to measure the distance can propose distance measuring ultrasonic systems. Most of them are using time-of-flight method.

Figure 6: Proposed model for visually impaired [Obstacle detection]



According to the Sahardande (2012) et. Al the Mowat Sensor is a pulsed ultrasound which is ordained with an analogue vibratory feedback operating over two ranges of distance. This is range between one to four meters.

The Binatural Sonic Aid (Sonic guide) is a device which furnishes much information about aspects of the person's social environment. It detects the immediate path of the user. This device is incorporated in the pair of spectacle with two receivers mounted on left and right side, while, the transmitter faces straight piercing the environment via pulsed ultrasound. An obstacle detected on the left side receiver signal will be send to left ear and similarly for right ear. Then easily blind person can identify the obstacle.

In order to detect the person and the obstacle mobile and wireless technologies could be used. This could be used to realize navigation systems in an intelligent environment. For the Deaf people the mobility system can detect obstacle that surrounds the deaf. People by using malty sonar system and sending appropriate vibro-tactile acknowledgement which, serves as an aid by permitting a person to feel the vibrations of sounds.

The Nottingham obstacle detector is a hand held device sunburned with ultrasound. The device provides feedback as a unique note on the musical scale which is audible, and depicts the distance of the obstacle.

Hearing Impaired

Vibe ring and hand talk are the new technologies could use for deaf people to communicate with their day today life. Vibe ring system comes in the form of a wrist watch and a pair of rings which have to be worn on both hands. The rings are designed to act as the persons ears as they listen for sounds coming from behind the individual. The wristwatch identifies the sound captured by

the rings and presents the information to the person wearing it in an easy to read display manner.

Hand talk is another method to solve the problems with disabled people. According to the Shrote (2014). A setup date glove is equipped with five flex sensors, each of the flex sensor is meant to be fixed on each of the finger of the hand glove for the monitoring and static movements of the fingers of the hand.

Hand gesture or keypad in the device could be used. The input is text is processed using a microcontroller. The output from the LCD can be read by the dumb people and speaker can be heard by the deaf people.

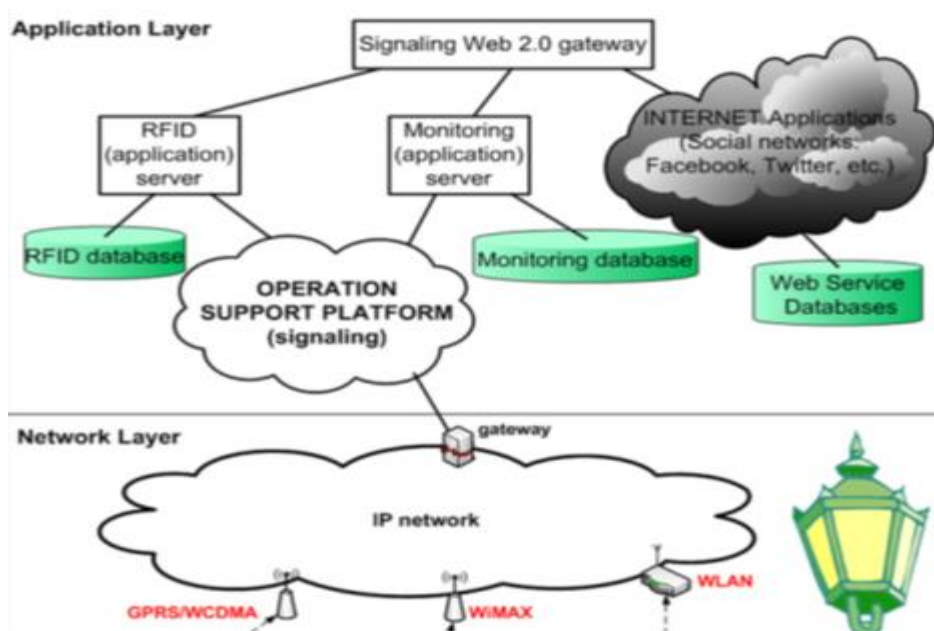
Physically Impaired

This people mainly having issues of mobility of their Hands especially for the Wheels chairs movement. They are basically need someone else need to push their wheel chair. As a solution with the IOT solution wheelchairs that developed could include sensors with shortest path an emergency wheelchair could detect and inform to the doctor. Boins sensors that help physically disabled people. They are wireless, injectable micro devices that are versatile, robust and relatively inexpensive to implant.

Network layer connect with IP Network. Different type of disabled people could connect via several transition methods such as GPRS/WCDMA, WiMAX or WLAN. Then this layer attached to a gateway .Through this gateway connected to the signaling platform. This connected to the RFID and Monitoring Server and Two data bases connected namely RFID Data base and Monitoring Database. Then via the gateway can connected to Web including Facebook, twitter etc.

Network Layer and Application Layer

Figure 7: Proposed Model for Network and Application Layer



CONCLUSION

Internet of things is a new start of the art technology which could be used for differently abled community in Sri Lanka. According the initial phase of this study indicated is proved that there is a digital divide in this country. Therefore this research subjected to implemented different IOT related solutions to the different type of disabled people in the country. This solutions are basically concern with economical and user friendly since initial studies indicated that Sri Lankan have some technology adoption issues as well as income issues to adopted these new technologies.

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A STUDY ON THEORETICAL ASPECT ON POST CONFLICT (WAR) PEACEBUILDING

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ABSTRACT

The government of Sri Lanka initiated its post war peacebuilding soon after the civil war ended in 2009. A number of resettlement and development projects were implemented in former war affected regions. Infrastructure development projects were highlighted among those projects. However, the government post war peacebuilding process was highly criticized not only by the local actors but also by the international actors. Therefore the aim of this paper is to examine the theoretical aspect of the post war peacebuilding and this will be made a clear understanding of the post war peacebuilding works. Further, this will be guided to success post war peacebuilding and create a positive peace in the country.

Key Words: *Post War Peacebuilding, Sri Lanka, Theory of Peacebuilding*

INTRODUCTION

Post-conflict peacebuilding has received wide recognition in the last two decades since the escalation of a number of intrastate conflicts in different parts of the world. Though several countries have concluded peace accords to control the recurring violence, new conflicts keep cropping up across the globe now and then and therefore the issue is now drawing greater attention. Even after reaching a peace settlement, a number of cases were reported of a return to war within a brief period of five years. In the conflict and peace literature, civil war endings have been classified into three types as follows: 1) Civil war ending with a ceasefire agreement or a peace agreement followed by negotiations between the conflicting parties, 2) War ending

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with a military victory by one side, 3) Armed conflict fizzles out without either a military victory or a settlement, because the parties no longer wish to fight or are unable to continue the fight (Miall et. 1999).

The Civil war in Sri Lanka ended in 2009 with a military victory by the Sri Lankan government forces. According to the above clarification the case in Sri Lanka falls under the third category. Ending 26 years of civil war in Sri Lanka is one thing, but the arbitrary and unilateral approach of the government toward addressing the issues of the post-war period left much to be desired in the eyes of many, especially the war affected people. The government of Sri Lanka argues that her post war peacebuilding was successful which they had much focused on physical development in former war affected areas (PTF, 2012). The government had resettled majority of IDPs and supplied infrastructure facilities to restore their livelihood. A number of mega projects were implemented to reconstruct the highways, railways, and renovate damaged hospitals, schools, electricity and telecommunication in the northern and the Eastern regions of the country with the help of international monitoring organizations (PTF, 2012; Central Bank of Sri Lanka, 2013; Ministry of Finance, 2012).

The official reports show that 11,664 ex-combatants surrendered to the military forces and the government carried out the rehabilitation programme for them in six rehabilitation centres in the Northern Province (“From Conflict to Stability – Northern Province”, 2012: 20) . But, last 09 years of post war peacebuilding process was criticised by the others. Several negative issues have been lifted up by the people in war former war zones. Eg: no political solutions for the root causes of the conflict; allegation on war and human rights violations during war times by the warring parties and no formal probe on those issues; issue on missing people during the conflict, issues on detained

suspects people by the security forces and land issues in the resettlement process in former war affected areas. Further, these issues are raised by not only in the local politics but also in international actors. For example the UNHRC had passed four resolutions against Sri Lanka since 2012. Further some western countries avoided economical assistants to the country.

Objective of This Paper

The main objective of this paper is to examine the theories of post-conflict peacebuilding to build a strong theoretical framework to guide the ongoing peacebuilding processes in Sri Lanka. To fulfil this task this paper will look at the UN notions broadly and then examine the other contemporary notions of post-conflict peacebuilding.

Data and Data Collection

The secondary data is used for this paper and data is collected by the contemporary UN documents as well as the other related books and journals published by the scholars in last two decades

Peace building

The term peacebuilding was introduced to the vocabulary of conflict and peace studies by Johan Galtung over 30 years ago. In 1976 Galtung introduced the structures of peacebuilding to promote sustainable peace by addressing the root causes of conflict (Galtung, 1976). According to Galtung the concept of negative peace includes the absence of direct violence. On the other hand, positive peace includes the absence of structural and cultural violence, and this will create sustainable peace with the help of justice and psycho-social healing (Miall, Ramsbotham, Woodhouse, 1999). The notion of Galtung is supported by the contemporary efforts at conflict resolution and peace management as well as the ideological evolution of the subject.

As some scholars argue, the term peacebuilding could be applied to the post-conflict period, but other scholars argue, that as a preventive measure it can be applied to all stages of a conflict, because it covers all activities to convert a conflicted society into a peaceful one (Beatrix, Giessmann, Ulijagar, 2012). However, Lederach is a leading scholar who agreed with such a notion in the field of peace and conflict. Lederach noted rightly, “I suggest that peacebuilding is more than post accord reconstruction. Here, peacebuilding is understood as a comprehensive concept that encompasses, generates and sustains the full array of processes, approaches, and stages needed to transform conflict toward more sustainable, peaceful relationships. The term thus involves a wide range of activities and functions that both precede and follow a formal peace accord.” (Lederach, 1997; 14)

He rightly identified peacebuilding as a long term process that is applied to conflict transformation, which transforms the conflict from a state of hostile relations to one of peaceful relations. Therefore, Lederach’s idea clearly implies that the term can be applied to any of the steps taken during the conflict to de-escalate hostilities, until a durable peace is achieved.

Post Conflict Peacebuilding

The terms post-conflict peacebuilding and post-war peacebuilding can be often seen in the thematic literature published since 1990. Lederach stresses that peacebuilding is the core process in the concept of “conflict transformation,” which is the process of transforming from conflict to long lasting peace. He rightly identified peacebuilding as a long term process that is applied to conflict transformation, which transforms the conflict from a state of hostile relations to one of peaceful relations. Therefore, Lederach’s idea clearly implies that the term can be applied to any of the steps taken during the conflict to de-escalate hostilities, until a durable peace is achieved

(Lederach, 1997). The United Nation Organization is the pioneer supra national organization which was established to promote the peace in the 20 th century. Escalation of civil wars in the post-cold war period in the 1990s and the failures of the current prevailing strategies compelled the UN to adjust its own strategies for consolidating peace (Ghali, 1992). As a result of revising its strategies to achieve a sustainable peace in conflicted countries, the organization introduced the concept of ‘post-conflict peacebuilding’ as a new tool of the UN peace strategies following its prevailing strategies such as preventive diplomacy, peacemaking and peacekeeping. Defining the term of post-conflict peacebuilding in the handbook, “An agenda for Peace,” the Secretary-General of the UN, Boutros-Ghali noted that the term preventive diplomacy, peacemaking, and peacekeeping are integrally related to achieving post-conflict peace. He defines preventive diplomacy as an action to prevent disputes from arising between parties, to prevent existing disputes from escalating

into conflicts and to limit the spread of the latter when they occur. Peacemaking is an action to bring hostile parties to an agreement in order to compel peace. Chapter VI of the Charter of the United Nations¹ points out that peacekeeping is the deployment of a United Nations presence in the field, hitherto with the consent of all the parties’ concerned, normally involving United Nations military and/ or police personnel and frequently civilians as well. Peacekeeping is a technique that expands the possibilities for both the prevention of conflict and the making of peace.

In addition, the report addressed the concept of post-conflict peacebuilding as an action identifying and supporting structures that tend to strengthen and

¹ Chapter VI of the charter concerns the pacific settlement of disputes (article 33 to article 38)

solidify peace in order to avoid a relapse into war.² In other words, the process of peacebuilding should be aimed at the root causes of a conflict and then followed up by eliminating them to avoid a violent conflict in the future.

Ghali's conceptual foundation of post-conflict peacebuilding was progressively developed by studying numerous UN documents and adopting successful practices used throughout conflict zones in the world since 1992. The following table shows the development of the UN peacebuilding key areas in the 1990's.

In the beginning of the 21st century the United Nations further build its post conflict peacebuilding areas which was influenced to the development of the theoretical concept of the subject. In 2001, the UN Security Council presidential statement pointed out that the actions for post-conflict peacebuilding should be focused on fostering sustainable development, the eradication of poverty and inequalities, transparent and accountable governance, the promotion of democracy, respect for human rights and the rule of law and the promotion of a culture of peace and non-violence.

² Ibid., paras. 20, 21

Table 01. Expansion of Key Areas of the UN Post-Conflict Peacebuilding Action Plan in the 1990s

1. Security	Demilitarization, control of small arms, reintegrating ex-combatants
2. Rule of law	Institutional reforms, improved police and judicial system
3. Human rights	Respect for human rights, encouraging reconciliation through respect for human rights
4. Political and national integration	Confirming political and national unity
5. Repatriation and resettlement	Resettlement of displaced persons and refugees, repatriation
6. Democratic and political reforms	Electoral reforms
7. Development	Social and economic development. Providing reintegration and rehabilitation programmes and creating conditions for resuming development, mobilizing the domestic and international resources for reconstruction and economic recovery

The statement emphasized the need to address the structural issues of a particular war torn country as a long term active process. The idea was further confirmed at the world summit of the UN in 2005. The summit report stresses the importance of establishing an efficient institutional mechanism and adopting an integrated approach in the UN system to address the issues of reconciliation of the war torn society.³ In 2006, “The inventory: the UN

³ The summit proposed to establish three institutions related to the peacebuilding affairs which are peacebuilding commission, peacebuilding fund and peacebuilding support office. While in the first session of the peacebuilding commission, the purpose of the commission was explained as to serve as a dedicated institutional mechanism to address these special needs and to assist those countries in laying foundations for sustainable peace and development, the countries who face a high risk of relapsing into violence.

capacity in peacebuilding”, a report of the executive office of the Secretary-General adopted a broad definition of post-war peacebuilding by pointing out that the peacebuilding strategy should be focused on the provision of transitional security through peacekeeping and other efforts to maintain public order, support due political process, provide lifesaving humanitarian assistance, and invest effort to create a framework for economic recovery and institutional development (United Nations,2010). The inventory maps out a wide range of post-conflict peacebuilding activities of the UN under the following four key areas.⁴

The inventory maps out a wide range of post-conflict peacebuilding activities of the UN under the following four key areas.

1. Security and public order – security system governance, law enforcement agencies, disarmament, demobilization and reintegration (DDR), mine action
2. Justice and reconciliation – transitional justice, judicial and legal reforms, human rights.
3. Governance and participation – good offices and mediation, constitution making, public administration and government, strengthening local governance, financial transparency and accountability, elections, electoral system and process/political parties, public information and media development.
4. Socio-economic well-being – protection of vulnerable groups, provision of basic needs, gender equality, physical infrastructure, employment generation,

⁴ United Nations (2006) is quoted Masayo Kondo Rossier, A Review of Practices and Expert Opinions: Linking Humanitarian Action and Peacebuilding. Working paper (Geneva: Centre on Conflict, Development and Peacebuilding, 2011.)

economic foundations for growth and development.⁵ In 2007, the Secretary-General's policy committee adopted a conceptual basis for post-conflict peacebuilding, which focused on the national needs of the country concerned:

“Peacebuilding involves a range of measures targeted to reduce the risk of lapsing or relapsing into conflict by strengthening national capacities at all levels for conflict management, and to lay the foundations for sustainable peace and development. Peacebuilding strategies must be coherent and tailored to the specific needs of the country concerned, based on national ownership, and should only comprise a carefully prioritized, sequenced, and therefore relatively narrow set of activities aimed at achieving the above objectives.”⁶

According to the UN Secretary-General's policy committee in 2007,

1. Support for basic safety and security, including mine action, protection of civilians, disarmament, demobilization and reintegration (DDR), strengthening of the rule of law and initiation of security sector reform.
2. Support for political processes, including electoral processes, promoting inclusive dialogue and reconciliation, and developing conflict management capacity at national and sub-national levels.
3. Support for the provision of basic services, such as water and sanitation, health and primary education, and support for the safe return and reintegration of internally displaced persons and refugees.
4. Support for restoring core government functions, in particular basic public administration and public finance, at the national and sub-national levels.

⁵ These wide range of peacebuilding activities undertaken by 31 UN agencies

⁶ Peacebuilding and the United Nations. What is peacebuilding” in United Nations Peacebuilding support office <<http://www.un.org/en/peacebuilding/pbso/pbun.shtml>> [Accessed 15 March 2017]

5. Support for economic revitalization, including employment generation and livelihood issues (in agriculture and public works) particularly for youth and demobilized former combatants, as well as restoration of basic infrastructure (United Nations, 2009).

Alternative Notions of Post Conflict Peace Building

In the light of the UN approach to post-conflict peacebuilding, several scholars, practitioners and other institutions developed the concept further, refining the term and restructuring the framework of post-conflict peacebuilding. That was encouraged on the one hand by the growing awareness of the complexity of post- conflict transition and the multiple, simultaneous needs of post-conflict societies and on the other hand partly by bureaucratic imperatives as more and more international agencies, parts of the UN system, and non-governmental organizations began to incorporate peacebuilding into their missions (Call & Cousens, 2008). To fulfil the above task, Miall et al. developed a framework for post-settlement peacebuilding, encompassing five major sectors and proposing different time frames such as short term, medium term and long term for implementing the measures in 1999 (See table 02).

Table 02. Post – Settlement Peacebuilding: A Framework

	Interim/short-term measures	Medium-term measures	Long-term measures
Military/security	Disarmament, demobilization of factions, separations of army, police	Consolidation of new national army, integration of national police	Demilitarization of politics, transformation of cultures of violence
Political/constitutional	Manage problems of transitional government, constitutional reforms	Overcome the challenge of the second election	Establish tradition of good governance including respect for democracy, human rights, rule of law, development of civil society within genuine political community
Economic/Social	Humanitarian relief, essential services, communications	Rehabilitation of resettled population and demobilized soldiers, progress in infrastructure and de-mining	Stable, long term macro-economic policies and economic management, locally sustainable community development, distributional justice
Psycho/social	Overcoming initial distrust	Managing conflicting priorities of peace and justice	Healing psychological wounds, long term reconciliation
International	Direct, culturally sensitive support for the peace process	Transference to local control, avoiding undue interference or neglect	Integration into cooperative and equitable regional and global structure

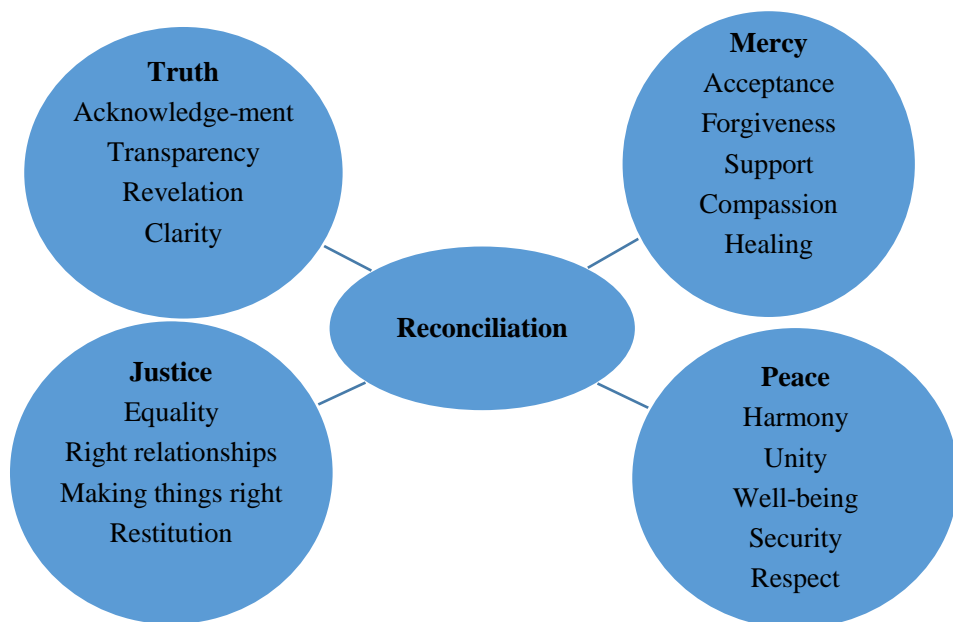
Source: H.Miall, O.Ramsbotham, and T. Woodhouse, *Contemporary Conflict Resolution*. 1st ed. Malden, MA: Polity Press in Association with Blackwell Publishers Inc., 1999). p.203

The post-settlement peacebuilding framework was built, taking into account the military/security, political/constitutional, economic, and social imperatives, which comprise the core areas of the UN strategy for post-conflict peacebuilding. The framework also focuses on the psycho/social aspect; which conflict resolution analysts say does have a marked impact on peacebuilding. Although the psycho/social sectors had been neglected in the original list of activities in the UN strategy on post-conflict peacebuilding, contemporary human rights movements are keen on the psycho-social concept of transitional justice to build sustainable reconciliation in war torn societies (Beatrix, Giessman, Ulijagar, 2012). The post-settlement peacebuilding framework proposed the psycho/social sector, which aimed at revealing the truth and healing psychological wounds in order to promote reconciliation and bring about a long term positive peace. The alternative models emphasize reconciliation as one of the strongest sectors to build a sustainable peace in a war torn society.

“Reconciliation” is a concept that is of much concern to the scholars and practitioners in the peacebuilding field in recent times. Although early recovery, security sector reform, political reform, and social and economic reforms are tied to the issues on humanitarian, physical and political sectors in the post-conflict peacebuilding process, they do not directly address the emotional and psychological aspects of the conflict. Bradbury and Healy noted that the mere establishment of government institutions, however numerous they may be, cannot be taken as the sole measure of successful reconciliation (Bradbury & Healy, 2010). Then, how do we address the emotional and psychological needs of the affected people in a post-conflict peacebuilding effort? Scholars observed that “reconciliation” focused on the emotional and psychological aspects, recognition the past grievances, and works for future interdependence by building relationships between

conflicted parties (Lederach, 1997). Although the term ‘reconciliation’ is usually connected with post-conflict peacebuilding and reconstruction, it has its own separate discourse in the literature of conflict and peace

Figure 01: Main Pillars of Reconciliation by Lederach



Source: J.P. Lederach, *Building Peace: Sustainable Reconciliation in Divided Societies*. (Washington, D.C.: United States Institute of Peace Press, 1997)

As a Western concept, post-conflict reconciliation involves both liberal and Christian - humanist moral roots such as truth, justice, forgiveness and peace (Uyangoda, 2012). Lederach is a leading exemplar of this approach who defines the term ‘reconciliation’ as, ‘building a relationship between antagonists’ by aiming for the creation of ‘sustainable peace’ in deeply divided societies and suggested that post- conflict peace involves more than the already difficult tasks of brokering a cease- fire, negotiatinga peace

agreement, or Implementing a peace accord (Uyangoda, 2012). He pointed out reconciliation as one of the essential elements of peacebuilding, which is a combination of truth, mercy, justice and peace (See figure 01).

According to Lederach, truth stands for acknowledgement of wrong and validation of painful loss and experiences. Mercy involves forgiveness and support for a new beginning. Justice represents the rights and equalities of the individuals, and peace indicates unity, harmony, well-being and security (Lederach, 1997). According to that, Lederach argues that when truth, mercy, and justice and peace link together, reconciliation would be created in society.

JUSTICE AS A SOURCE OF RECONCILIATION

Ramsbotham et al. also explained the relationship between peace and justice in order to build reconciliation in post-war societies. They argued that justice acts as a catalyst to transform the negative peace into a positive peace. In terms of that, justice embeds a number of instruments such as rule of law, truth commissions/trials, and reparations/ retributive justice. They argued that through these instruments positive peace can be created, which is embedded in the long term reconciliation (Ramsbotham, Woodhouse, Miall, 1999). The following table of Miall et al. (Table 03) shows the relationship between negative peace and positive peace via justice.

Table 03: From Negative to Positive Peace, via Justice

Negative Peace	→	Justice	→	Positive Peace
Absence of violence reconciliation		Truth/ acknowledgement Reparation / rehabilitation Punishment /pardon		Long term

Source: H. Miall, O.Ramsbotham, T. Woodhouse, Contemporary Conflict Resolution. 1st ed. Malden, MA: Polity press in Association with Blackwell Publishers Inc., 1999.) p. 208

PROPOSED FRAME WORK TO SRI LANKA

What are the key areas of peacebuilding and post-war reconstruction that the study has identified, where improvements can be made to realize a long lasting peace in Sri Lanka? The above exploration of the theoretical background of the study revealed that addressing both the immediate outcome of the war as well as the structural causes of the war would support to achieve the positive peace in a war affected society. The study was concerned with the above theoretical aspects alone within the war context of Sri Lanka to develop the proposed framework of this study. Accordingly, the study identified five key areas of post-conflict peacebuilding with a nexus to post-war reconstruction, broadly divided into two processes, as process A – covering humanitarian relief and physical reconstruction for recovery and development, and process B – covering socio-political reconstruction for reconciliation. Along with the two processes (process A and process B) the two subsets are embedded with five key components, viz. (1) Resettlement,(2) Reconstruction and development of socio-economic sectors, (3)

Rehabilitation and reintegration,(4) Political consensus, and (5) Transitional justice, all of which should help to create a strong framework to build a long lasting peace in the war affected provinces of Sri Lanka.

CONCLUSION

The theory on post war peacebuilding has been developed by the United Nations as well as other scholars and practitioners. Earlier, the post war peacebuilding works were attention for physical reconstruction which aimed to renovation of war damages. Later, the theory on post war peacebuilding was focus into social and political aspect. Concepts of Reconciliation and Justice do help to create positive peace in a war torn society. Therefore, both physical reconstruction and socio political reconstruction are important to create sustainable peace in war affected country. The government of Sri Lanka should pay her attention for both processes to success the post war peacebuilding.

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RITUALS AND CEREMONIES ON SACRED TOOTH RELIC

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ABSTRACT

The sacred tooth relic of Gauthama Buddha preserved in Kalinga, India and was brought to Sri Lanka in the 4th century A.D. It was received by the then King Kirthi Sri Meghavanna who was ruling the country at that time in Anuradhapura. Since then tooth relic became the most venerated object and a symbol of status denoting the right to ascend the throne. With the tooth relic came to be regarded as a symbolic representation of the living Buddha, there grew up a series of offerings, rituals, and ceremonies under the patronage of kings. The aim of present study is to look into the offerings, rituals, and ceremonies conducted for the sake of sacred tooth relic. This examination is based on the primary and secondary literary sources. In addition to daily rites and rituals, the Tooth Relic is revered by way of various ritualistic ceremonies throughout the year. According to the sources tooth relic demonstrations were one of the main rituals conducted since the ancient times. Among many festivals, the Esala Perahera is one of the important festival held in July to commemorate Lord Buddha's Conception, Renunciation, and First Sermon. This celebration is part of the social tradition of Sri Lanka. In the ancient times these festivals were patronage by kings. At present it is the responsibility of the government. At present these rites and rituals have become national ceremonies of the country.

Keywords: *Buddhism, Rites and Rituals, Tooth Relic, Sri Lanka*

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INTRODUCTION

Vast majority of Sri Lankans are Buddhist. The Buddhism came to be established in the island of Sri Lanka in the 3rd century B. C. As a result of the 3rd Buddhist Council the Great King Asoka in India sent missionaries to nine states to propagate the Buddhism. Sri Lanka was one among these nine states and the mission was headed by Mahinda thero, the son of King Asoka. Since then Buddhism became the foremost religion of Sri Lankans. The sacred tooth Relic of Gautama Buddha preserved in Kalinga, India and was brought to Sri Lanka in the 4th century A.D. by Prince Danta and Princess Hemamala, son and daughter of the Kalinga King Guhasiva in order to prevent its possession by his enemies who made war. It was received by the then King Sirimeghavanna who was ruling the country at that time in Anuradhapura. Since then Tooth Relic became the most venerated object and a symbol of status denoting the right to ascend the throne. Later kings in the kingdoms of Anuradhapura, Polonnaruwa, Dambadeniya, Yapahuwa, Kurunegala and Kotte etc. built temples for the sacred Tooth Relic close to the royal residences. Currently it has been placed in Temple of the Tooth Relic (Dalada Maligawa) which was built by King Veera Parakrama Narendra Singha (1707-1739) in the early 1700s in sacred city of Kandy (Mahanuwara). At present not only Buddhist but also non-Buddhist as well as foreigners are coming to see and worship the Tooth Relic.

With the tooth relic came to be regarded as a symbolic representation of the living Buddha, there grew up a series of offerings, rituals, and ceremonies under the patronage of kings of the country. The aim of present study is to look into the offerings, rituals, and ceremonies conducted for the sake of sacred tooth relic. This examination is based on the primary and secondary literary sources.

Royal patronage to the Sacred Tooth Relic

The left eye-tooth of the Buddha which was brought to Sri Lanka in the ninth years of Siri Megavanna was the most important and precious of all Buddhist relics ever brought to Sri Lanka (Rahula Thero, 1956: 280). The king received Sacred Tooth Relic with reverence, paid it the highest honors and brought it to the building called Dhammachakka built by Devananpiyatissa on the royal territory. Henceforth this building was the Temple of the Tooth Relic (Culavamsa, XXXVII: 94-96). The king arranged a great festival for the Sacred Tooth Relic and he decreed that it should be brought every year to the Abbayauttara Vihara and that the same sacrificial ceremonial should be observed (Culavamsa, XXXVII: 97-98). King Datusena (455-473) had renovated the Tooth Relic Temple (Culavamsa, XXXVIII: 70-72).

King Aggabodi I(571-604) decorated the Temple of the Tooth Relic with gold and offered it a casket made of pure gold (Culavamsa, XLI:33,34). Many other kings such as Sena II (835-887), Sena IV (954-956) and Mahinda IV (956-972) had paid homage to Sacred Tooth Relic (Culavamsa, LI:22,23 ; LIV: 5, 56,57).

With the defeat of the Anuradhapura kingdom, Polonnaruwa became the next kingdom, which reined the country. King Vijjiyabahu I brought the Sacred Tooth Relic to Polonnaruwa and erected a Dalada Maligawa to place it and paid homage to it by performing many religious rites (Culavamsa, LX:16,17). It is this building which is known today popularity as ‘Atadage’. This king in order to protect the Sacred Tooth Relic, developed the best fighting unit that lived in Sri Lanka known as “weelaikkara’ fighting squad (EZ, vol: II: 242-255).

After the demise of king Vijayabahu I, there was a state of political confusion in the country. This was brought under control by the next king

Parakkarmabahu I, who according to Culavamsa, build three Dalada Mandira (Culavamsa, LXXIII: 129, 130; LXXIV: 199; LXXVIII: 42). One of these Mandiras was built in the heart of the town. It was in this particular Mandira the Sacred Tooth Relic was kept (Culavamsa, LXXIV: 199). The Culavamsa records, how he paid great homage to it, by way of many ceremonial rituals (Culavamsa, LXXIV: 200-228).

King Nissankamalla of Polonnaruwa who took reigns as the next ruler, conducted a Mandira in just 60 hours and shifted the Tooth Relic to that building. This mandira became famous as 'Hata-dage'. The king had made a sacrificial offerings of his son, prince Weerabahu and his daughter princess Sarwagasundri in homage to the Temple of the Tooth Relic (EZ., vol. II, 87, 170). During the Polonnaruwa Era, the Shrine of the Tooth Relic became the emblem of the ruling king. And many rulers have paid homage to the Tooth Relic with much veneration during the same period.

In 1215 A. D. Magha of Kalinga state of India invaded Sri Lanka. This invasion caused a very fearful backdrop to the people of the country. Magha destroyed all places of Buddhist worship (Culavamsa, LXXX: 54-79). In order to safeguard the Tooth Relic from him, venerable monks of the Vachissara order, voluntarily came forward and removed it to an undisclosed location in Kotmale (Culavamsa, LXXXI: 17-20). King Vijayabahu who started reigning from Dambadeniya in 1232 A. D. removed the Tooth Relic from Kotmale to Dambadeniya (Culavamsa, LXXXI: 24-30). But the king did not keep the Sacred Tooth Relic in Dambadeniya and put it in Beligala.

Culavamsa describes the erection of a temple to place the Tooth Relic, also as a place of refuge for the Monks, who order the performing religious rituals on top of the Beligala Mountains (Culavamsa, LXXXI: 31-39). After the demise of king Vijayabahu III, king Parakkamabahu II became the king of Dambadeniya. He brought the Tooth Relic in a procession to Dambadeniya

(Culavamsa, LXXXII: 1-8). After that he built a temple for the Tooth Relic near to the palace (Culavamsa, LXXXII: 8-9). A casket made of jewels was made to place the Sacred Tooth Relic, which was then lowered into another casket made of gold, the value of five thousand gold Nikkhas and this was kept in another casket made of Silver of twenty five thousand nikkhas (Culavamsa, LXXXII; 13-15). The king starting with the relic temple, had adorned the town, and had devoutly celebrated a great sacrificial ceremony for the Tooth Relic, he took the Tooth in the lotus of his hand and speak in the midst of the Great community the solemn declaration (Culavamsa, LXXXI: 16-49).

The responsibility and the task of the king is to defeat the enemy and gain victory over them and protect the country and Buddhism (Culavamsa, LXXXII: 40). The Culavamsa records of a great phenomenon that took place in the meantime. Soon after this incident the king paid homage to the Tooth Relic, adorning it with very precious jewels and seven days long he celebrated with the offering of the seven kinds of precious articles (Culavamsa, LXXXII: 50- 53).

It is recorded that the king had opened the doors for the public to worship the sacred Tooth Relic in the Sirivaddanapura, his birth place. In order to take the Tooth Relic in procession, the king ordered the road between the City of Dambadeniya and Sirivaddanapura, re-constructed and both sides of road decorated. And the procession was escorted with performances of dancing and

music. During the seven days the sacred Tooth Relic was exhibited in Sirivaddanapura, many religious observances had been held (Culavamsa, LXXXV: 1-56).

When the ceremonial activities were over, Sacred Tooth Relic was taken back and placed in the newly built three storied building in Dambadeniya. There also it was kept to be exhibited by the public and special religious observances were performed, in the sacred area (Culavamsa, LXXXV: 90-93).

Thereafter, king Parakramabahu II who was still ruling, took the Sacred Tooth Relic to Polonnaruwa, where it was displayed for a period of the three months. Culavamsa attractively explains the many religious rituals had been conducted whilst enroot to Polonnaruwa from that Dambadeniya in a sacred procession (Culavamsa, LXXXIX: 12-46). The description brings to live the actual experiences, through it took place centuries ago.

After the Damdeniya, Yapahuwa become the Capital and the Sacred Tooth Relic was taken in procession there, by the king Bhuvanekabahu I, ruling during that time. The present archaeological ruins belonging to the era, shows the building in which the Tooth Relic was kept had been a magnificent building. The king celebrated daily a great sacrifice for Tooth Relic, where it remained for eleven long years. With the demise of king Bhuvanekabahu I the country faced a very critical period. During this period there landed, sent with an army by the five brothers, the kings who held sway in the Pandu realm, a Damial general known by the name of Ariyacakkavatti who invaded Sri Lanka removed the Tooth Relic by force and kept it in the custody of the king of Pandya, Kulasekhara (Culavamsa, LXXXIX: 43-47)

King Parakkamabahu III, who took it back from king Kulasekhara and brought the Tooth Relic back to Sri Lanka and bring to Polonnaruwa, to be placed in the same Tooth Relic Temple where it was once kept (Culavamsa, LXXXIX: 51-56). The king performed a daily ritual in the form a sacred festival in memory of the Sacred Tooth Relic, placed there in and accumulated a great abundance of meritorious works, through his untiring efforts on its behalf (Culavamsa, LXXXIX: 57).

After king Parakkamabahu III, king Bhuvanekabahu II (1293-1302) ruled the country, he chose Kurunegala as the kingdom (Culavamsa, LXXXIX: 59, 60). He had also brought the Tooth Relic to the Kurunegala (Vajira Thero, 2008: 370). After king Bhuvanekabahu II, the king Parakkamabahu IV (1302-1326) came into power. He erected a beautiful Temple within the royal courtyard itself to keep the Sacred Tooth Relic. It was built with specific instructions. It was a three storied building and its walls and pillars were painted in white, under his instructions. Paintings were done on the walls with bright hued pictures. Provided with golden spires, with gate posts of gold, splendid, three stories high (Culavamsa, LXXXIX: 64-68). The king composed in Sinhala language a work expounding this, with the title “Ceremonial of the Tooth Relic” and in keeping with it he performed daily a daily ceremony for the Relic (Culavamsa, LXXXIX: 77-79). The work that was inaugurated in memory of Kurunegala’s palace of the Tooth Relic, not only brought out in vivid detail the structural workings of it, but also made it possible to recognize the customs and rules connected with the Tooth Relic (Dalada Sirita, 2008).

From Kurunegala the Kingdom shifted to Gampola and the Sacred Tooth Relic was also moved there. There were many kinds of sacrifices and rituals that had been performed on it, during the period (Vajira Thero, 2008; 316,317). From Gampola, when the kingdom was shifted to Kotte, again the Tooth Relic had to be carried there, The king of Kotte, king Parakkaramabahu VI (1412-1467) had built a three storied building to keep the Tooth Relic (Hansa Sandesaya, 46; Paravi Sandesaya, 42, 43; Kokila Sandesaya, 135; Gira Sandesaya, 50; Salalihini Sandesaya, 17). The Tooth Relic remained in the Kotte Temple premises until 1551 A. D. In the year 1505 A. D. the Portuguese invaded Ceylon and captured Kotte and became very vital that the Tooth Relic had to be somehow or other protected. The Diyawadana Nilame of the Kotte, Temple of the Tooth Relic, secretly smuggled the Tooth Relic and taking it to the Delgamuwa Temple, hid inside the grinding stone.

In the year 1590 A. D. the Portuguese were defeated and chased out of the Kandyan kingdom (Hill country) by king Wimaladharmasuriya I, and removed the Tooth Relic, which had hitherto been deposited at the Delgamuva temple and house it in an attractive two storied building which had been erected very close to his palace (Culavamsa, XCIV:12-14; Vajira Thero, 2008: 474). During the latter part of the reign of his reign this two storied Temple had been converted to a three storied Temple (Daladavamsa, 1957: 78; Vajira Thero, 2008:382).

With the death of king Wimaladharmasuriya I, and with the invasion of Portuguese, the Sacred Tooth Relic had to be concealed in a safe place. So, the Sinhalese Buddhists had to move one place to another protecting it from the Europeans invasions (Kusumsiri, 2012:20). Until Kandyan kingdom came under the British power, kings who ruled the country performed many religious ceremonies, while at the same time guarding and safely keeping Tooth Relic in the assigned place for it. During the reign of king Rajasingha II (1635-1687) a new two storied building for the Tooth Relic had been erected at the location where the previous building stood (Daladavamsa, 1959: 80). Again during the reign of king Wimaladharmasuriya II (1687-1707) some renovations had been effected and a new three storied building had also been erected (Daladavamsa, 1959: 81). King Sri Viraparakkrama Narenasingha (1707-1739) renovated this building and made it two storied (Culavamsa, XCVII: 38). Kumburugamuwe Vajira has pointed out that the present Temple was erected by this king (Vajira Thero, 2008: 384). King Sri Vijayarajasingha (1739-1747) renovated the Temple beautifully and performed religious ceremonies to honor it. King Kirti Sri Rajasingha (1747-1779) made arrangements for the Perehara carrying the Tooth Relic to join the Masala perahara of the four Devas. King Rajadira Rajasingha (1779-1797) also paid homage to the Tooth Relic, as the former kings. The last Sinhala king, King Sri Wikrama Rajasingha (1779-1814) added a new feature to the

Temple of the Tooth Relic known as the pavilion ((Vajira Thero, 2008: 383, 384).

The British conquered Sri Lanka by conquering the Kandian Kingdom on the 2nd of March 1815. At the same time the ownership of the Tooth Relic to the Sinhala-Buddhists lost its grip.

Rituals and Ceremonies

Continuing the age old traditions, the Tooth Relic is revered by way of various ritualistic ceremonies throughout the year. In addition to daily rites and rituals, there could be seen many ceremonies conducted to venerate tooth relic. According to the sources, tooth relic demonstrations were one of the main rituals conducted since the ancient times.

Fa-Hien, the Chinese Buddhist traveller has mentioned about such demonstrations held in Anuradhapura period (Beal, 1957: 46-49). In these demonstrations, the general mass were able to see and worship the tooth relic. Sometimes these exhibitions were functioned expecting rain in the severe drought seasons.

Among many festivals, the Esala Perahera is one of the most important festivals held in July to commemorate Lord Buddha's Conception, Renunciation, and First Sermon. This celebration is part of the social tradition of Sri Lanka. It is a colorful procession which includes number of elements such as elephants, Kandian dancers, fire eaters, stilt walkers, etc.

In the ancient times these festivals were patronage by kings. At present it is the responsibility of the government and these are conducted under the supervision of the two Mahanayaka thero of Malwatte, Asgiriya chapters, and Diyawadana Nilame of the Maligawa. At present all these rites and rituals etc. have become national ceremonies of the country.

Daily Rituals

From ancient times offerings and rituals had been held daily, to the Sacred Tooth Relic (Dalada Sirita, 2008; Datuvamsa, 1957; Culavamsa, 1992; EZ., vol. III: 225). The daily rituals are held thrice a day. During the period of King Parakkaramabahu II, in order to carry out these rituals, a sacred shrine was built close to the palace. The Culavamsa recorded it, 'I have the desire at every moment when I think of it to worship the Tooth Relic with devotion at the three periods of the day' (Culavamsa, LXXXII: 8, 9).

Even today these three rituals are performed on a daily basis. They are separated as, Early Morning Service, Mid-Day Service and Evening Service. The Temple officials in charge of the rituals carry the sacred items necessary as the normal custom practiced and do it punctually. For the Early morning services which begin at 5.15 a.m., drums are beaten. The Buddha Pooja begins at 6.00 a. m. To carry out this Pooja, 32 bushels of rice cooked, 32 different kinds of vegetables and curries and sweet meats are prepared.

For the mid-day Service, the doors of the Palace are opened at 9.30 a.m. The Pooja begins at 10 a. m. The meals are offered at 10.30 a. m. By 11.00 a. m. all the rituals come to an end and the doors are closed.

The evening Pooja begins with playing of drums at 6.15 p. m. The first alms giving Pooja starts at 7 p. m. and the Second at 7.30 p. m. After that the devotees can worship the Tooth Relic. The doors are closed, according to a practiced custom.

Weekly Rituals

There are two rituals which performed once a week namely Nanumura Mangalla (bathing or anointing ceremony) and Hatara Poya (four ceremonies connected with the phase of the moon).

Nanumura Mangalla

Nanumura Mangalla is a traditional ceremony which performs to venerate the Seared Tooth Relic. The aim of this ritual is to be to maintain the holiness of the Seared Tooth Relic. This ritual performs in Wednesdays with almost purity with the participation of monks in service and the officials.

The mixture known as Nanu, a preparation made out of Nelli, lime and Embul leaf etc., which placed in vessel containing Sandal wood is carried to the upper chamber in a pingo (kada) with a procession with drummers, conch blowers etc. This mixture used to anointing the Seared Tooth Relic. The anointing of the Seared Tooth Relic Ceremony is not done directly but through the image reflected by a mirror placed in front of the casket contains the Seared Tooth Relic. This anointing is done by the chief monk with almost purity.

Hatara Poya

Poya days are the sacred days for the Buddhists of Sri Lanka. The 1st, 8th, 15th and 23rd days of the lunar months are recognized as poya days. According to the traditional, Poya hewisi is held by the chief of drummers of the Temple of the Sacred Tooth Relic.

Annual Festivals

Apart from these daily, weekly and monthly ceremonies, there are four major ceremonies held every year. They are Aluth Sahal Mangailaya (The Ceremony of the first offering of New Rice after harvest), Avurudu Mangallaya (New Year Festival), Esala Mangalla (pageant in the month of Masala) and Karthika Mangallaya (Feast of Light in November).

Aluth Sahal Mangailaya

King Sri Veraparakkama Narendrasingha prepared the crop, when the harvest from the paddy field in his resident area Gurudeniya, was ready and initiated a new festival known as the New Harvest Festival. The day before this festival is to be celebrated, the official of the Dalada Maligawa and the other Devales, proceed with elephants and tuskers, in procession to the barn in the Gurudeniya Devale, where the rice is kept prepared as the custom. There the milk rice prepared from new crop of rice and other refreshment are to those officials representing the Maligawa Shrine and other Devales. And the newly harvested rice is put into gunny bags and brought in the procession with elephant to the Natha Devale in Kandy. The surrounding Temples and Devales send pingos (kada) to the Natha Devale, where later, paddy and rice is distributed as per a given list.

With the rice offered to the Kiribada Rice Bowl, milk rice is prepared and the bowl is filled with it. This is supposed to be an offering made by the king in honor of Lord Buddha and the other venerable monks. The New Harvest Festival is commemorated by the king, as a mark of respect for the sacrifices made to all the other places in Sri Lanka. The New Harvest Festival is treated as an annual offering of alms by the king's place, according to the findings of its history.

New Year Festival

The official who forecasts the auspicious times of the king's palace is appointed to carry out his duties in the Dalada Maligawa also. His duty is to find the auspicious times to hold the annual festivals of the four devales and attend to all other matters in connection with those, according to other auspicious times. In other words he is known as the 'Auspicious Time Keeper' of the Dalada Maligawa.

The auspicious time to start the Buddha Pooja on the New Year Day is a task delegated to this Mohottala. Even on the Sinhala New Year Day the Buddha Pooja are conducted, according to the time selected by him. The Dalada Maligawa is decorated on behalf of the Sinhala New Year according to the traditional custom

Karthika Festival

Karthika Festival is dedicated to the lighting of oil lamps. On this festival, representatives from ancient temples gather at the Natha Devale. According to a list prepared by the Natha Devale, those officials gathered are given a 'pint' of oil each. This oil is supplied to the Natha Devale by Dalada Maligawa.

Those who received this oil, are to hold take it in a Perehare procession to their respective Devales, and light oil lamp as an offering to the king. On the day of the festival the Dalada Maligawa, New Vihara in Asgirya and the other Viharas participating in the Karthika Festival have to decorate their respective Temples. On that particular day a Perahara procession, carrying the casket of the Sacred Tooth Relic proceed through the streets. The main feature of this festival, compared to other festival is holding of the Perahara.

Asala Perahera

Asala perahera is one of the greatest pageants with great socio-cultural value, held annually in July and August in honor of the Sacred Tooth Relic. It is most popular not only among Buddhist but also non-Buddhist and among the foreign tourists.

There are different views over the origination and aim of Masala festival. As Senevirathna (2004:131) pointed out, the Asala perahera originated in India and continued throughout in Sri Lanka in the month of Asala. Another view

is that it commemorate the victory of the Suras (Gods) over the Asuras Demons (Senevirathna, 2004:131). According to Aluwihare it commemorates the victory of King Vankanasika Tissa over the King of Chola (in India) invaded Ceylon.

While the Perahera referred to in the Mahawamsa was a purely religious one, at present, it is performing to commemorate various events. Among these one of the main purposes is that to assure timely rain.

As seneviratna (2004: 130) mentioned the Asala festival is held annually to propitiate the Gods in order to assure timely rains for cultivation and this suggests that it is an integral part of the complex fertility cult prevalent among the peasants.

As sources revealed the Tooth Relic were honored organizing colorful pageants annually by Sri Lankans since the Anuradhapura period. The king Kirthisiri Meghawanna, the ruler of the country at time the Sacred Tooth Relic was brought has decreed that the Relic should be taken round the city of Anuradhapura once a year in spring. The kings followed him also have continued this decree. Fa Hien, the famous Chinese traveler in his book describing his travels in India and Ceylon in the 5th century A.D. has described about these festivals (Aluwihare, www.lankalibrary.com/heritage/esala.htm). Robert Knox, the most famous foreign prisoner in Sri Lanka has portrayed his experience over this festival which was held in the reign of king Rajasinha II (1629-1687 A.D.) in his book on 'A Historical Relation of Ceylon' (1948: 138-140).

According to the narration of Knox in the earlier times the king himself participated in the procession. However, the festivals on Sacred Tooth Relic were amalgamated with Asala perahera only in the time of Mahanuwara (Kandy) kingdom. The Dalada perahera (Procession of the Temple of the

Scared Tooth Relic) commenced in 1753¹ A. D., under the reign of Keerthi Sri Rajasingha was a main element of the Asala perahera (Vajira 436; Mv., XCVII: 42-65).

This perahera was confined initially to four Devala perahera dedicated to four Gods namely Natha, Vishnu, Skanda and Pattini. However, with the amalgamated Dalada perahera with four Devela perahers, the whole pageant became more Buddhistic (Seneviratna, 2004: 141). As sources reveal, since the reign of Keerthisri Rajasinha, Asala perahera has continued for the honor of Sacred Tooth Relic. This festival has continued after fell the Kandyan kingdom into the hands of the British in the year 1815.

According to the writings of John Davy² (1969: 128-130), high official in the temples (would be mahanayakas) and the government have participated the perahera. It was held twice a day in the afternoon and night. For the first time Dalada perahera amalgamated into Devala peraheras, thereby giving the whole pageant a Buddhist appearance. Moreover the king has participated in the procession actively during the five days which held the procession.

From 1818 to 1828, the perahera has not held due to the rebellion of Sinhalese against the British administration which is known as Uva-wellasa uprising. It was interrupted again by the Sinhala-Muslim riot in 1915 and started again only in 1919. Since then the festival and perahera continued throughout. Under the British rule since 1815, the custody of Tooth Relic was handed over to Buddhist Clergies in Malwatta and Asgiri chapters of Siyam Maha Nikaya. In order to handle administrative matters a lay custodian known as Diyawadana Nilame was appointed.

¹ According to Aluwihare www.lankalibrary.com/heritage/esala.htm, the year is 1775 A. D.

² John Davy spent four years in Sri Lanka from 1816-1820 and his work on *An Account of the Interior of Ceylon* has given a graphic description over the Asala perahera.

At present, the Asala perahera festival is celebrated the Buddha and to Gods namely Natha, Vishnu, Kataragama and Goddesses Pattini who with their divine to beseech blessings of the gods to obtain rain for the cultivation of crops and to enrich the lands of the kingdom. The festival started off by the ritual known as 'Kap situweema'. In this ritual the sanctified young jackfruit tree is cut into four pieces and planted in the premises of the four Devales dedicated to above Gods.

This ritual begins in the auspicious time given by the astrologer of the temple known as the Nekat Mohottala. Within the next five nights the Devala Preraheras take place within the premises of the four Devales with a large procession including Nilames of four Devales and dances, drummers etc. On the sixth night, the Kumbal Perahera begins.

Firstly, Devala Peraheras congregate in front of the Dalada Maligawa (the Temple of Tooth Relic) accompanied by the Basnayake Nilames (the lay custodians of the Devales). Next, Dalada perahera accompanied by the Maligawa Elephant with Ransivigeya which affixed on it with the Relic casket join the awaiting Devala perahera and leads the procession. Whip-crackers and fireball acrobats clear the path, followed by the Buddhist flag bearers. This is followed by the official in the Dalada Maligawa known as Peramune Rala and Kandyan Drummers and Dancers, elephants, groups of musicians, dancers and flag bearers. A group of singers dressed in white heralds the arrival of the Maligawa Tusker carrying the Secred Tooth Relic. The Diyawadana Nilame walks in traditional Kandyan-clothed splendor after the tusker. Other four processions begin from Natha Devala, Vishnu Devala, Kataragama Devala and Pttini Devala respectively. Pattini Devala procession is the only procession that has women dances.

After the five nights of the Kumabal Perahera, Randoli Perahera begins. This Perahera held with the participation of thousands of peoples. After the

Randoli perehara which take place over five nights, the pageant concludes with the Diya

Kepeema, which is the water cutting ceremony at the place known as Gatambe at the Mahaweli River.

Rituals associated with Drought

Since the begging of the civilization of the Sinhala people, their main occupation has been agriculture. Therefore the water became a necessity. The nation expected rains, especially during the period of cultivation.

Since 3rd century B.C. during which period Buddhism was introduced to the Island, the majority of the Sinhala people embraced Buddhism. There after the cultural background of Sri Lanka became under the banner of Buddhism. When the tooth Relic came into the possession of the people of Sri Lanka, they also became accustomed to invoke it's blessings to get rain. Now it became a belief, that in order to get rains during a particular season, the blessings of the Sacred Tooth Relic, plays a major role. Therefore the objective of holding the annual Sacred Tooth Relic turned out, to get rain.

A very good example of this took place during the time king Parakkaramabahu I ruled the country. No sooner the Dalada Perahara was held and immediately after it, there came down rains (Culavamsa, LXXIV: 232-248). Whenever there was a severe drought in the Island, the king and the people both made it a habit to invoke blessings by holding of poojas, in the Dalada Maligawa, where the Sacred Tooth Relic also was displayed at the same time to the public.

Whenever the country faced a critical period due to the lack of rains and faced drought, in order to get down rain, the Dalada Perahara procession and the displaying of the Tooth Relic should be repeated as conducted annually. This

is conducted in accordance with the “Enactment” embodied in the Dalada Pirith Statutory. The “Enactment” is as follows;

‘The invoking of blessings should be carried out every year and whenever there are no rains, the Dalada pooja should be carried out’ (Dalada Sirita, 2008:79).

According to the Culavamsa, a great calamity took place during the reign of Parakkamabahu II.

“Through the influence of evil planets a great heat arose in lanka by which everything was burnt up, when the corn withered and a famine was inevitable and the host of the people was filled with great anxiety, the king ordered a splendid festival in Dambadeniya. He gathered the monks and having caused them to chant pirith and bear the sacred Tooth Relic around the town in fitting manner with the firm resolve “the heaven shall rain”.

Thereupon great clouds gathered on every side flashing with lightning and again and again thundering so that it was a bliss for the ears of the people and it began to rain, destroying the glowing heat, driving away famine, beautifying the country and reviving the corn”(Culavamsa, LXXXVII:1-9). In this manner, by the invoking of blessings of the Sacred Tooth Relic, the people of Sri Lanka were able to get relief from their distress.

Temple of the Tooth Relic in Kandy

Presently the Tooth Relic is placed in the Kandy Temple of the Tooth Relic. It is placed in a special shrine known as the ‘seat of the shrine of the Tooth Relic’. Only the Bhikkus who are detailed to attend to the Shrine and other officials performing various duties have permission of access to the enclosure.

The Tooth Relic is placed inside seven caskets. The outer casket had been presented by Burma. It has no lock for it. The second casket has a padlock, the key of which is kept under the custody of the Diyawadana Nilame of the Dalada Maligawa. The key for the third casket is kept under the custody of the Malwathu

Maha Nayake Thero. The fourth is kept under the custody of the chief Incumbent of the Asgiri Viharaya. Inside the 7th casket is kept the Sacred Tooth Relic, in the similar manner the Sacred Chaitya is embedded.

When the public is allowed to pay homage to it, the Tooth Relic is transferred from the casket to a transparent casket made of Glass. The Sacred object is placed on a golden lotus with covered on golden thread and keeps in the centre of the glass casket.

CONCLUSION

The Sacred Tooth Relic is one of the most important and venerated sacred objects among Sri Lankan Buddhists. From 4th century A.D. various rites have been performed to protect and venerate the Sacred Tooth Relic under royal patronage. Almost every Buddhists community have been worshiped Sacred Tooth Relic to fulfill their various ambitions. Not only Buddhist but also people in other faith honor the Sacred Tooth Relic. Through the participation of thousands of Sri Lankan Buddhists in daily and annual rites and festivals, their faith in the Sacred Tooth Relic is very much evident. In the ancient times these festivals were patronage by the kings. At present it is the responsibility of the government and these rites and rituals have become national ceremonies of the country. Sacred Tooth Relic has become a symbol not only of religious but political and economics also.

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HEALTH IMPACT OF WOOD FUEL COOKING IN RURAL SETTINGS: WITH REFERENCE TO KARAMETIYA DIVISIONAL SECRETARIAT, SRI LANKA

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ABSTRACT

Wood fuel consumption in rural settings deprives community's ability of reaching long run development because of its higher health risk. Although adverse effects of indoor air pollution on respiratory health is well researched globally, impact of biomass cooking in terms of health risk is not adequately researched in Sri Lankan context. This study utilized a primary sample of 200 households in Badulla district chosen under convenient sampling method to collect data. Dependent variable is binary which takes value 1 for risky group and 0 otherwise. Health risk index was constructed using Principle Component Method and the respondents were grouped into two based on the mean score value. Independent variables were mainly awareness on cleaner fuel benefits, fuel type used for cooking, per head income; mean age of household, time spent on cooking and collecting firewood and education level of the head of the household. This study examines factors affecting health risk of rural households, emphasizing the significant positive impact of wood fuel cooking. Binary logit model and Principle Component Method were employed to estimate relationships while SPSS analyzed data. Results suggests that wood fuel, awareness and higher mean age significantly increased the probability of households being in biomass cooking related health risk recommending the national policies on changing cooking practices, fuel type, improving ventilation and increasing opportunity cost of women being unemployed.

Key Words: Logit Model, Biomass, Health risk, Principle Component Method

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INTRODUCTION

The rural consumption of traditional, inefficient biomass energy sources for cooking in developing countries deprives community's ability to reach long term goal of sustainability because of its high influence on the health risk of households. More than half of the developing world's population, particularly rural poor households depends on solid fuels such as agricultural residues, green waste, wood and wood derivatives, charcoal, coal, crop waste, and dung for their primary cooking. Depending on the typical level of energy development, the cooking fuel used in the households can be categorized as 'traditional', 'intermediate' and 'modern'. Above solid fuels are included in the traditional category while cleaner modern fuel includes LPG and electricity.

Individuals' larger reliance on traditional, inefficient and dirty energy sources has been identified as a major threat to the economic development specifically in developing countries. The hazardous effects of biomass consumption challenge the standards of living, education, health, employment and many economic aspects of the humans. While encouragement of cleaner fuel consumption is activated to uplift the development and economic status, factors influencing threats on it should be addressed in parallel.

The use of cooking fuels is determined based on many factors such as socio-economic conditions, energy use patterns, housing characteristics, cooking behavior, cultural factors, government policies and people's willingness to reduce the impact of indoor air pollution etc. Lower adequate supply of cleaner fuel, lack of affordability, unawareness of cleaner fuel and the negative effects of the use of traditional solid fuels, unavailability like factors have influenced the higher demand for these solid energy sources.

LITERATURE REVIEW

The household cooking energy can be categorized in few types according to different definitions. Depending on the typical level of energy development, the cooking fuel used in the households can be categorized as ‘traditional’, ‘intermediate’ and ‘modern’. The traditional type includes animal dung, agricultural residues and fuel wood. And further, the cooking energy types can also be categorized as ‘renewable’ and non- renewable’ too. The renewables will include biomass, solar and biogas while non- renewables include coal, kerosene, natural gas and LPG. (Malla & Timilsina., 2014).

One of the two issues faced by developing regions is that this inefficient production and use of traditional energy sources which significantly negatively affect the environmental, economic, and health impacts (Barnes & Floor., 1996). In these countries, a major cause of indoor air pollution has been identified to be wood fuel cooking. The burning of these inefficient fuel sources in traditional unimproved, open stoves, they generally release a number of hazardous pollutants, such as carbon monoxide, sulphur oxides, formaldehyde, polycyclic organic matter and nitrogen oxide adding up factors for health cost. Desai et al. (as in Arcenas et al., 2010). A Micro-environmental study in rural Burdwan, West Bengal finds that a higher concentration of CO₂ was released during burning of dry leaf, straw, cow dung compared to that from LPG. They can be significant threats which will damage or injure human health through causing respiratory infections, nasopharyngeal and airways irritation, wheezing, chronic bronchitis, chronic obstructive pulmonary disease, low birth weight, increases in parental deaths, cancer of the lung, mouth, cataracts etc. (Banerjee et al., 2012 & Chakraborty et al., 2014). In rural Rajasthan, approximately 4 million adults suffer from serious respiratory symptoms. 2 million adults would have respiratory diseases. 3.6 million People are estimated to be suffered from eye

diseases. 1.1 million suffer from bronchitis. Some rurally and less development inherited characteristics such as poor ventilation, household lifestyles, housing conditions and individual characteristics will exacerbate these negative effects (Laxmi et al., 2003).

As a result of several factors, the developing world's rural households tend to use unsafe, inefficient wood fuel instead of commercial fuels which are safer and efficient. In Sub Saharan Africa, they do not have enough access to clean energy solutions and electrification. Therefore, nearly a third of the urban population and the majority of the rural population are using biomass for cooking and heating in traditional open fires. The use of kerosene and LPG like commercial fuels is lower in rural Rajasthan for several reasons. Kerosene is used as the main source of lighting, because of the low and inadequate supply of electricity. 99 percent of households in rural Rajasthan use bio- fuels for cooking. Fuel wood is the main source of cooking for a majority of them which accounts for 87 percent. Dung- cake and crop residues are used in 84 percent and 27 percent of households respectively. Kerosene like cleaner fuels are used only for lighting purposes and only about 6 percent of the households use it for cooking. LPG usage was limited only for 4 percent of them. According to further details, the Electricity and biogas usage for cooking can be identified to be almost negligible. (Laxmi et al., 2003). West Bengal mostly use wood followed by twigs, coal cake, dung, straw and dry leaf in rural areas. The use of gas stoves were quite low (Chakraborty et al., 2014).

The use of cooking fuels is determined based on many factors such as socio-economic conditions, energy use patterns, housing characteristics, cooking behavior, cultural factors, government policies and people's willingness to reduce the impact of indoor air pollution (Malla & Timilsina., 2014, Laxmi et al., 2003). In rural Rajasthan; a quantitative analysis have considered

educational level, age, income and gender like factors under socio- economic conditions (Laxmi et al., 2003). The World Bank Research Group have focused on several socio- economic factors, such as income, education, age and size of the households, time spent at home, ownership, age and type of the dwelling, influence households cooking fuel and cook stove choices, while giving a more wider view. Access to organizational services such as employment, banking, schooling, health care and transportation in the local communities have a significant potential to increase the use of alternative cleaner fuels in Nepal (Link et al., 2012).. Further these studies significant evidence that the education or awareness is also another factor that affects the cooking fuel choices. Especially the education level of wife influences the probability of switching from fuel wood to charcoal or kerosene in rural areas in Kenya. Alongside household expenditure and household size also influence this choice in both rural and urban areas in India (Malla &Timilsina., 2014, Jan., 2012). In Philippine, a correlation between income and the use of dirty fuels have been identified further emphasizing the need to improve active interventions (Arcenas et al., 2010).

Information on consumption of bio fuels and commercial fuels, time and effort involved procurement and rate at which procured came under energy use pattern. Housing characteristics included location of the kitchen, number of rooms, type of house and type of kitchen and number of doors and windows to the kitchen. Cooking behavior was considered to have influence of number of meals cooked using different fuels in a day, hours of cooking, and cooking involvement in different age groups and type of involvement (Laxmi et al., 2003). The poor ventilation pattern in houses was recorded in the West Bengal with the higher rate of indoor air pollution related diseases. Study revealed that about 70.58 percent of the people cooked their food inside a room. That means they had no specific area separated as a kitchen. Totally four types of kitchen area were identified in the study. It revealed that although there was

no link between the kitchen and the living room, there was a corridor through which the fuel generated smoke from kitchen passed and directly entered the living room. Therefore, the population was intensely exposed to toxic indoor pollutants generated from solid biomass fuel (Chakraborty et al., 2014).

Chakraborty (2014) finds that the use of greener fuel basically depends on their economic condition. 30 percent of them cooked food one time a day and 20 percent of them cooked two times a day. This frequency of cooking meals is also depended on their family strength and the nature of the job in West Bengal. In Indonesian, Chinese and Sri Lankan findings, Ramani and Heijndermans (2003) states that there is a difference for men and women in the served purposes of time saved due to improvement in access to modern energy in cooking practices (as sited in Malla, S and Timilsina, G. R., 2014). Sri Lankan households use wood than any other fuel source. Approximately 65% of households are cooking inside the main household structure while only 9% had a separate building for cooking (Nandasena et al., 2012).

The case in Rajasthan mainly addresses the relationship between the health impacts of health cost of the indoor air pollution and its significant factors. As per the results, cough, phlegm, breathlessness, wheezing and eye irritation are significantly higher in illiterate persons. And further, higher the no. of years of cooking, involvement in cooking, and age, higher the risk to suffer from cough, phlegm, breathlessness, blood in sputum and eye irritation in female adults. The study reveals that Asthma and pulmonary TB are not directly associated with indoor air pollution, but there is a potential to some extent. The annual cost per year on respiratory diseases and eye problems is estimated to be Rs. 7.2 billion for adults in Rajasthan.

Chakraborty (2014) reveals that the systolic and diastolic pressure levels of the rural population was showing a significantly positive relationship with the type of fuel used and age of them. The symptoms such as eye irritation,

shortness of breath, cough and dizziness are highly prominent among them. Exposure to hazardous air pollutants at home have significant effects on the health issues such as child cognitive functions, low birth weights, cervical cancer, adverse pregnancy outcomes, asthma and tuberculosis, (Kurmi et al., 2010), and compared to infants born in the households who used LPG, the infants born in households who depend on biomass and coal were more likely to be born with low birth weight. It further reveals that the mean birth weight of infants born in households using fuel wood and coal and kerosene was significantly lower than the mean birth weights in households using LPG (as in Malla & Timilsina., 2014).

Problem of the study

The study intends to answer the following questions.

- What are the significant explanatory factors influencing the health risk of biomass cooking for the rural households and their magnitude?
- Do fuel type used in cooking exhibit a significant relationship with the health risk of a household?
- Does biomass cooking have a positive relationship with the health risk of a household?

Main objective:

To identify the significant factors influencing household health risk of biomass cooking.

- Co- objective:

To examine whether there is a significant positive relationship between wood fuel cooking and household health risk.

METHODOLOGY

This is a quantitative research examining the factors affecting health risk of biomass cooking rural households. The analysis will include both the descriptive and quantitative methods to explain the associations between variables and to establish the causality among them.

The sample of 200 households was selected on convenient sampling method. Kandaketiya divisional secretariat in Badulla district was selected as the geographical sample area since it is an area which largely use traditional energy sources such as firewood and other biomass sources in daily cooking activities. For an accurate estimate of the relationship between variables.

The households were selected on convenience basis and on judgmental sampling method when the enumerator knew the right place to ensure optimization of time and resources. This made the sampling technique cheaper and convenient with less time consumption.

Structured questionnaire method was employed in the collection of data, and the respondents were interviewed by trained enumerators who followed the structured questionnaire and got them filled accordingly. The questionnaire was designed in English first and then translated into Sinhalese in order to improve the level of understanding of enumerator and the respondents. The questionnaire was translated back into English to check further accuracy. A pilot survey was done prior to check the efficiency of the survey.

This research employed primary data in the benefit of the study with a sufficient level of accuracy, through a household level data collection. The questionnaire comprised of eight sections and data generated are presented as follows.

- The first section is comprised of awareness data, which directly questions the respondent about cleaner fuel types, reasons for indoor air pollution and the health effects caused by indoor air pollution up to their knowledge.
- Second section is comprised of socio- economic data such as family size, area of living, occupation, income, marital status and education level. Further this section explores the housing characteristics and asset ownership data which will indicate the level of wealth of the household and which is later used in an asset index as explained below.
- The third section describes energy use patterns.
- Fourth section is comprised of data on kitchen type.
- Fifth section covers the information on cooking behavior of chief cook, regular assistants and occasional assistants.
- Sixth section is comprised of economic cost data related to biomass consumption, while covering the discomforts faced in collecting, processing and cooking.
- Health profile data covered the presence of indoor air pollution related respiratory illnesses and eye illnesses along with the respective medical costs and indoor air pollution related health effect symptoms in the seventh section.
- The last section is comprised of households' willingness to reduce the negative effects of biomass cooking and the reasons for not using or lack of usage of cleaner fuel.

MODEL SPECIFICATION

Methods used for the analysis: Principle Component Analysis (PCA)

Principle Component Analysis (PCA) is a practical, standard statistical tool used in modern data analysis which is known as a straight forward and non-parametric method for extracting pertinent information from confusing data sets. The main reason to use this method is the presence of large number of questions or variables. Or in other words, it is used to reduce the number of variables which is most widely used in face recognition. This method is used to separate a sub characteristic from a main attribute or to create multidimensional indices. Further, it transforms a number of correlated variables into a smaller number of uncorrelated variables called principle components. The first principle component accounts for as much of the variability in the data as possible and each succeeding component accounts for as much of the remaining variability as possible.

Therefore, in this study, PCA is utilized to reduce the dimensionality of the data set. It involves replacing a set of correlated variables with a set of uncorrelated principle components that represent unobserved characteristics of the population

Health Risk Index

Considering the health issues related to the utilization of biomass cook fuel sources in these households they are often suffering from respiratory illness symptoms such as cough, phlegm, wheeze, breathlessness and red eye and eye itchiness. Some of the illnesses such as red eye, eye itchiness, cough and phlegm are covered by direct questions.

To create the Health risk index which is a main and important variable in the study that will be used in further model building, PCM is used. Presence of cough, phlegm, red eye and eye itching inside the household were entered as cough/ phlegm= 1, red eye/ eye itching= 2 and both= 3. But for the convenience of the index construction, these variables were compressed in to

one using PCM, while re-coding values as absence of these illnesses= 0 and presence of any of the illness=1 and is converted in to binary form.

Cough/ phlegm	= 1	}	1
Red eye/ eye itching	= 2		
Both	= 3		
None	= 0		

Difficulties faced while collecting, processing wood fuel and while cooking with it was also re- coded and created a binary variable.

Absence of any of the difficulties faced by anyone of the household = 0

Presence of any of the difficulty faced by anyone of the household = 1

Health Risk Index

- IAP related Health issue
- Difficultied faced in collecting fuel wood
- Difficulties faced in processing fuel wood
- Difficulties faced in cooking with fuel wood

All the above variables

were compressed in to one variable called “HealthRiskIndex” using PCM and the health risk index is considered to be the first principle component as in the asset index. Thus the dependent variable is binary which takes value 1 for risky group with presence of any of these issues and 0 otherwise.

Binary Logistic Regression

Explaining regression models used for dichotomous data, the logistic regression is used in the analysis of data. These models are appropriate when the response variable takes one of only two values representing presence and absence of a particular characteristic in the variable which the researcher is interested in.

Health risk will be viewed as response variable or the dependent of mean age of the household, per head income of the household, main fuel type used in cooking daily, awareness on cleaner fuel sources and indoor air pollution related health

issues, time spent on collecting wood fuel, time spent of cooking one meal per day and level of education of the head.

Since the outcome variable regarding health risk is dichotomous, binary logistic model which specified below is estimated to examine the probability of being affected by indoor air pollution related issue. Explaining it with the health cost model;

Hence, in this model, binary dependent variable takes value 1 if a household has related health risk or 0 for otherwise. Then the basic model takes the form of,

$$y_i = \sum_{j=0}^k X_{ij}\beta_j + \varepsilon_i \quad (1)$$

We consider the case where the response Y_i is binary, assuming only two values can be taken by the dependent variable as one or zero. For example;

$$Y_i = \begin{cases} 1 & \text{if } i\text{th person has biomass cooking related health issue} \\ 0 & \text{otherwise} \end{cases}$$

0 otherwise

Where y denotes binary dependent variable, β is vector of parameters and the error term ϵ which has zero mean and logistic distribution. If P_i is the probability that a household report a health issue takes logistic distribution

$$\ln\left(\frac{P_i}{1 - P_i}\right) = \alpha + \sum \beta_j X_{ij} \quad (2)$$

Health Risk Model (biomass cooking related health risk)

$$\begin{aligned} \ln\left(\frac{P_i}{1 - P_i}\right) = & \beta_0 + \beta_1 \text{mean_ageH} + \beta_2 \text{Edu_head} + \beta_3 \text{fue_type} \\ & + \beta_4 \text{awareness} + \beta_5 \text{tym_2p} + \beta_6 \text{time_cook} \\ & + \beta_9 \text{perHd_Inc} + \epsilon \end{aligned}$$

Where,

Mean_ageH = Mean age of the household

perhd_Inc = Per head income of the household

fuel_type = Main fuel type used in cooking daily

awareness = Awareness on cleaner fuel sources and indoor air pollution related health issues

time_2p = Time spent on collecting wood fuel per day

time_cook = Time spent of cooking one meal per day

Edu_head = Level of education of the head

To use the health risk index in the benefit of the health risk model, which employs binary logistic regression, first principle component is re-coded as a binary variable with the values above mean (mean= 0.00) in to 1 and values less than mean in to 0 which indicated;

Presence of biomass cooking related health issue/ risk = 1

Absence of biomass cooking related health issue/ risk = 0

This variable is used in the logit model as the dependent variable while other covariates facilitate determining the effect of them on households to have a biomass cooking related health issue/ risk.

The other variables are used in the model as independent variables which has a possibility of determining the probability of a household to have a biomass cooking related health issue or risk. Especially the awareness about cleaner fuel sources and the dirty fuel related health issues and the use of biomass cooking fuel are expected to be significant factors on a household's health. Fair enough awareness will tend to reduce the risk on health which is generated by biomass cooking significantly, while wood fuel use (fuel type being wood fuel) have a significant impact of increasing the probability of being in related health risk.

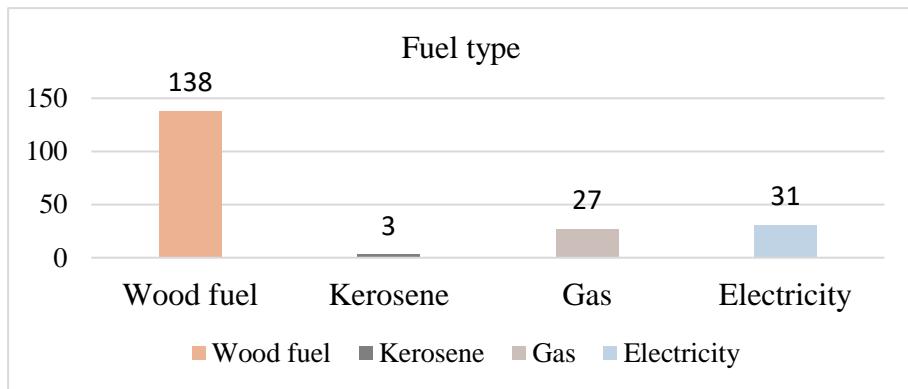
Mean age of the household is obtained by dividing the total ages of the household by the total family size. Prior to this mathematical operation, the total family size is calculated by imposing 0.5 to one child below age 12. Per head income is calculated by dividing total income of the household by total family size. Fuel type is a categorical variable with 5 codes as; biofuel=1, kerosene=2, gas/LPG=3 and electricity=4. For the regression we only use the head's level of education from the household. Finally time taken to cook one meal per day and time spent on collecting wood fuel are obtained in hours were also considered.

DISCUSSION

Almost 70% of the households use wood fuel as their main source in daily cooking while nearly half (48%) of the sample were in biomass cooking

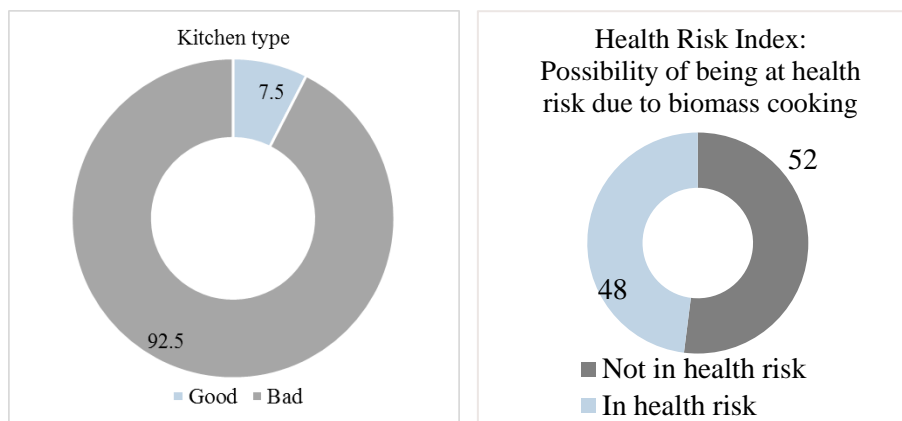
related health risk. More than a half (69%) of households in Karametiya area use wood fuel for cooking as their main fuel choice. The next most used fuel type is electricity which is used by 31 households accounting for 15.5% of the sample. Gas was used as the main cooking fuel by 27 households which were 13.5% of the total sample. Kerosene was used by only 3 households; hence it is almost negligible.

Figure 1: Fuel Type



Alongside 68.5% of the households were not aware of the cleaner fuel sources and the hazardous health effects of indoor air pollution. 98.5% of the household heads were employed in a wider range of occupations including farmers (56.7) while 94% of the women were reported as unemployed. 92.5% have their kitchen inside the house while only 7.5% of the households had a separate kitchen outside the house.

A quartile analysis was conducted to see the relationships between the selected dependent and independent variables for the Binary Logit Model with the purpose of setting a base for the regression. The dependent variable is Health Risk Index while following other variables be the independents. Quartiles of the dependent variable are discussed with the various covariates to identify the independent variable that correlate with the Health risk.

Figure 2: Quartile Analysis: Health Risk

In the quartile analysis, the mean age is showing a positive relationship with the Health Risk Index, in the four quarters as 29.7742, 31.1562, 34.0754 and 36.3692. The means of four quarters are increased through. It is an indicator that these two variables are correlated positively. Likewise, since the expected relationships from the other selected variables were visible through the quartile analysis, they are used in the inferential analysis.

Logit Model

Except per head income of the household, time spent cooking and time spent collecting firewood, all the other variables were significant having the expected signs. Fuel type and mean age of household showed a significant positive relation under 0.05 significant levels confirming; higher the age, higher will be the risk of having a biomass cooking related health issue. Fuel type being significant for wood

fuel, it confirmed the wood fuel usage at home as main cooking energy source increased the odds of having a wood fuel consumption related health risk ($p < 0.05$). Awareness showed a negative relation confirming that better awareness on cleaner fuel and negative health effects of biomass and indoor

air pollution have a low risk of falling in to biomass cooking related health issues. For example; regarding wood fuel users, it is 30.96 times more likely to be in health risk than for other fuel type users while aged groups were more likely to be in biomass cooking related health risk 1.095 times.

Table 1: Determinants of Health Risk Of Biomass Cooking: Regression Results

Variable	Coefficient	sd	Odds Ratio	Wald	Sig.
Fuel type				19.535	.000
Wood fuel	3.422*	0.918	30.634	13.901	.000
Kerosene	0.861	1.704	2.364	0.255	.614
Gas	-0.198	0.910	0.821	0.047	.828
Mean_ageH	0.091*	0.026	1.095	12.670	.000
Awareness (1)	-0.937*	0.475	0.392	3.894	.048
Perhd_Inc	0.000	0.000	1.000	0.010	.922
Time_cook	0.012	0.647	1.012	0.000	.985
Time_2p	0.003	0.224	1.003	0.000	.990
Constant	-4.900	1.552	0.007	9.969	.002

* $p < 0.05$

Estimated Model:

$$\hat{Y} = -4.9 + 3.422\text{fuel_type} + 0.091\text{mean_ageH} - 0.937\text{awareness}$$

(1.552) (0.918) (0.026) (-0.937)

Given 1 for being in biomass cooking related health risk and 0 for otherwise, when all the other variables held constant, the log of estimated odds ratio of a household being in health risk will increase by 3.422 for fuel type of wood fuel ($p = 0.000 < 0.05$). Or in other words, for wood fuel users, it is 30.96 times more likely to be in health risk than for other fuel type users.

When mean age of the household increase by 1 year, the log value of estimated odds ratio will increase by 0.091 ($p = 0.000 < 0.05$). This indicates

that aged groups are more likely to be in biomass cooking related health risk 1.095 times.

Awareness confirms that households who are aware of cleaner fuel are 0.392 times more likely to be not in health risk than who are unaware ($p = 0.048 < 0.05$). Or in other words, when a household is aware of the clean fuel, the log value of estimated odds ratio will decrease by 0.937.

Therefore, the fuel type being wood fuel, awareness and mean age of the household are the three factors which significantly influence the health risk of biomass cooking. Among them, the most significant factor that influence the health risk of households is the fuel type with Wald value of 13.901 ($p = 0.000$). This significant relationship identifies among the dependent variable and the explanatory variable is a positive value indicating that for wood fuel users, it is 30.96 times more likely to be in health risk than for other fuel type users.

CONCLUSION

Concluding the findings of the research, along with all the above facts, fuel type being wood fuel, unawareness and higher mean age were finalized to be the significant factors affected increasing biomass cooking related health risk in rural Sri Lanka. With the kitchen type considered, low rate of outside kitchens is surprisingly noticed while Karametiya being a rural area. This implies the need of sufficient ventilation to the kitchen for those who are not in the safe conditions.

For wood fuel using households in selected sample, health cost is higher than the direct cost incurred in monetary terms. Indirectly, biomass cooking costs the rural community more than what is actually felt by them in day to day life. This strengthens the idea that members who suffer from indoor air pollution

related health issues or other physical discomforts will add up to barriers for development.

Changing the fuel type used at home through awareness programme on risks of dirty fuel consumption will be helpful in improving the knowledge about health effects due to indoor air pollution and in changing attitudes will be beneficial. Increasing women employment and the capacity to engage in self-employment activities will reduce the extra time left for them at homes and there by encourage them to shift for efficient energy sources, since once women are employed in income earning activities, the opportunity cost of one hour wasted on fire wood collection or traditional cooking would be higher.

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Appendix 1: Pearson Correlations

Correlations of the selected variables with the selected dependent variable; Health Risk index, is described below

Covariates	Pearson Correlation	Sig. (2 tailed)	N
Mean age of the respondent	0.239**	.001	200
Education level of the spouse	-0.270**	.000	183
Total income of the household	-0.284**	.000	200
Per head income of the household	-0.389**	.000	200
Per earner income of the household	-0.309**	.000	200
Number of earners in the household	-0.034	.633	199
Ownership of a vehicle	-0.132	.062	200
Fuel type	-0.474**	.000	199
Time spent on cooking one meal per day	-0.297**	.000	196
Time spent on procurement of fire wood per day	0.188**	.008	200
Total Medical cost per month	0.043	.546	200
Awareness on cleaner fuel and benefits	-0.091	.198	200
Asset index	-0.177*	.013	197

** Correlation is significant at the 0.01 level (2 tailed), * Correlation is significant at 0.05 level (2 tailed)

Appendix 2: Quartile analysis; Health risk index

Indicators	Explained variation	Un rotated loadings	Anti-image correlations	n
P related Health issue	0.227	0.355	0.794	200
Difficulties faced: collecting	0.158	0.309	0.754	200
Difficulties faced: processing	0.145	0.357	0.737	200
Difficulties faced: cooking	0.226	0.008	0.447	200
Health risk Q1	0.615	0.539	0.748	200
Health risk Q2	0.643	0.062	0.750	200
Health risk Q3	0.757	0.753	0.753	200
Health risk Q5	0.708	0.590	0.721	200
Health risk Q6	0.460	0.558	0.641	200
Health risk Q7	0.510	0.646	0.623	200
Health risk Q8	0.693	0.452	0.691	200
Health risk Q9	0.255	0.165	0.516	200
KMO measure of sampling adequacy 0.698				
Bartlett's: Chi square 0.000				

Appendix 4: Logistic Regression

Case Processing Summary			
		N	Percent
Unweighted Cases ^a			
Selected Cases	Included in Analysis	195	97.5
	Missing Cases	5	2.5
	Total	200	100.0
Unselected Cases		0	.0
Total		200	100.0

a. If weight is in effect, see classification table for the total number of cases.

Dependent Variable Encoding		
Original Value	Internal Value	
not in health risk		0
in a health risk		1

Categorical Variables Codings					
		Frequency	Parameter coding		
			(1)	(2)	(3)
type of fuel type	woodfuel	134	1.000	.000	.000
	kerosene	3	.000	1.000	.000
	gas	27	.000	.000	1.000
	electricity	31	.000	.000	.000
awareness about cleaner fuel and dirty fuel related health issues	no	135	1.000		
	yes	60	.000		

Block 0: Beginning Block

Classification Table ^{a,b}					
Observed			Predicted		
			Health risk index as a binary variable		Percent age Correct
			not in health risk	in a health risk	
Step 0	Health risk index as a binary variable	not in health risk	103	0	100.0
		in a health risk	92	0	.0
Overall Percentage					52.8

Omnibus Tests of Model Coefficients				
		Chi-square	df	Sig.
Step 1	Step	71.323	8	.000
	Block	71.323	8	.000
	Model	71.323	8	.000

-2 Log likelihood	Cox & Snell R Square
198.383 ^a	.306

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	9.978	8	.267

Observed		Predicted		
		Health risk index as a binary variable		Percentage Correct
		not in health risk	in a health risk	
Health risk index as a binary variable	not in health risk	70	33	68.0
	in a health risk	22	70	76.1
Overall Percentage				71.8

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