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Contents of the Issue

- i. Copyright Notice
- ii. Editorial Board Members
- iii. Chief Author and Dean
- iv. Contents of the Issue
- 1. Human Rights, Social Welfare, and Greek Philosophy Legitimate Reasons for the Invasion of Britain by Claudius. *1-5*
- 2. Development of an Absorption Refrigeration System Powered by Solar Energy to Extract Fresh Water from Humid Air in Saudi Arabia. *7-13*
- 3. Pattern of Substance Abuse, Sexual Behavior and its Determinants among Unmarried Youth in India. *15-24*
- La Importancia del Fortalecimiento de los Sistemas Nacionales de Investigadores en América Latina y el Caribe. Caso del Programa Nacional de Incentivo al Investigador del Paraguay (PRONII). 25-38
- 5. Benjamin Franklin Fitch the Forgotten Developer of the Container System in US of America. *39-48*
- 6. Vinculando La Investigación Con La Sociedad a Través de Los *Living Labs.* Una Experiencia Paraguaya. *49-55*
- 7. Factors Influencing Antenatal Care Services Utilization in Empowered Action Group (EAG) States, India: A Spatial and Multilevel Analysis. *57-68*
- v. Fellows
- vi. Auxiliary Memberships
- vii. Process of Submission of Research Paper
- viii. Preferred Author Guidelines
- ix. Index



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Human Rights, Social Welfare, and Greek Philosophy Legitimate Reasons for the Invasion of Britain by Claudius

By Tomoyo Takahashi

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Abstract- In 43 AD, the fourth emperor of Imperial Rome, Tiberius Claudius Drusus, organized his military and invaded Britain. The purpose of this paper is to investigate the legitimate reasons for The Invasion of Britain led by Claudius. Before the invasion, his had an unfortunate life. He was physically distorted, so no one gave him an official position. However, one day, something unimaginable happened. He found himself selected by the Praetorian Guard to be the new emperor of Roma. Many scholars generally agree Claudius was eager to overcome his physical disabilities and low expectations to secure his position as new Emperor in Rome by military success in Britain. Although his personal motivation was understandable, it was not sufficient enough for Imperial Rome to legitimize the invasion of Britain. It is important to separate personal reasons and official reasons.

Keywords: (1) roman, (2) britain, (3) claudius, (4) roman emperor, (5) colonies, (6) slavery, (7) colchester, (8) veterans, (9) legitimacy.

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Human Rights, Social Welfare, and Greek Philosophy Legitimate Reasons for the Invasion of Britain by Claudius

Tomoyo Takahashi

Abstract- In 43 AD, the fourth emperor of Imperial Rome, Tiberius Claudius Drusus, organized his military and invaded Britain. The purpose of this paper is to investigate the legitimate reasons for The Invasion of Britain led by Claudius. Before the invasion, his had an unfortunate life. He was physically distorted, so no one gave him an official position. However, one day, something unimaginable happened. He found himself selected by the Praetorian Guard to be the new emperor of Roma. Many scholars generally agree Claudius was eager to overcome his physical disabilities and low expectations to secure his position as new Emperor in Rome by military success in Britain. Although his personal motivation was understandable, it was not sufficient enough for Imperial Rome to legitimize the invasion of Britain. It is important to separate personal reasons and official reasons. A significant part of this research was library based. In this paper, I will focus on three possible reasons Claudius used to legitimatize the invasion of Britain: 1) Human Rights: To salvage refugees from Britain, 2) Social Welfare: To distribute land and resources for military veterans as part of a social welfare program, and 3) Natural Slave Theory: To apply ancient Greek philosophy by Plato and Aristotle. Because primary sources are limited during the first century, I applied an interdisciplinary view to analyze texts to complete my study.

Keywords: (1) roman, (2) britain, (3) claudius, (4) roman emperor, (5) colonies, (6) slavery, (7) colchester, (8) veterans, (9) legitimacy.

I. INTRODUCTION

he aim of this paper is to investigate the reasons used to legitimize the invasion of Britain by Claudius in A.D. 43. To begin the invasion, Claudian military crossed English Channel and landed approximately 20,000 soldiers at Richborough or Fishbourne Harbour at Chichester in Britain (Ex.1).

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Source: Bedoyere, Guy de la. ROMAN BRITAIN A NEW HISTORY (2006) p25

Ex.1 : The progress of British Invasion only approximately reconstructed from historical source and inscriptions

After a number of battles with local leaders and their followers, the Roman soldiers successfully conquered the South East side of Britain. Claudius' army continuously invaded North East Britain and gained his terrain.

Before Claudius, Britain had been a target for Roman emperors almost 100 years. Julius Caesar was the first commander to invade Britain in 54 BC, and 55 BC, but due to rebellion in Gaul he left without creating a formal Roman colony or military base. He was able to only establish informal relationship with local people.

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Following Caesar, his successors, the first Roman emperor Augustus and the third Roman emperor Caligula, also planned on invasion of Britain. According to historian Peter Salway, "Romans were scorned to do so" because "Britons were too weak to cross the Channel," but none of their plans were carried out (Salway1993).

The fourth Roman emperor, Claudius, was born in 10 BC into part of the royal family; one of the first consuls, Marc Antonius, was his great grandfather, and the second emperor, Tiberius, was his uncle. However, Claudius spent an unfortunate childhood. When he was a baby, he suffered various diseases and disabilities. As a result, he was physically distorted and unable to speak clearly. His mother, Antonia, did not show Claudius sympathy; in fact, she even called him "a monster." In addition, no one, including his highly successful relatives, gave him an official position. Soon, his family decided him incapable of doing intellectual work even though his physical disability did not affect his intelligence (Suetonius 5:2). Moreover, disabilities did not stop Claudius' ability to learn. He became an avid reader and eventually applied himself to literature to gain varied academic knowledge. According to Suetonius, he wrote several historical books when he grew up although those books, unfortunately, did not survive (Suetonius 5:41).

One day, something unimaginable happened. The previous emperor, Claudius witnessed Caligula was murdered on January 22nd, 41 AD, and Claudius found himself selected by the Praetorian Guard to be the fourth Roman emperor. According to historian Guy de la Bedoyere, Claudius "knew he needed to prove himself" (Bedoyere 2006, 24). Soon after, he revived the invasion plan for a British invasion and soon occupied the southeast of Britain. In Rome, it was important for the emperor to publicize his greatest military triumph because military success was an essential gualification for a leader. In fact, Claudius actually traveled to Britain to lead his army during the invasion. His act was needed to prove himself as a leader for Roman citizens and senators. After 60 days, he came back to Rome and celebrated the success. His military achievement brought him respect and confidence to secure his position as the fourth Roman emperor. Claudius even issued new Roman coins that celebrated on this achievement (Ex. 2). One side shows his profile, and another side shows the triumphal arches erected in Rome to commemorate the invasion of Britain. Citizens of Rome learned the greatness of Claudius, so the successful campaign validated his right to rule.



Claudius' profile



Source: Bedoyere, Guy de la. ROMAN BRITAIN A NEW HISTORY (2006) p30.

Ex. 2 : Coin issued by Claudius

The triumphal arches erected in Rome.

The man on the house is believed to be Claudius.

Many scholars, including Sheppard Frere, Stephen Kershaw, Salway, Bedoyere generally agree Claudius was eager to overcome his physical disabilities, achieve a real legacy, and invade Britain to secure his position as new Emperor in Rome (Frere 1967) (Kershaw, 2010) (Salway1993) (Bedoyere 2006). Although his personal motivation was understandable, it was not sufficient enough to Imperial Rome to legitimize the invasion of Britain. It was important to separate personal reasons and official reasons. History suggests the necessity of valid reasons when major countries initiate war. For example, during The First Punic War, Rome was officially asked by Mamertines of Messina for aid in his fight against the Carthaginian navy (Bagnall 2002). Once Rome received legitimate reasons from Messina, they arrogantly begun the war even though their true reason was to destroy a rival country, Carthaginia. Moreover, in the first invasion of Britain, Caesar's official reason was to prevent anti-Roman barbarians from fleeing Gaul to Britain. He used this reason to legitimatize the invasion and enter a mostly unknown island.

What are the legitimate reasons for Claudius' British invasion? In this paper, I will illustrate Claudius' family and social background, and will analyze three possible reasons to legitimatize the invasion of Britain: 1) To salvage legal and human rights for refugees from Britain, 2) To distribute land to Roman military veterans as part of a social welfare program, and 3) To use ancient Greek philosophy focusing on the natural slave theory by Plato and Aristotle. At the end, I will synthesize all valid motivations to conclude the invasion of Britain was seen as a legitimate act by Claudius. This study is important to understand actual historical conquest, which is relevant to complex modern society. The findings might be helpful to separate legitimate reasons from illegitimate reasons for current conflicts.

II. Methods and Procedures

Library-based research was a large part of this study. The main libraries were Oxford University Sackler library, which I visited in earlier August 2015, and the University of California, Berkeley Moffitt library, which I visited in September in 2015 to correct texts from Greek philosophers and modern scholars. Both libraries contain a significant amount of resources, especially in Classical studies.

Also, I visited old Roman towns, forts, and villas, including Vindolanda at Hadrian's Wall, Verulamium Museum and theatre, Fishbourne Roman Palace, Corinlum Museum, Chedworth Roman Villa and Bath between July 17h and August 11th in 2015. Viewing Roman villas in England was important for me to understand the social structure of Roman Britain, especially the slave (Britons) and master (Romans) relationship. During the visit, I interviewed some of the museum technicians and archeologists, who provided me with a considerable knowledge of Roman Britain. In August 2015, at Oxford, I interviewed Classics professor, Stephen Kershaw, to correct information focusing on Aristotle's Natural Slave Theory.

III. Discussion

a) Human Rights

The first valid reason was to rescue political refugees from tribal areas in Britain. Adminius, was the youngest son of the tribal king, Cunobelinus in Catuvellauni (now, called St. Albans area). After Cunobelinus' death in AD 40-43, his heirs were his three sons, Caratacus, Togodumnus, and Adminius (Salway 1993) (Frere 1967). The first two were spiritedly anti-Roman; in contrast, Adminius was allied with the Romans. The reason why Adminius left his land is unclear. According to Professor David Shutter, Adminius wanted to protect his inheritance (Shotter 2002). The archaeologist, John Wacher, said that "Adminius was expelled either for openly expressing [pro-Roman] opinions, or for not supporting the hardening anti-

Roman outlook of his brothers" (Wacher 1975, 203). Even though Adminius' true motivation is still a mystery, he appealed to Rome for assistance in establishing his claim to the kingdom. As a result, "Britain (Adminius) provided not only the ideal opportunity, but also a positive reason for immediate intervention" (Salway 1993 57).

Another refugee from tribal Britain is king of the Atrebates (now, called Silchester area), Verica (or Berrios). He was believed to own some territory in the southwest of Britain, but Caratacus, who was a leader of the Catuvellauni tribe, took over Verica's territory by force. After Caratacus established his entire kingdom in 40 BC, Verica escaped his tribe and traveled to Rome hoping for help in taking back his territory.

According to Dio Cassius, "his exile persuaded Claudius to send a force thither" (Dio 1924). Bedoyere also specified "Verica provided Claudius with a reason to invade Britain" (Bedoyere 2006, 26).

Adminius and Verica's action provided the golden opportunity for Claudius to invade Britain, giving himself a valid reason to invade Britain. He could be seen as rescuing innocent young men, Adminius and Verica, who were inappropriately exiled from Britain with the possibility of losing all of their territories. In this theory, Claudius is not invading British land for his own sake, such as military honor or confiscating land. Instead, he is protecting the legal and human rights of Adminius and Verica. Claudius found a legitimate reason for his invasion of Britain.

b) Social Welfare

Next, Claudius used the invasion of Britain as a way to expand social programs in the colonies. Through this program, land and resources are provided a means of paying off soldiers as a reward for their services by giving retired soldiers since they did not own any place to return to (Kristinsson 2010) (Gascoigne From 2001). Also, colonies were intended to act as civilizing influences on the indigenous people. They were selfgoverning communities, with a city-council (ordo) and a system of magistrates modeled on that of Rome. (Roger 1980). The historian Tacitus said the part of Britain was gradually shaped into a province and was given a colony of veterans (Tacitus).

The first colony, Colchester (Corinium Dobunnorum), was established in 49 AD by Claudius (Bedoyere 2006). However, Salway said the local people hated that a very large proportion of Roman war veterans received land, so Claudius needed more land to avoid conflict with local people (Salway 1965). Those evidences show Claudius used the new territories transform available land for his retired soldiers and their family members.

c) Greek Philosophy

The third and final reason is Claudius found profoundly refers to Greek philosophy to justify

suppressing people. To fill the expanding Roman labor market, Roman emperors are inevitably seeking inferior people (Richmond 1947). Romans often called Britons and other non-Roman people barbarians. The used the word, barbarians, "to refer to all foreigners, especially the wide variety of people who were encroaching on their borders" (Jarus 2014). In Politics, Aristotle describes there are four types of barbarians: 1) Broad: strangeness, 2) Limited: lack of language and letter, 3) Strictly: Stupid, do not follow administration law, and 4) Lack of religion (Aristotle). For Romans, including Claudius, Britons belong to those categories because they often have long beards, long hair, no written language, and are violent. Also, they do not have any gods in common with the Romans.

In addition, it is possible Claudius refereed to Aristotle's theory of natural slavery. According to Aristotle, people who lack the capacity for rational deliberation are naturally slave to dominants, who are capable of rational deliberation; therefore, some people were naturally born to be slaves (Ward 2002). For Aristotle, by nature some are free, others slaves, so from Claudius' perspective, Romans are free, but Britons should be ruled. Clearly, the Roman Empire is a slave society, and slavery is an integral part of Roman civilization. The Sociologist Max Weber describes social condition in Rome.

Together (Aristocrats and slaves) they formed ...the basis for the special position held by the Roman aristocracy, a position which has no parallel in history. Even English aristocrats in the 18C could not equal Roman aristocrats in power, although their position was structurally similar (Weber 1897, 281).

As Weber describes, there was a salient distinction between the Roman aristocracy and the slaves. It was the norm in the Roman society for slave owners to manage the tasks, awards, punishment, and even the life of their slaves.

How do Romans justify such salient social stratification? Claudius might consider it morally correct and, it is his duty to suppress tribal people in Britain. According to Oxford University Professor Stephen Kershaw, Plato believed those who are not inhabited by divine wisdom are better off when controlled by those who are, and Aristotle supports the ideology of slaves by nature (Kershaw 2010, 118). Bedoyere also said by promoting a way of life the Romans genuinely believed they benefited others, even by enslaving man, and their conquests were legitimate and morally justifiable (Bedoyere 2006). It is highly possible Claudius believed as a ruler, he should rule barbarians, such as in Britain.

Did Romans, especially Claudius, know about Greek philosophy? Most likely, they did. In Chedworth Roman Villa and Fishbourne Roman palace, wealthy citizens enjoyed mosaics of Greek mythology and gods. This evidence shows the strong relationship between Roman and Greek cultures. In Roman society, almost everyone, young women, soldiers of lower ranks, community members of both genders, and even some slaves were able to correspond by letters. The Vindolanda writing tablets show a considerable amount of documents written by ordinal people in the first century (Birley 2015). More specifically, according to Keith Bradley at University of Notre Dame, reflective Romans were also aware that the theory of natural slavery had been articulated (Bradley 1994, 133-4). Israeli historian Benjamin Issac also said "the Romans duly substitute themselves as the ideal rulers. As a result masters and slaves, rulers and subject people live in a symbiosis beneficial to both parties" (Issac 2003, 11).

Moreover, the Roman philosopher Cicero set up schools of Greek philosophy in Rome, and it had become fashionable for Roman aristocrats to have a Greek philosopher among his intimate friends and counselors (Bradley 1994). Remember, Claudius was an avid reader and writer, who studied hard when he was young. It is reasonable to believe Claudius understood Greek philosophy and the essence of Aristotle's natural slave theory and exercised it when he conquered barbarian territory, such as Britain.

IV. Conclusion

With all of the above considerations in hand, I conclude the legitimate reasons for Claudius's British invasion are based on human rights, social welfare, and Greek philosophy. Adminius and Verica fled Britain and gave Claudius a valid reason, protecting human rights, for the invasion of Britain. From Claudius' perspective, the Roman army would be a salvation army to rescue innocent young men to save their land and social rights. Also, for Claudius, the invasion of Britain might expand social welfare for war veterans in the Roman army and their families and dependents. Colonies provide land and resources for them to start a new life after military service since retired soldiers usually did not own any land to go back. Moreover, Claudius sees the people of Britain as barbarians because of their unsophisticated physical and behavioral characteristics. Roman citizens were highly educated: even women were able to correspond in their own handwriting, and they enjoyed Greek mythology in their home settings. It is highly possible that Claudius refers to Greek philosophy: barbarianism and the theory of natural slavery. As Plato and Aristotle believe, Claudius also believes some people are born to rule (Romans), and other are born to be ruled (Britons). Human rights, social welfare, and Greek philosophy were the reasons identified as necessary to legitimatize the invasion of Britain. To hide his personal ambition to secure his position as an emperor, he used British refuges from tribal family members, colonies for retired soldiers, and Greek philosophy to legitimatize the British Invasion. After the

invasion, he never had to go to war again. He secured his title for 13 years until his death.

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Strictly as per the compliance and regulations of:



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Development of an Absorption Refrigeration System Powered by Solar Energy to Extract Fresh Water from Humid Air in Saudi Arabia

Ghassan Al-hassan^a, Naif K. Al Shammari^o & Mohammed AL-Meshaal^p

Abstract- The purpose of this paper is to investigate the extraction of fresh water from humid air in Saudi Arabia by direct solar absorption system using aqueous ammonia 0.45 mass fractions (ammonia–water). In the system, ammonia is boiled out of the water then condensed in an air cooled condenser. The refrigerant is then expanded and evaporates in the evaporator exists inside a tunnel where humid air flows, and therefore the temperature of humid air is reduced beyond its dew point temperature so a process of water separation from humid air starts.

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Keywords: absorption, refrigeration, humid air, solar energy, fresh water, aqua ammonia.

I. INTRODUCTION

he next challenge to human life in the world is how to solve the future problems that appeared in the world. The most three critical problems that face human life are energy crisis, water crisis and pollution [1]. Fresh water supply and sustainable energy sources are of the most important topics on the international environment and development plans. They are also, critical factors that govern the lives of humanity and promote civilization. The history of mankind proves that water and civilization are two inseparable entities. This is proved by the fact that all great civilizations were developed and flourished near large sources of water. Rivers, seas, oases and oceans have attracted mankind to their coasts because water is the source of life [2].

Saudi Arabia is facing a water scarcity due to the prevailing weather conditions especially for remote areas caused to over population, industrialization and agricultural expansion. The problem of providing remote areas with fresh water can be solved by using three techniques [3],

- a) Transportation of water from other location.
- b) Desalination of saline water (ground, or underground.
- c) Extraction of water from atmospheric air.

Water transportation from other locations is usually expensive and of high initial cost to those remote areas. The desalination of saline water (ground and underground) is also expensive, high initial cost and related to water existence in zone.

Atmospheric air is a huge and renewable reservoir of water. This endless source of water is available everywhere on the earth surface. The amount of water in atmospheric air is evaluated as $14000 \ Km^3$, where as the amount of fresh water in rivers and lakes on the earth surface is only about $1200 \ Km^3$ [4].

The extraction of water from atmospheric air can be accomplished by different methods, the most common of these methods are cooling moist air to a temperature lower than the air dew point [5], and absorbing water vapor from moist air using a solid or a liquid desiccant [6, 7].Choice of methods is an engineering decision dependent on local climatic conditions and economic factors such as capital, operating, and energy costs.

The first major project on an all solar absorption refrigeration system was undertaken by Trombe and Foex (1964)[8]. Ammonia-water solution is allowed to flow from a cold reservoir through a pipe placed at the focal line of a cylinder-parabolic reflector. Heated ammonia-water vaporized in the boiler is subsequently condensed in a cooling coil. The evaporator is a coil surrounding the container used as an ice box. In the prototype trials, the daily production of ice was about 6 to 4 kilograms of ice per square meter of collecting area 2015

Year

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for four-hour heating. The design by Trombe and Foex is very promising and should be studied further although modifications may be necessary on the solar collector, boiler, and condenser.

Farber (1970) [9] has built the most successful solar refrigeration system to date. It was a compact solar ice maker using a flat-plate collector as the energy source. It was reported that an average of about 42,200 kJ of solar energy was collected by the collector per day and ice produced was about 18.1 kilograms. This gave an overall coefficient of performance of about 0.1 and 12.5 kilograms of ice per m^2 of collector surface per day.

Swartman and Swaminathan (1971) [10] built a simple, intermittent refrigeration system incorporating the generator-absorber with a 1.4 m^2 flat-plate collector. Ammonia water solutions of concentration varying from 58 to 70 percent were tested. Tests were relatively successful; evaporator temperatures were as low as -12°C, but due to poor absorption, the evaporation rate of ammonia in the evaporator was low. Staicovici [11] made an intermittent single-stage H2O-NH3 solar absorption system of 46 MJ/cycle (1986). Solar collectors heat the generator. Installation details and experimental results were presented. The system coefficient of performance (COP) varied between 0.152 and 0.09 in the period of May-September. Solar radiation availability and the theoretical (COP), also applicable to the Trombe-Foex system, were assessed. Reference was made to evacuated solar collectors with selective surfaces. Actual (COP) system values of 0.25-0.30 can be achieved at generation and condensation temperatures of 80°C and 24.3°C respectively. In 1990 Sierra, Best and Holland [12] made a laboratory mordent of absorption refrigeration. Using ammonia - water solution at 52% concentration by weight and the total weigh is 38 kg. this system was operated intermittently using this heat source .A heat source at temperature no higher than 80 °C was used to simulate the heat input to an absorption refrigeration from solar pond. In this system the temperatures of generator was as high as 73°C and evaporator temperatures as low as -2 °C. Tap water was used to remove the heat generated from the condensation of the ammonia vapor and the absorption of the refrigerant in the water. The temperature of the tap water was near the ambient laboratory temperature of 28°C. The COP for this unit working under such condition was in the range 0.24 to 0.28. In 2000 Hammad and Habali [13] made a steel sheet cabinet of 0.6 m x 0.3 m face area and 0.5 m depth. The cabinet was intended to store vaccine in the remote desert area, away from the electrical national grid. A solar energy powered absorption refrigeration cycle using Aqua Ammonia solution was designed to keep this cabinet in the range of required temperatures. The ambient temperatures reached about 45°C in

August. A computer simulation procedure was developed to study the performance and characteristics of the cooling cycle. The simulation included MATLAB computer programs for calculation the absorption cycle. In this system using a cylindrical solar concentrator extended the daily operating time to about 7 h and increased the output temperature up to 200 °C and the range of the COP was between 0.5 to 0.65 .While the temperature which gives optimum condition (of COP =0.65) was 120 °C. For this study a solar absorption refrigeration unit was constructed. The working fluids employed was aqueous ammonia (25wt% NH3 – H2O). The system was operated during the months of June and July (2009) for a period of 8 hours per day (8 am to 4 pm).

II. Ammonia Absorption System

The absorption cycle is a process by which refrigeration effect is produced through the use of two fluids and some quantity of heat input, rather than electrical input as in the more familiar vapor compression cycle [14]. Both vapor compression and absorption refrigeration cycle accomplish the removal of heat through the evaporation of refrigerant at a low pressure and the rejection of heat through the condensation of the refrigerant at a higher pressure. The method of creating the pressure difference and circulating the refrigerant is the primary difference between the two cycles. The vapor compression cycle employs a mechanical compressor to create the pressure differences necessary to circulate the refrigerant. In the absorption system, a secondary fluid or absorbent issued to circulate the refrigerant. Because the temperature requirements for the cycle fall into the low - to - moderate temperature range, and there is significant potential for electrical energy savings, absorption would seem to be a good prospect for cooling application [15].

Thus, the purpose of this paper is to utilizing an absorption refrigeration system driven by solar energy in order to generate a cold surface with which extract water from moisture air passing though the generated cold surface.

III. CYCLE DESCRIPTION

Figure 1 illustrates the main components of the absorption refrigeration cycle and the humid air tunnel. High-pressure liquid refrigerant from the condenser (2) passes into the evaporator (4) through an expansion valve (3) that reduces the pressure of the refrigerant to the low pressure existing in the evaporator, which is located in the humid air tunnel and where the process of water separation from the moisture air stream begins due crossing the cooling coil and reaching a temperature beyond its dew-point temperature. The liquid refrigerant evaporates in the evaporator by

absorbing heat from the humid air being cooled and the resulting low-pressure vapor of ammonia passes to the absorber, where it is absorbed by the week solution coming from the generator (1) through an expansion valve (5), and forms the strong solution. The strong solution is pumped to the generator pressure, and the refrigerant in it is boiled off in the generator due of solar energy. The remaining solution flows back to the absorber and, thus, completes the cycle. By weak solution is meant that the ability of the solution to absorb the refrigerant vapor is according to the ASHRAE definition [5]. In order to improve system performance, a solution heat exchanger is included in the cycle. I order to remove water vapor from the refrigerant mixture leaving the generator before reaching the condenser a rectifier is added into the cycle. For the current study, it is assumed that the refrigerant vapor contains 100% ammonia for compatibility of the results for NH3-H20 cycle.



Fig. 1 : Schematic diagram of the Solar–Absorption refrigeration system for water extraction from humid air

IV. Design of the Major Components of the Absorption Refrigeration System

- a) Design of the Generator and collector
 - i. The cooling capacity of the system (the heat absorption from the humid air passing within the tunnel by the R717 during the evaporation process)

$$Q_o^{\bullet} = Q_a^{\bullet} = m_a^{\bullet}.C_{pa}.\Delta T_a$$

$$Q_{a}^{\bullet} = Q_{a}^{\bullet} = 50X1.2X1.002X(40-10) = 1803.6Kj/h = 501W$$

ii. Determining the flow rate of ammonia in the evaporator. The refrigeration capacity of the system is found out from following formula;

$$Q_o^{\bullet} = m_R^{\bullet} \Delta h$$

And by using the P-h diagram of R717 and at $P_c = 17.85 bar$ and $P_o = 175 bar$, then $\Delta h = 1000 kj/kg$, thus $m_R^{\bullet} = 0.000501 kg/s$, Therefore the whole amount of the refrigerant running in the cycle (assuming that the original mass of the solutions are taken 10% more) is:

- $M_R^{\bullet} = 1.15 X m_R^{\bullet} = 0.000575 kg / s$.
- iii. The flow rate of weak solution leaving the generatorcollector (considering that 90% of the ammonia

leaves the collector toward the condenser and density difference) is

 $M_{\scriptscriptstyle WE}^{\bullet}=0.0029+0.1 X M_{\scriptscriptstyle R}^{\bullet}=0.0039$ kg/s, and the flow rate of strong solution running between the generator and absorber is:

$$M_{ST}^{\bullet} = M_{R}^{\bullet} + W_{W}^{\bullet} = 0.000575 + 0.0039 = 0.00448 kg / s$$

iv. Determination of the volume rate of R717 vapor flows through the generator

 $V_R^{\bullet} = M_R^{\bullet} X v_R$ where $v_R = 0.0726m^3 / s$ the specific volume of the ammonia vapor in the generator at operation pressure ($P_G = P_C = 17.82bar$), therefore $V_R^{\bullet} = 0.000042m^3 / s$.

v. Calculate the volume rate of H_20 vapor flows through the generator (considering 2.5% of water will evaporate) and the specific volume of water vapor (in the generator at $P_G = P_C = 17.82bar$) is $v_{WV} = 0.111667m^3 / kg$, thus

$$V_{WV}^{\bullet} = \frac{2.5}{100} M_R^{\bullet} X v_{WV} = \frac{2.5}{100} 0.000575 X \, 0.111667 = 0.000002 m^3 \, / \, s$$

vi. Determine the total volume rate of the strong solution entering the generator considering that the specific volume of the strong solution cycling through the generator at the operation pressure $(P_G = P_C = 17.82bar)$ is $v_{ST} = 0.0726m^3 / kg$ $V_{ST}^{\bullet} = M_{ST}^{\bullet} X v_{ST} = 0.00033m^3 / s$ Total volume of the generator = volume of R717 vapor + volume of H_2O vapor + volume of strong solution, $V_G = 0.000374m^3 / s = 374cm^3 / s = 22440cm^3 / min$ considering that the volume of the generator is more 15% bigger than the calculated value, thus the required volume of the generator and collector is $V_G = 25806cm^3$, therefore the sizes of the generator and collector are $100X50X5cm^3$.

b) Design of the air cooled condenser

An air cooled finned condenser is used for domestic refrigerators and considering that it employs as a counter flow type heat exchanger for heat transfer with following design factors:

- Heat transfer and pressure drop characteristics
- Working pressure
- Type of fluid
- Manufacturing ease and service

Temperature of R717 vapor at inlet $T_{Ri} = 80^{\circ}C$,

Temperature of R717 liquid at outlet $T_{Ro} = 45^{\circ}C$,

Assuming that the humid air passing through the evaporator and after lossing part of its humidity will be used to accomplish two functions, first absorbs the generated mixing heat (mixing the saturated ammonia vapor coming from the evaporator and the weak solution returned from the collector) formed in the absorber and second also absorbs rejected heat from the condenser, therefore, assuming that the temperature of cooled air stream entering the condenser is 25 ^{o}C .

Inlet temperature of ambient air $T_{ai} = 25^{\circ}C$,

Outlet temperature of ambient air $T_{ao} = 27^{\,o}C$,

Thus, $\Delta T_1 = 80 - 25 = 55^{\circ}C$, and $\Delta T_2 = 45 - 27 = 18^{\circ}C$, then the logarithmic mean temperature difference (as counter flow heat exchanger) is $\Delta T_{Lm} = \frac{\Delta T_1 - \Delta T_2}{Lm(\frac{\Delta T_1}{2})}$,

so that
$$\Delta T_{Lm} = 33.13^{\circ}C$$
. Using following equation to find out the overall heat transfer coefficient between

NH3 and ambient: $U = \frac{1}{\frac{1}{h_o} + \frac{d_o}{k}[(\frac{d_0 - d_i}{d_0 + d_i})] + \frac{1}{h_i} X \frac{d_o}{d_i}}, \text{ so it is required to}$ determine the values of the transformation o

determine the values of heat transfer coefficients by convection, namely, h_o and h_i . First considering that $d_0 = 0.012m$ and $d_i = 0.01m$ for the stainless steel condenser coil and the properties of ambient air at $40^{\circ}C$ are: $\rho = 1kg/m^3$, $k = 0.648W/m^3.K$, $v = 0.498X10^{-6}m^2/s$ and $P_r = 3.58$ [16]. For natural convection, it is assumed that $h_o = 17W/m^2.K$.

Heat transfer coefficient by convection for vapor flowing inside a metallic tube with decrease in temperature and film condensation inside horizontal tube is given by following equation [17]:

$$h_{i} = 0.555 \left[\frac{k_{avg}^{3} \times \rho_{L} \times (\rho_{L} - \rho_{v}) \times g \times h_{fg}}{\mu \times (t_{s} - t) \times d_{i}} \right]^{\frac{1}{4}}$$

Where

$$k =$$
 thermal conductivity of R717 Refreigerant = 0.232645 w/m.k
 $\rho_L =$ Density of liquid ammonia at 17.82 bar = 571.3 kg/m³
 $\rho_v =$ Density of vapor ammonia at 17.82 bar = 13.8 kg/m³
 $h_{fg} =$ Enthalpy of super heated vapor at 17.82 bar = 1075 kj/kg
 $\mu =$ Dynamic viscosity at 17.82 bar = 0.0001094 kg/m.s
 $g =$ Acceleration due to gravity = 9.81 m²/s

By substituting the given values

$$h_i = 0.555 \left[\frac{(0.232645)^3 \times 571.3 \times (571.3 - 13.8) \times 9.81 \times 1075}{0.0001094 \times (45 - 25) \times 0.01} \right]^{\frac{1}{4}}$$
$$= 1356.75 \ w/m^2. k$$

Thus, the U value is

$$U = \frac{1}{\frac{1}{18} + \frac{0.012}{50.2} \times \left[\frac{0.012 - 0.01}{0.012 + 0.01}\right] + \frac{1}{925.5} \times \frac{0.012}{0.01}} = 17.71 \ w/m^2.k$$

The heat removed from the refrigerant in the condenser is

$$Q_c = \dot{m}_R(h_2 - h_3) = 0.00198(1570 - 396.8) = 2.32 \ kw = 2320 \ W$$

Therefore

$$Q_c = U imes A_c imes LMTD$$

 $A_c = rac{Q_c}{U imes LMTD} = rac{2320}{17.71 imes 33.13} = 3.95 \ m^2$, by

considering that the tube area of the condenser forms 25% from the total area on the air cooled condenser.

$$A_{c} = \pi d_{o}L$$
$$L = \frac{A_{c}}{\pi d_{o}} = \frac{3.95X0.33}{\pi \times 0.012} = 34.6 m$$

c) Design of the Evaporator

An evaporator should transfer enough heat with smaller size as possible. It should be light, compact, safe and durable. The pressure loss in the evaporator should be as low as possible as well. Some design factors should be considered:

- Evaporator temperature.
- Refrigerant properties.
- Refrigerant effect.
- Tube selection.

Heat absorbed by NH3 vapor= 1803 W. The refrigerant R717 evaporates due to absorbing heat from the humid airstream entering the tunnel and passes through the cooling coil.

- i. Determination of ΔT_{Lm} (Assuming counter flow heat exchanger)
- Temperature of air entering the evaporator, $T_{ei} = 40^{\circ}C$

Temperature of air leaving the cooling coil after few seconds $T_{eq} = 15^{\circ}C$.

Temperature of NH3 liquid entering evaporator $T_{\rm _{Ri}} = -18^{\,o}\,C$,

Temperature of NH3 liquid leaving evaporator $T_{_{Ro}} = -18^{o}C$,

Thus
$$\Delta T_{Lm}=rac{\Delta T_1-\Delta T_2}{\lnrac{\Delta T_1}{\Delta T_2}}$$
, $\Delta T_1=40-(-18)=58^{\,o}C$,

and $\Delta T_1 = 15 - (-18) = 33^{\circ}C$.

Therefore, $\Delta T_{Im} = 14.23^{\circ} C$

ii. Determination of **U** (The overall heat transfer coefficient between the NH3 in cooling coil and surrounding humid hot air).

$$U = \frac{1}{\frac{1}{h_{oa}} + \frac{x_t}{K_t} + \frac{1}{h_{ia}}}$$

Assuming: $h_{oa} = 35 \frac{W}{m^2 K}$, $x_t = 1mm$ Stainless tub thickness, $K_t = 50.2 \frac{W}{m K}$ and Also consider that $h_{ia} = h_{i_{condenser}} = 1356.75 \frac{W}{m^2 K}$

Therefore:

$$U = \frac{1}{\frac{1}{35} + \frac{0.001}{50.2} + \frac{1}{1356.75}} = 34.09W / m^2 K$$

Finding out \dot{Q}_w (heat transfer rate between NH3 and surrounded humid air stream in the tunnel)

$$30661 = 33.6XA_e \times 14.23$$
$$A_e = 64.13 m^2$$
$$L = \frac{2A_e}{2\pi d_0} = \frac{2 \times 64.13}{2\pi \times 0.012} = 1701 m$$

d) Design of the absorber

Determination of the volume of the absorber. K = N(a) where A is a probability of A is a proba

 V_{Ab} = [Volume of NH3 vapor] + [volume of weak NH3+H2O solution]

Temperature of NH3 vapor leaving the evaporator is $-30^{\circ}\,\text{C}$

Density of NH3 vapor $\rho_v = 0.701 \ kg/m^3$

Density of weak solution $\rho_{Lw} = 596 \, kg/m^3$

$$V_{Ab} = \left[\left(\frac{1}{\rho_v} \times \dot{m}_r \right) + \left(\frac{1}{\rho_{Lw}} + \dot{m}_{ws} \right) \right]$$
$$V_{Ab} = \left[\left(\frac{1}{0.701} \times 0.11574 \right) + \left(\frac{1}{596} + 0.1794 \right) \right] = 0.346 \frac{m^3}{min} = 346,000$$

Thus,

Volume of the absorber = $75 \times 75 \times 62 \ cm$

e) Design of the solution pump

Quantity of rich solution to be supplied to the generator (Discharge)

= Mass flow rate × *specific volume*

$$=\frac{0.29514}{60}\times\frac{1}{\rho_{rs}}=\frac{0.29514}{60}\times\frac{1}{689.01}=7.14\times10^{-6}\frac{m^3}{s}$$

cm³

min

The density of the rich solution $(\rho_{rs}) = 689.01 \frac{Kg}{m^3}$

The required work output = *Discharge* × *Pressure rise*

V. Determine of the amount of Heat Energy Transferred from the Solar Radiation into the Solution (ammonia-water) in the Solar Collector

In general the total radiation [specula + diffused] on any surface on earth is about 955 W/ m², taking the inclination of flat plate collector at 40° placed North – South, then the energy received by the solar collector can be calculated as following.

a) The emission received outside the earth's atmosphere is determined from this relation

$$= 3.816X10^{26} / 4\pi X (15X10^{10}) = 1349.6W / m^{2}$$

b) Total energy received by the earth

Assuming the earth a spherical body, the energy received by it will be proportional to the perpendicular projected area, i.e., that of a circle, = $\pi X r^2$ (r_e is the radius of the earth).

Energy received by the earth = $1346.6X\pi X (6.4X10^6)^2$

 $= 1.736 X 10^{17} W$

Energy received by the solar collector

The direct energy reaching the earth = (1 - .42)X1349.6

 $= 782.77W / m^2$

The diffusion radiation

 $= 0.22X782.77 = 172.21W / m^2$

Total radiation reaching the solar collector

 $= 782.77 + 172.21 = 955W / m^2$

Solar collector area

$$A = 1X0.5 = 0.5m^2$$

The projected area = $AX \cos \theta = 0.5X \cos 40^{\circ}$ = $0.383m^2$

Therefore, Energy received by the solar collector = 0.383X955 = 365.765W

Note: Since solar energy is not constant throughout the day, an excess capacity of the solar collector is accepted and taken.

VI. The Efficiency of the System

Basically, the efficiency of the absorption refrigeration unit powered by solar energy to produce a cooling effect in order to absorb heat from domestic water tank is determined based on the coefficient of performance as refrigeration reverse cycle.

COP=Cooling Effect /Heat aborted from solar radiation

$$COP = \frac{501}{365.765} = 1.369$$

VII. Amount of Fresh Water Extracted from the Humid Air

Based on the atmospheric conditions in Jeddah-Saudi Arabia in summer which they are $T_{a1} = 40^{\circ}C$; $\phi_{a1} = 50\%$; $T_{de1} = 27^{\circ}C$; $\omega_{a1} = 23.25g_{H2O} / Kg_{dry.air}$ and since the properties of humid air leaving the air tunnel after passing the cooling coil where part of its humidity has been separated due reaching a temperature beyond of its dew point temperature are;

 $T_{a2} = 10^{\circ}C$; $\phi_{a2} = 100\%$; $\omega_{a2} = 7.85g_{H2O} / Kg_{dry,air}$, therefore the fresh water separated from the humid air

tream is
$$M_W^{\bullet} = M_a^{\bullet} X \rho_{aX} (\omega_{a1} - \omega_{a2}) = 50 X 1.2 X (0.02325 - 0.00785) = 0.942 Kg / h$$

VIII. Conclusion

This project presents, a study of absorption refrigeration system for water extraction from humid air in Saudi Arabia is carried out by designing the components of the cycle through establishing a comprehensive mathematical model describing the entire processes accomplished within the major components of the unit based on heat and mass conservation balancing considering steady flow processes. The sizes of major components involved within the system have been determined. The amount of the extracted fresh water from humid air is determined for certain operation conditions in the Kingdome of Saudi Arabia, it was found for real atmospheric conditions to be 0.942Kg/h and the efficiency of the system is 1.369. The designed system can be widely used for water production from moisture air for remote regions.

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PATTERN OF SUBSTANCE A BUSESE XUAL BEHAVI OR AN DITS DE TERMINANTS AMONG UNMARRIE DYOUTH IN INDIA

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Pattern of Substance Abuse, Sexual Behavior and its Determinants among Unmarried Youth in India

Jeetendra Yadav^a, Kusum Bharati^o & Kh Jitenkumar Singh^a

Abstract- This paper describes patterns of substance abuse, sexual behaviour and its determinants among unmarried youth in India and also evaluates how these patterns are associated with each others. Data come from the Youth in India: Situation and Needs Study, a sub-nationally representative survey conducted during 2006-2008. Logistic regression analysis (binary and multinomial) showed relationships between predictor variables and alcohol consumption and alcohol and sexual risk indicators as well as two of the sexual health indicators associated with premarital sex. Substance use was significantly high among the age group of 20-24 years. Factors such as substance use by caste/tribe, any member in family, paid work, and lower educational status were significantly associated with substance use by study subjects. The prevalence of substance use was high among male youths as compared to female youths. Male youth recognized more Premarital sexual behavoiur than the female youth. Premarital sex were significantly higher among youths who had some disposable income in hand, i.e., those belonging the paid work or both paid and unpaid work. Youth is most important period of human life as they are easily influenced by habits and behavoiurs of their parents, siblings or peers and initiate substance use as well as premarital sex. Therefore improvement of educational and employment status of youths strongly needed. Youths and their parents urgently need health education regarding the consequences of substance use and unsafe pre marital sex.

Keywords: youth, substance use, alcohol, tobacco, sexual behaviour, sexual risk, sexual health.

I. INTRODUCTION AND REVIEWS OF LITERATURE

Substance use is one of the most common causes of preventable human deaths worldwide. Alcohol and to bacco are most commonly used substances throughout the world. Alcohol and tobacco are the most commonly used substances in India also. Other substances that can be used are Ganja (Cannabis), Cocaine, Inhalants, Hallucinogens, Sedatives, Tranquilizers and intravenous drugs. Alcohol and tobacco are the substances commonly used as a part of socialization in some communities in India. Substance use is defined as, "Persistent or sporadic drug use inconsistent with or unrelated to acceptable medical practice" [1]. According to estimates of the World Health Organization, there are about 2 billion people worldwide consuming alcohol beverages and

76.3 million are diagnosed with alcohol related disorders in 1990. Globally alcohol consumption causes 3.2 % of overall human deaths [2]. Worldwide 5 % of all human deaths were in the age group of 5 to 29 attributed to alcohol use [3]. General population studies conducted in different parts of India suggest prevalence rates of use of alcoholic beverages ranging 23 % to 74 % among males. Women constitute over 90% of abstainers, though among tribal group there is substantial number of alcohol users with the prevalence rates ranaina between 28 to 48% [http:// www.who.int/substance abuse/publications/alcohol/en/index.html]. Studies from late 1970'sand early 1980's found that 12.7 % of high school students, 36.6% of university students and 31.6% of non student young people are using alcohol beverages [http://www.who.int/substance abuse/publications/alcohol/en/index. html]. But generally those who are using alcohol not restricted themselves to single substance use as either alcohol follows the tobacco or tobacco follows the alcohol or any other substance. Tobacco smoking and chewing is one of the major causes of human deaths due to many medical conditions in the world. According to WHO estimates, 4.9 million annual deaths are attributed to tobacco use only. This figure expected to rise to 10 million by 2030, out of which 7 million deaths will occur in developing countries, especially China and India. Currently India constitute about one fifth of overall deaths attributed to tobacco use worldwide, more than 8, 00,000 people die and 12 million people become ill as a result of tobacco use each year [4]. Deaths attributed to tobacco in India are expected to rise from 1.4 % in 1990 to 13.3 % in 2020. It is estimated that 5.500 adolescents starts using tobacco every day in India [5]. World Health Organization defined youth as, "the individual belonging to the age group of 15-24 years" [6]. India now has the second largest number of HIV infected persons in the world [7]. The rise in HIV infections in India has been associated with three main factors: migration, labor mobility and the increasing use of alcohol among high risk populations and the poor. There is considerable concern that widespread and increasing alcohol use is fueling the epidemic and acting as a catalyst in shifting it beyond high risk populations into the general population rural and urban men and women, together with the exposures to sexual risk encountered by male migrants and mobile workers. Alcohol use is increasing in India as a source of revenue

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for local governments and as a symbol of globalization and modernization [8].

Youth population is considered Very important population group for the wealth of any nation. There are special reasons why we need to concentrate more on youth, is the need of time to discover the new behavior and relationship towards substance use and sexual behaviour specially risky sexual behaviour among youths so that it can be corrected and prevented from serious element of diseases at an early stage. Various studies were conducted on substance abuse among the youths in urban areas. But few studies carried out on substance use and sexual behaviour among youths in India. Hence more such studies are required to know prevalence of substance use, sexual behaviour and its determinants among youths so that preventive actions can be taken as early as possible. With this conditions background we conducted this study among youths in India to know the pattern and determinants of substance use and sexual behaviour and also explore the potential linkage between substance use and sexual behaiour among youths in India. The present study aims to analyses the pattern and determinants of substance use and sexual behaiour among youths in India.

II. DATA SOURCE AND METHODOLOGY

Data for the present paper comes from the "Youth in India: Situation and Needs study," a sub nationally representative study conducted in six states (Bihar, Jharkhand, Maharashtra, Rajasthan, Andhra Pradesh, and Tamil Nadu) undertaken between 2006 and 2008 [9]. The six states, selected for their different geographic and socio cultural backgrounds, represent 39% of the country's population. The survey employed a multistage sampling design, initially selecting 300 primary sampling units (PSUs) in each state, split equally between rural and urban areas. In rural areas, the 2001 Census villages served as the sampling frame, with selection proceeding in two stages. First, villages were selected systematically from a stratified list (based on region, village size, caste composition, and female literacy), with selection probability proportional to size. The 150 PSUs selected were then ordered by district and taluka codes and numbered from 1 to 150. Oddnumbered PSUs were designated for interviews with male youth and even-numbered PSUs for female youth. For urban areas, the 2001 Census list of wards (containing multiple census enumeration blocks (CEBs)) served as the sampling frame, with selection proceeding in three stages. First, wards were ordered by district and female literacy, and then 75 wards were selected systematically with probability proportional to size. Second, within each selected ward, CEBs were arranged by their administrative number and one CEB was selected proportional to size. This CEB was designated a male PSU and an adjacent CEB to each selected male CEB was subsequently selected to be a female CEB, resulting in a total of 150 urban CEBs per state. The choice to designate male and female PSUs was guided by concern that the sensitive nature of some questions might lead to teasing, damaged reputations, or violence, if respondents became aware that similar questions were being asked of the opposite sex.

Once the PSUs were selected, household selection involved systematic sampling using a self-weighing design that took into account the target sample. There was no replacement for households that could not be contacted or refused to participate. Of 186, 152 selected households, 174,037 agreed to participate, with a household response rate of 93.5%. A household schedule was administered in participating households to determine whether there was an age-eligible youth living in the household. In households where there were multiple age-eligible youth, the Kish table was used to select one unmarried youth. No replacement of a selected youth was allowed. In all, 45,555 male and female youth aged 15 to 24 participated, with individual response rates ranging from 84% to 90%.

The survey tools were informed by existing surveys and an intensive presurvey with youth, parents, and key stakeholders, both before and after it was translated into four languages (Hindi, Marathi, Tamil, and Telugu, reflecting the major language groups of selected states). Approximately 75 locally trained and regularly supervised field investigators collected data over a six- to eight-month period. Informed consent was obtained from all respondents as well as parents of unmarried minor youth. To preserve confidentiality, consent forms were detached and stored separately from completed questionnaires. Complete details on all aspects of the survey are available elsewhere [9]. To identify determinants of substance use and sexual behaviour of migrants, bivariate and multivariate analyses were performed. Bivariate analyses were performed to examine the nature of association in the substance use, sexual behaviour by selected socioeconomic and demographic background characteristics. Multivariate analyses used logistic regression to investigate which factors best explain and predict the substance use and sexual behaviour outcome [10]. It is worth mentioning that all the variables identified as significant in the bivariate analyses using the chi-squared test were included in the binary logistic regression model. The results are presented by estimated odds ratio with 95% confidence intervals (CIs). All statistical analysis is done using STATA 13.1 after adjusting study design and sampling weight.

III. Results and Discussion Substance use

Alcohol and tobacco are most commonly used substances throughout the world. Alcohol and tobacco are the most commonly used substances India also. Research has shown that substance uses can directly compromise young people's health. For example, evidence suggests that the use of alcohol and drugs among youth is associated with physical fight, risky sexual activity, depression and suicide as well as irregular school or work attendance and others negative outcomes [11]. The distribution of substance use (tobacco, alcohol, any of them (tobacco or alcohol), both (tobacco and alcohol), by selected sociodemographic characteristics among youth in India are presented in table 1.It is evident from the analysis that the proportion of the male youth consume more tobacco (30.2%), alcohol (18.7%), tobacco or alcohol (35.2%), tobacco and alcohol (13.7%) as compared to female, tobacco (2.1%), alcohol (0.9%), tobacco or alcohol (2.8%), tobacco and alcohol (0.2). Older youth (age group 20-24 years) were consume more as compared to younger youth (age group 15-19 years) in the case of

those who were consuming tobacco, alcohol, tobacco or alcohol, tobacco and alcohol. It is already established by the different studies that less educated are consuming more (tobacco as well as alcohol) as compared to those who are more educated and this study reveals same finding also. There was strong connection between the substance use by consuming subsistence any member in family. Analysis shows that youth which family member are using substances were found more substance user as compared to youth which family member were not using the substances use. This indicates that the behavior of youths towards substance use was influenced by the behavior of their family member. Existing evidences clearly show the inverse relationship with wealth guintile and substance use. In other words, with the increase in wealth status of an individual, the substance use decreases. This study also observed the same pattern.

Table 1: Percent distribution of respondents by types of Substance use and its frequency of consumption by selected socio - demographic characteristics among youth in India ("Youth in India: Situation and Needs Study," 2006–08)

| Background characteristics | Substance use | | | | |
|----------------------------|---------------|-------------|------|------|-------|
| <u> </u> | Tobacco | Alcohol | Any | Both | n |
| Sex | | | • | | |
| Male | 30.2 | 18.7 | 35.2 | 13.7 | 14281 |
| Female | 2.1 | 0.9 | 2.8 | 0.2 | 31274 |
| Residence | | | | | |
| Rural | 11.0 | 7.2 | 13.1 | 5.1 | 21459 |
| Urban | 10.9 | 5.8 | 12.8 | 3.8 | 24096 |
| Age Group | | | | | |
| 15-19 | 7.1 | 3.3 | 8.2 | 2.1 | 25041 |
| 20-24 | 15.6 | 10.3 | 18.7 | 7.3 | 20514 |
| Education | | | | | |
| Illiterate | 12.7 | 6.5 | 14.8 | 4.4 | 7971 |
| Less than 8 years | 14.8 | 8.1 | 16.7 | 6.1 | 10613 |
| 8-11 vears | 9.2 | 5.4 | 10.9 | 3.6 | 18771 |
| 12 or more years | 8.2 | 6.7 | 10.8 | 4.1 | 8199 |
| Religion | | | | | |
| Hindu | 10.7 | 6.5 | 12.6 | 4.5 | 37384 |
| Muslim | 12.3 | 3.1 | 13.0 | 2.4 | 5275 |
| Others | 11.5 | 12.2 | 16.7 | 7.0 | 2896 |
| Castes/Tribes | | | | | |
| Scheduled castes | 12.7 | 8.3 | 14.8 | 6.3 | 8577 |
| Scheduled tribes | 20.0 | 14.3 | 25.3 | 9.0 | 3755 |
| Other backward classes | 10.0 | 5.7 | 11.9 | 3.8 | 23087 |
| General | 8.0 | 3.6 | 9.1 | 2.6 | 9878 |
| Wealth quintile | | | | | |
| Poorest | 14.7 | 8.1 | 17.0 | 5.8 | 5629 |
| Poorer | 13.9 | 7.0 | 15.7 | 5.2 | 7217 |
| Middle | 11.7 | 6.8 | 13.6 | 4.9 | 9142 |
| Richer | 10.1 | 6.5 | 12.3 | 4.3 | 10835 |
| Richest | 7.7 | 5.1 | 9.6 | 3.2 | 12732 |
| Work Status | | | | | |
| Paid work | 23.8 | 14.4 | 27.6 | 10.6 | 13775 |
| Unpaid work | 8.7 | 4.3 | 10.3 | 2.6 | 3876 |
| Both paid and unpaid work | 17.5 | 13.4 | 22.4 | 8.5 | 2564 |
| Not working | 2.6 | 17 | 1 1 | 0.0 | 05212 |
| | 3.0 | 1.7 | 4.4 | 0.9 | 20010 |
| i ype of family | 0.7 | <u> </u> | 11.0 | 1.0 | 00500 |
| Nuclear family | 9.7 | 6.2 | 11.9 | 4.0 | 22522 |
| | 12.1 | b. <i>1</i> | 13.9 | 4.8 | 23033 |
| Any user in tamily | 44.0 | 110 | 10.0 | 0.0 | 10000 |
| Yes | 14.3 | 14.0 | 16.2 | 2.6 | 16833 |
| No | 6.2 | 3.4 | 7.3 | 10.1 | 28722 |

2015

The results of the multivariate logistic regression analyses for the tobacco and alcohol use are presented in table 2 reiterate that some important factors such as youth's sex, age, education, wealth quintile, work status, any substance user in family, emerged as significant factors affecting the consumption of tobacco and alcohol. Sex of the youth emerged significant determinants of consumption of tobacco and alcohol. Compared with male, tobacco and alcohol use was found to be less likely among female (OR=0.039 CI=0.035-0.043), (OR=0.028 CI=0.024-0.032), respectively. The probability of tobacco and alcohol use was found to be less among urban as compared to rural. As regards the age of youth, results reiterate that older youth (age group 20-24 year), were found 2.4 times (CI=2.209-2.585), more likely to consume tobacco and 3.3 times (CI=2.953-3.639), more likely to consume alcohol as compared to younger youth (age group 15-19 years).

Lower educational status was stronalv associated with tobacco and alcohol use, it was also observed that as educational status of youth increases the tobacco and alcohol use decreases. Other studies also documented similar findings in their studies [12, 13]. Youth with 12 or more years having education were found less likely (OR=0.296 CI=0.255-0.344), (OR=0.536 CI=0.447-0.643), to consume tobacco and alcohol as compared to Illiterate youth. The likelihood of using tobacco was observed to be high among youth belonging to the Muslim religion (OR=1.306 CI=1.163-1.466), compared to youth belonging to the Hindu religion, but in case of alcohol use trend showing in reverse direction, the probability of alcohol use was found to be less likely among Muslim religion (OR =0.581, Cl = 0.480-0.703), than among Hindu religion. The likelihood of consume alcohol was found to be nearly two times higher (CI = 1.897-2.643) among youth from others religion than among those from the Hindu religion poorest wealth quintile. There was strong association between the substance use by parents (any member in family). Chances of consume tobacco (OR=0.369 CI=0.340-0.400), and alcohol (OR=0.179 CI=0.163-0.197), were found to be less likely among youth which family member were not using any substance use compared to youth which family member were using substance use. Similar findings were documented by Lisa S et al and Kokiwar PR et al in their studies [13, 15]. Dhupdale NY et al observed in their study that the alcohol use is 2.9 times higher in those children whose father used alcohol [14]. This indicates that the behavior of youths towards substance use was influenced by the behavior of their parents [13, 15].

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Year

Table 2 : Adjusted odds-ratio measuring the association between substance use among youth and selectedsocio- demographic characteristics ("Youth in India: Situation and Needs Study," 2006–08)

| Background Characteristics | Substance use | | | | |
|----------------------------|---------------|-------------|------------|-------------|--|
| - | То | bacco | Alc | ohol | |
| | Odds ratio | 95%Cl | Odds ratio | 95%Cl | |
| Sex | | | | | |
| Male (ref) | 1.000 | | 1.000 | | |
| Female | 0.039*** | 0.035-0.043 | 0.028*** | 0.024-0.032 | |
| Residence | | | | | |
| Rural (ref) | 1.000 | | 1.000 | | |
| Urban | 0.799*** | 0.737-0.866 | 0.686*** | 0.620-0.759 | |
| Age Group | | | | | |
| 15-19 (ref) | 1.000 | | | | |
| 20-24 | 2.389*** | 2.209-2.585 | 3.278*** | 2.953-3.639 | |
| Education | | | | | |
| Illiterate (ref) | 1.000 | | 1.000 | | |
| Less than 8 years | 0.674*** | 0.600-0.757 | 0.693*** | 0.597-0.805 | |
| 8-11 years | 0.375*** | 0.333-0.423 | 0.469*** | 0.402-0.546 | |
| 12 or more years | 0.296*** | 0.255-0.344 | 0.536*** | 0.447-0.643 | |
| Religion | 4 000 | | 4 9 9 9 | | |
| Hindu (ref) | 1.000 | | 1.000 | | |
| Muslim | 1.306*** | 1.163-1.466 | 0.581*** | 0.480-0.703 | |
| Others | 1.042 | 0.893-1.217 | 2.239*** | 1.897-2.643 | |
| Castes/Tribes | | | | | |
| Scheduled castes (ref) | 1.000 | | 1.000 | | |
| Scheduled tribes | 1.507*** | 1.322-1.717 | 1.460*** | 1.251-1.705 | |
| Other backward classes | 0.826*** | 0.750-0.910 | 0.870** | 0.773-0.980 | |
| General | 0.716*** | 0.633-0.810 | 0.665*** | 0.566-0.782 | |
| | 1 000 | | 1 000 | | |
| Poorest (rei) | 1.000 | | 1.000 | | |
| Poorer | 0.804*** | 0.708-0.912 | 0.711*** | 0.603-0.838 | |
| Middle | 0.716^^^ | 0.630-0.814 | 0.805^^^ | 0.683-0.949 | |
| Richer | 0.602*** | 0.527-0.687 | 0.786*** | 0.664-0.930 | |
| Richest | 0.596*** | 0.516-0.690 | 0.772*** | 0.641-0.929 | |
| Work Status | | | | | |
| Paid work (ref) | 1.000 | | 1.000 | | |
| Unpaid work | 0.699*** | 0.609-0.803 | 0.736*** | 0.609-0.890 | |
| Both paid and unpaid work | 1.090*** | 0.952-1.247 | 1.533*** | 1.309-1.797 | |
| Not working | 0.443*** | 0.403-0.486 | 0.376*** | 0.331-0.428 | |
| Type of family | | | | | |
| Nuclear family (ref) | 1.000 | | 1.000 | | |
| Joint family | 1.190*** | 1.107-1.279 | 0.935 | 0.853-1.024 | |
| Any user in family | | | | | |
| Yes (ref) | 1.000 | | 1.000 | | |
| No | 0 369*** | 0 340-0 400 | 0 170*** | 0 163-0 107 | |

Levels of significance: *p<0.10; **p<0.05; ***p<0.01.

IV. Sexual behaviors and Safe Sex

Throughout the human history and in almost every society and cultureacross the globe, there exists the mutual sexual attraction between sexes, whichtakes its peak during youth. Like many other married couples, unmarried youths do have negative attitudes of misleading information about contraceptives. While studying adolescent sexual behaviour, similai views were also reported by S. J. Jejeebhoy [16]. With nearly half of new HIV infections worldwide occurring in young people aged 15–24 years, changing sexual behaviour in this group will be crucial in tackling the growing pandemic. Campaigns targeting young people have encouraged safer sex, either through condom use or avoiding penetration. Prevention efforts have often involved giving out condoms free of charge and providing information through school talks and leaflets [17]. Other studies indicate that while adolescents' attitudes toward premarital sex are becoming more liberal, their awareness of contraceptives remains poor [18].

The percent distribution of premarital sex and adjusted odds ratio measuring the association between extra marital sex and selected socio-demographic characteristics are presented in table 3. Results reveals form analysis that the premarital sex (13.6%) was higher among male youth as compared to female (3.8%) only. The odds of having premarital sex by female (OR=0.257, CI=0.235-0.280) were lower compared to male. The probability of premarital sex was found to be more likely among urban youth (OR=0.1.326, CI=0.235-0.280), than among rural youth. Education have a positive association with premarital sex. In other hand, increase the educational level, premarital sex also increases. Compared to uneducated youth, those who had less than 8 year educational level (OR=1.435 CI=1.263-1.629), 8-11 years education (OR=1.323 CI=1.162-1.507), 12 or more years education (OR=1.2.1, CI=1.023-1.410), were more likely to have premarital sex as compared to uneducated youth. Youth

those who have some disposal income i. e, paid work, were more involved in premarital sex with compared to not working youth. The likelihood of premarital sex were found to be less among not working youth (OR=0.590, CI=0.535-0.651), youth who have work without income "unpaid work" (OR=0.720, CI=0.617-0.840), as compared to youth working with paid work. As regards to caste/ tribe the results indicate that scheduled tribe youth have more premarital sex as compared to scheduled caste, other back word caste and general caste. The probability of premarital sex was found to be more likely among scheduled tribe (OR=1.491, CI=1.311-1.695), than scheduled caste.

 Table 3 : Adjusted odds ratio measuring the association between extra marital sex and selected sociodemographic characteristics ("Youth in India: Situation and Needs Study," 2006–08)

| Background characteristics | Pre marital sex | | | | |
|---|-----------------|-------|------------|-------------|--|
| - | Yes | п | Odds ratio | 95%Cl | |
| Sex | | | | | |
| Male (ref) | 13.6 | 14281 | 1.000 | | |
| Female | 3.8 | 31274 | 0.257*** | 0.235-0.280 | |
| Residence | | | | | |
| Rural (ref) | 5.4 | 21459 | 1.000 | | |
| Urban | 7.7 | 24096 | 1.326*** | 1.214-1.449 | |
| Age Group | | | | | |
| 15-19 (ref) | 5.1 | 25041 | 1.000 | | |
| 20-24 | 8.4 | 20514 | 1.538*** | 1.416-1.671 | |
| Education | | | | | |
| Illiterate (ref) | 5.6 | 7971 | 1.000 | | |
| Less than 8 years | 8.2 | 10613 | 1.435*** | 1.263-1.629 | |
| 8-11 years | 6.5 | 18771 | 1.323*** | 1.162-1.507 | |
| 12 or more years | 5.7 | 8199 | 1.201** | 1.023-1.410 | |
| Religion | | | | | |
| Hindu (ref) | 6.5 | 37384 | 1.000 | | |
| Muslim | 5.2 | 5275 | 1.034 | 0.899-1.189 | |
| Others | 11.4 | 2896 | 1.535*** | 1.338-1.760 | |
| Castes/Tribes | | | | | |
| Scheduled castes (ref) | 8.5 | 8577 | 1.000 | | |
| Scheduled tribes | 14.3 | 3755 | 1.491*** | 1.311-1.695 | |
| Other backward classes | 5.5 | 23087 | 0.699*** | 0.631-0.774 | |
| General | 4.8 | 9878 | 0.676*** | 0.592-0.772 | |
| Wealth quintile | | | | | |
| Poorest (ref) | 8.7 | 5629 | 1.000 | | |
| Poorer | 8.5 | 7217 | 0.909 | 0.796-1.037 | |
| Middle | 6.9 | 9142 | 0.812*** | 0.709-0.929 | |
| Richer | 6.5 | 10835 | 0.813*** | 0.707-0.935 | |
| Richest | 4.5 | 12732 | 0.656*** | 0.560-0.769 | |
| Work Status | | | | | |
| Paid work (ref) | 11.5 | 13775 | 1.000 | | |
| Unpaid work | 5.6 | 3876 | 0.720*** | 0.617-0.840 | |
| Both paid and unpaid work | 11.8 | 2564 | 1.245*** | 1.082-1.431 | |
| Not working | 3.6 | 25313 | 0.590*** | 0.535-0.651 | |
| Type of family | | | | | |
| Nuclear family (ref) | 6.4 | 22522 | 1.000 | | |
| Joint family | 6.8 | 23033 | 1.059 | 0.979-1.145 | |
| Total | 6.6 | 45555 | | | |
| Levels of significance: *p<0.10: **p<0.05: ** | *p<0.01. | | | | |

Table 4 Represents the percent distribution of consistence condom use and also logistic regression odds ratios of condom use in last sexual intercourse. Results highlight the fact that lot of sex are unprotected.

 Table 4 : Adjusted odds ratio measuring the association between consistence condom use and selected

 Socio- demographic characteristics ("Youth in India: Situation and Needs Study," 2006–08)

| Background characteristics | | | | |
|----------------------------|--------------|------|-------------------|--------------|
| | Yes | п | Odds ratio | 95%Cl |
| Sex | | | | |
| Male (ref) | 10.85 | 1944 | 1.000 | |
| Female | 2.06 | 1070 | 0.254*** | 0.157-0.409 |
| Residence | | | | |
| Rural(ref) | 11.13 | 1150 | 1.000 | |
| Urban | 5.63 | 1864 | 0.720** | 0.530 -0.978 |
| Age Group | | | | |
| 15-19(ref) | 4.97 | 1287 | 1.000 | |
| 20-24 | 9.79 | 1727 | 1.385** | 0.999 -1.918 |
| Education | | | | |
| Illiterate (ref) | 2.68 | 447 | 1.000 | |
| Less than 8 years | 6.42 | 872 | 1.772* | 0.922-3.407 |
| 8-11 vears | 8.06 | 1228 | 1.845* | 0.967-3.521 |
| 12 or more years | 14.16 | 467 | 2.747*** | 1.364-5.533 |
| Religion | | | | |
| Hindu (ref) | 7.59 | 2412 | 1.000 | |
| Muslim | 9.19 | 272 | 1.015 | 0.626 -1.647 |
| Others | 7.58 | 330 | 1.707** | 1.047 -2.784 |
| Castes/Tribes | | | | |
| Scheduled castes(ref) | 7.16 | 726 | 1.000 | |
| Scheduled tribes | 5.22 | 536 | 1.051 | 0.636 -1.737 |
| Other backward classes | 7.75 | 1264 | 1.019 | 0.698-1.489 |
| General | 11.13 | 476 | 1.223 | 0.776 -1.926 |
| Wealth guintile | | | | |
| Poorest(ref) | 3.89 | 488 | 1.000 | |
| Poorer | 3.74 | 615 | 0.778 | 0.413 -1.465 |
| Middle | 6.62 | 634 | 1.230 | 0.687 -2.203 |
| Richer | 11.21 | 705 | 1.870** | 1.065 -3.286 |
| Richest | 12.24 | 572 | 1.741* | 0.939 -3.230 |
| Work Status | | | | |
| Paid work(ref) | 9.82 | 1578 | 1.000 | 0 400 4 500 |
| Unpaid work | 5.99 | 217 | 0.865 | 0.468 -1.599 |
| Douri palu anu unpalu work | 0.03 5.05 | 3UZ | U./JU 0.612*** | 0.437 -1.287 |
| | 5.25 | 915 | 0.013 | 0.414 -0.907 |
| Nuclear family(ref) | 7 00 | 1446 | 1 000 | |
| Joint family | 7.00 7.50 | 1440 | 1.000 0.073 | 0 736 -1 286 |
| Total | 7.09 | 2014 | 0.970 | 0.750-1.200 |

Levels of significance: *p<0.10; **p<0.05; ***p<0.01.

Youth's age, education and wealth guintile were found to be strong factors associated with the consistence condom use among unmarried youth. About (10.85%) male were reported that they were use condom in last sex where as only (2.06%), female use condom in last sex. Odds ratio also showing the condom use were found to be less among youth female ((OR=0.254, CI=0.157-0.409) than youth male. Youth's education emerged as a vital determinant in the condom use. Youth had 12 years or more education they use condom in last sex more (14.16%) as compared to 8-11 year education (8.06%), less than 8 years education (6.42%), illiterate (2.68%), respectively. Youth with 12 years or more education were 2.8 times (CI=1.364-5.533), 8-11 year education were 1.8 times (CI=0.967-3.521) more and less then 8 years education were 1.7 times (CI=0.922-3.407) more likely to use condom in last sex compared with uneducated youth. Youth who have some disposal income in hand i.e, belonging in

richest wealth quintile (12.24%), richer whelth quintile (11.21%), were using more consistence condom as compared to poorest wealth quintile youth. Moreover, the odds of consistence condom use among youth who belongs the richest quintile were higher (OR=1.741, Cl=0.939 -3.230) compared with those who belongs poorest wealth quintile. Unmarried youth in the study community find it difficult to translate their knowledge and attitudes about condoms into safe sexual practices which has significant implications for intervention development.

V. SUBSTANCE USE AND SEXUAL BEHAVIOR

Cross-sectional and longitudinal research on the relationship between alcohol and sexual risk has shown consistent associations across a variety of situations, age groups and countries [19-23]. Studies support the relationship between alcohol and early sexual debut [24], multiple partners [25-26], inconsistent condom use, or lack of protection during intercourse [27-28] unwanted pregnancies, and sexual violence, including sexual abuse, forced sex, and rape [29-30]. Recent research has shown that alcohol plays a role in condom use when gender and partner type are considered [31]. They showed that for women only, condom use was less likely when alcohol consumption preceded sex with non primary partners.

Heavy drinkers are more likely to engage in high risky sexual behavior, including sex for money [32]. They have more sexual partners [33], and use condoms less consistently [34-36], though these associations are not always consistent.

The results of the multivariate analyses (Binarylogistic regression) for the measuring the

association between substance use and pre marital sex among youth in India are presented in table 5. Results reiterate from the analysis that the positive association between substance use and premarital sex. Youth who were using tobacco (21.19%) they were more involved in sex before marriage as compared to non tobacco user. Almost same trend were found in logistic regration analysis. However non tobacco user youth were found to be less likely (OR=0.325, CI=0.294-0.360) to have sex before marriage than tobacco user. Youth who were who were alcohol user, they were more (29.89%) involved in the premarital sex as compared to non alcohol user (5.01%) only. The likelihood of having sex before marriage was lower (OR=0.251, CI=0.225-0.281) among youth who were non alcohol user compared to those youth who were alcohol user.

| Table 5 : Adjusted odds ratio measuring the association between Substance use and Extra marital sex |
|---|
| ("Youth in India: Situation and Needs Study," 2006–08) |

| Background characteristics | Pre marital sex | | | | |
|--|-----------------|-------|------------|-------------|--|
| - | Yes | п | Odds ratio | 95%Cl | |
| Tobacco consumption ever | | | | | |
| Yes | 21.19 | 1909 | 1.00 | | |
| No | 4.70 | 40576 | 0.325*** | 0.294-0.360 | |
| Last 4 week tobacco consume | | | | | |
| Not at all | 14.34 | 258 | 1.00 | | |
| Once or twice in last 4 week | 20.13 | 467 | 1.452* | 0.736-2.864 | |
| Once a week | 20.00 | 365 | 1.776 | 0.882-3.578 | |
| More than once a week | 20.27 | 592 | 1.196 | 0.612-2.335 | |
| Everyday | 23.69 | 3297 | 1.578 | 0.852-2.923 | |
| Alcohol consumption ever | | | | | |
| Yes | 29.89 | 2934 | 1.00 | | |
| No | 5.01 | 42621 | 0.251*** | 0.225-0.281 | |
| Last 4 week alcohol consume | | | | | |
| Not at all | 22.82 | 653 | 1.00 | | |
| Once or twice in last 4 week | 30.63 | 1270 | 1.344** | 1.018-1.773 | |
| Once a week | 33.04 | 569 | 1.363** | 0.995-1.867 | |
| More than once a week | 35.87 | 329 | 1.543*** | 1.082-2.201 | |
| Everyday | 29.36 | 109 | 1.292 | 0.740-2.254 | |
| Usually alcohol drink with peers group | | | | | |
| Yes | 30.91 | 2550 | 1.00 | | |
| No | 22.87 | 376 | 0.746* | 0.542-1.026 | |
| Drink so much (Over dose) alcohol | | | | | |
| Never | 27.44 | 1928 | 1.00 | | |
| Sometimes | 34.76 | 961 | 1.293*** | 1.053-1.587 | |
| Often | 31.43 | 35 | 0.727 | 0.253-2.091 | |

Levels of significance: *p<0.10; **p<0.05; ***p<0.01.

Further the question were also asked to respondent that frequency of tobacco and alcohol use last 4 week preceding the survey those who were the tobacco and alcohol user. However results revels that the youth who whose frequency of alcohol use were everyday (30.63%), more than once a week (35.87), once a week (33.04%), once or twice in last 4 week (30.63%), were more involved in sex before marriage as compared to not alcohol user (22.82%) last 4 week. The likelihood of having sex before marriage were higher among youth those frequency of alcohol use were more than once a week (OR=1.543, CI=1.082-2.201), once in a week (OR=1.363, CI=0.995-1.8671) and once or twice in last 4 weeks (OR=1.344, CI=1.018-1.773) as compared to non alcohol user in last 4 week. Youth usually drink alcohol with peer group were more involved in premarital sex as compared to usually drink alcohol with non peer group. The odds having sex before marriage were found lower (OR=0.746, CI=0.542-1.026), among youth usually drink alcohol with non peer group than youth drink alcohol usually with peer group.

VI. Summary and Conclusion

The focus of the present paper is showing the scenario and pattern of substance use, sexual behaviour and its determinants and also association between the sexual behavior and substance use, among vouth in India. We conclude by this study that, the prevalence of substance use among male youths was very high. The main reasons for high prevalence of substance use were substance use by using substance in family, work status, caste/tribe, lower educational status. Despite these limitations, our study makes and important contributions several new to understanding the correlates of age at initiation of premarital sex among both young women and men about which information is scant in India. Programmatically, findings underscore the need for sexual and reproductive health interventions to target not only young people but also their peers and the influential adults in their life, including parents. Methodologically, the study emphasises the need to continue the search for appropriate methodologies to measure sensitive behaviours among youth as well as the need for prospective or panel study designs that capture the ways in which the situation and experiences in adolescence influence their life courses at later ages. Youth is most important period of human life as they are easily influenced by habits and behavoiurs of their parents, family member and initiate substance use and sexual behaviour. Hence IEC activities regarding consequences of substance use and risky sexual behaviour should betargeted towards youths.

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VIII. Limitations

The study had a number of limitations. Although the opportunity for reporting pre-marital sex anonymously via the sealed envelope approach did indeed enable a considerable number of sexually active young women and men who opted not to disclose their sexual experiences in faceto-face questioning the opportunity to do so, we note that, as in many studies, pre-marital sexual xperience may have been underreported, particularly by young women. Moreover, among young men, it is possible that sex worker, exchange, forced and same-sex relationships were under-reported.

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La Importancia del Fortalecimiento de los Sistemas Nacionales de Investigadores en América Latina y el Caribe. Caso del Programa Nacional de Incentivo al Investigador del Paraguay (PRONII)

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Resumen- Es importante seguir avanzando en el fortalecimiento de los Sistemas Nacionales de Investigadores, con su diversidad de mecanismos y modelos instalados a lo largo de la región latinoamericana y caribeña (ALC). Los indicadores en Ciencia y Tecnología muestran un avance importante de los esfuerzos realizados por los diversos países en aumentar el número de investigadores, así como la inversión realizada en I+D. Todos estos esfuerzos parecen no ser suficientes para pertenecer a la reducida cantidad de países que están a la vanguardia del conocimiento, pero sin embargo, ALC ha demostrado tener gran capacidad para ir avanzando en el camino del desarrollo científico y tecnológico. Se destacan entre todas las herramientas emanadas de las Políticas Nacionales de Ciencia y Tecnología, el establecimiento de los Sistemas Nacionales de Investigadores, y en este marco, los diversos mecanismos de incentivo para los investigadores, con opiniones positivas y negativas en el seno de sus propias comunidades. En este escenario es México el que lleva la delantera, con un Sistema que data de 1984 y que ha sido objetivo de muchas evaluaciones.

Palabras clave: sistemas nacional de investigadores, programa nacional de incentivo, Paraguay.

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Es importante seguir avanzando Resumenen el fortalecimiento de los Sistemas Nacionales de Investigadores, con su diversidad de mecanismos y modelos instalados a lo largo de la región latinoamericana y caribeña (ALC). Los indicadores en Ciencia y Tecnología muestran un avance importante de los esfuerzos realizados por los diversos países en aumentar el número de investigadores, así como la inversión realizada en I+D. Todos estos esfuerzos parecen no ser suficientes para pertenecer a la reducida cantidad de países que están a la vanguardia del conocimiento, pero sin embargo, ALC ha demostrado tener gran capacidad para ir avanzando en el camino del desarrollo científico y tecnológico. Se destacan entre todas las herramientas emanadas de las Políticas Nacionales de Ciencia y Tecnología, el establecimiento de los Sistemas Nacionales de Investigadores, y en este marco, los diversos mecanismos de incentivo para los investigadores, con opiniones positivas y negativas en el seno de sus propias comunidades. En este escenario es México el que lleva la delantera, con un Sistema que data de 1984 y que ha sido objetivo de muchas evaluaciones. A partir de la experiencia mexicana, aparecen otros sistemas, como el de Uruguav (que inicia el mecanismo de incentivo en 2002) y más tarde el de Paraguay, en 2011.

El presente documento muestra también, los resultados de la Primera Convocatoria (2011) del Programa Nacional de Incentivo para los Investigadores del Paraguay (PRONII), lanzado el año pasado, y por supuesto, con las consideraciones y adecuaciones necesarias para el Paraguay y las características de sus científicos e investigadores. Esta primera convocatoria del PRONII ha tenido una masiva participación y con altas expectativas para con la institución que lidera y coordina el Sistema Nacional de Ciencia, Tecnología e Innovación, que es el Consejo Nacional de Ciencia y Tecnología, CONACYT. Esta primera convocatoria ha tenido 273 postulantes de las diversas áreas de la ciencia: 115 del área de la Salud, Biología y Química; 54 del área de las Ciencias Agrarias y Ciencias Naturales; 46 de las Ciencias Sociales y Humanidades y 36 pertenecientes a las Ingenierías y Tecnologías, Informática; Física y Matemática.

Palabras clave: sistemas nacional de investigadores, programa nacional de incentivo, Paraguay.

Abstract- It is important to continue the strengthening of the National Systems of Researchers all along the Latin-American

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and Caribbean (LAC) region, with its assortment of established mechanisms and models. The Science and Technology Indicators confirm that important advancements have been done, by many countries, in their efforts to increase the number of researchers, as well as the investment on R&D. All these efforts, seem not to be sufficient, to allow them to join the reduced number of countries that are on the leading-edge of knowledge, nevertheless, the LAC has displayed great capacity to progress in the path of scientific and technological development. Of all the tools forthcoming from the National Policies on Science and Technology, the most admirable are the establishment of the National System of Researchers, and in its environment the diverse mechanisms of incentive for the researchers, with positive or negative opinions in the midst of their own communities. In this scenario, México is the leader; with a System that dates back from 1984 and which has been the focus of many evaluations. The Mexican experience has been the starting point for the appearance of other Systems, such as the Uruguayan (which starts the incentive mechanism in year 2002) and later on Paraguay in 2011.

The present document also illustrates the results of the First Official Call (2011) of the National Incentive Program for Researchers of Paraguay (PRONII, in its Spanish initials), launched a year ago, and on course, with all the reflections and modifications necessary according to the characteristics of Paraguay and its scientists and researchers. This first call of the PRONII has had a massive participation and with high expectations from the institution that leads and coordinates the National System of Science, Technology and Innovation, which is the National Council of Science and Technology, CONACYT. This first call had 273 applicants from the various areas of science: 115 from the areas of Health, Biology and Chemistry; 54 from the areas of Agricultural and Natural Science; 46 from Social Science and Humanities; and 36 belonging to the areas of Engineering and Technology, Information Technology, Physics and Mathematics.

Keywords: national systems of researchers, national incentive program, Paraguay.

I. INTRODUCCIÓN

n el contexto mundial se ha demostrado que el crecimiento económico de los países está estrechamente vinculado a la competitividad dentro del mercado global de productos y servicios. Competitividad que se basa fundamentalmente en la capacidad de generar y utilizar el conocimiento, ya sea para crear o innovar los procesos económicos. Ésta capacidad es función exponencial de los recursos humanos dedicados a las actividades de Investigación y Desarrollo, I+D, el entorno y la infraestructura disponible para desarrollar dichas actividades.

La disponibilidad de investigadores altamente calificados en calidad y cantidad es una condición esencial para fomentar la innovación y estimular el desarrollo científico tecnológico de un país. A nivel mundial, la brecha existente entre los países desarrollados y los en desarrollo se puede apreciar cuantitativamente en la correlación que existe entre las variables que miden el comportamiento económico y la generación/aplicación del conocimiento, aunque existen serias objeciones a cuales son estas variables (Chatziparadeisis, 2006).

La inversión en I+D que realizan los países de América Latina y el Caribe, ALC tan solo abarca el 2,2% del total invertido en el mundo, comparable a lo que invierte Oceanía y muy por encima del 0,4% del continente Africano, pero abismalmente pequeño comparado con lo realizado por Estados Unidos y Canadá (37,5%), Europa (32,2%) y Asia (25,5%), según el Informe del Año 2011 "El Estado de la Ciencia, Principales Indicadores de Ciencia y Tecnología Iberoamericanos/Interamericanos" publicado por la Red de Indicadores Ciencia Tecnología de V Iberoamericanos e Interamericanos RICYT (Figura 1).



Figura 1 : Inversión en I+D en dólares corrientes por bloques geográficos seleccionados (2009) *Fuente: RICYT, 2011*

A pesar de que el porcentaje de participación de América Latina y el Caribe en el Gasto Interno Bruto de Investigación y Desarrollo (GBID) mundial es muy bajo, ha mantenido un crecimiento sostenido, inclusive acelerado entre los años 2006 y 2008, en la inversión en I+D desde el año 2000, que es destacable al comparar con los otros bloques geográficos del mundo, (Figura 2). En el bloque de América Latina y el Caribe, la inversión en I+D en dólares corrientes en el año 2009 estuvo dominada por Brasil con un 70% de la inversión total, seguida de por México con un 13% y Argentina con un 7%; el restante 10% corresponde al resto de los países de ALC, (RICYT, 2011).



* Base Año 2000 = 100

Figura 2 : Evolución de la inversión en I+D en dólares corrientes por bloques geográficos seleccionados (2009) *Fuente: RICYT, 2011*

Evolución que se ve reflejada en el aumento del numero de investigadores dedicados a I+D en el ALC, incremento que se dio también debido al retorno de muchos investigadores desde Europa o EEUU al despejarse el clima político, a la inserción y uso masivo de las TICs (Tecnologías de Información y Comunicación) lo que propicio mayor movilidad y la formación de redes de investigación, y a la universalidad de la educación ya sea básica o superior.

Mantener esta tendencia de crecimiento es el gran desafío de los gobiernos de ALC, ya que a causa de la baja inversión en I+D, los investigadores se encuentran con bajos presupuestos, infraestructura obsoleta y exigua, sueldos bajos y reconocimientos escasos, brechas tecnológicas y líneas de investigación de poco interés para los países desarrollados ya que los problemas a solucionar no son necesariamente iguales a los de países desarrollados. Por ello es importante analizar y verificar los avances y el impacto que han tenido la implementación de los Sistemas Nacionales de Investigación en algunos países de ALC, como ser Colombia, Brasil, Argentina, Uruguay, México, Venezuela y Chile, a los que hace un poco más de un año se unió Paraguay.

Comparando con el los otros bloques geográficos del mundo, América Latina y el Caribe, lidera en el crecimiento del número de investigadores en EJC (Equivalente a Jornada Completa), (Figura 3). Se espera que Asia retorne el crecimiento del número de investigadores EJC, después del ajuste que debe realizar en la toma de datos para los indicadores de Ciencia y Tecnología CyT, conforme al Manual de *Frascati*. Para el 2009, se estimó que el total de investigadores EJC en el mundo rondaba en la cifra de 7 millones, de los cuales el 93% de los investigadores y tecnólogos de I+D en EJC están concentrados en EEUU y Canadá, La Unión Europea y Asia; solo el 3,6% corresponde a ALC que aumentó 1% desde el 2000, (RICYT, 2011).



* Base Año 2000= 100



II. Los Sistemas Nacionales de Investigadores

Una revisión bibliográfica sobre casos de sistemas de investigación y de mecanismos de Incentivos a investigadores en instituciones nacionales de Investigación y organismos rectores de los Sistemas Nacionales de Ciencia y Tecnología de varios países de América Latina (Colombia, Brasil, Argentina, Uruguay, México, Venezuela y Chile) reportan cada uno sus experiencias y describen sus objetivos, los beneficiarios e instituciones elegibles, los incentivos que otorgan los mecanismos y criterios de evaluación y las instancias de coordinación y ejecución, entre otros aspectos. Los programas de incentivos reportados ya tienen en su mayoría una década de funcionamiento, pero en general responden a un objetivo principal, que es el fortalecimiento de la comunidad investigativa (IICA, 2004), pero antes presentaremos un panorama más amplio sobre el patronazgo de la ciencia y la tecnología por parte del Estado.

Schot y Rip (1997) demuestran que si bien la ciencia se desarrolla por largos años al alero del patronazgo del Estado, es la misma incomprensión de la ciencia por parte de las burocracias políticas lo que obliga a incorporar la revisión entre pares como forma de asignar recursos para ella. Esto último explica porque la mayoría de los fondos que surten los programas de incentivos provienen de fuentes públicas, concretamente del presupuesto de la nación. Otras

fuentes son los excedentes de los proyectos de investigación, donantes y de recursos propios de las instituciones (IICA, 2004).

Rutherford (2003) argumenta que se debe incentivar a la comunidad científica para que haga más por incrementar y mejorar las oportunidades disponibles para que las personas participen en el mundo de la ciencia. Para el autor, esto requiere al menos dos medidas: i) aumentar el número de científicos deseosos y capaces de comunicar la ciencia efectivamente a los no científicos a través de los medios informativos e Internet; y ii) aumentar las oportunidades e incentivos para que las personas, en todos los ámbitos de la vida, puedan encontrar a la ciencia en entornos humanísticos ricos.

Cabe mencionar que quizás la mayor razón por la cual los Estados de ALC apoyan mínimamente a los sistemas de CyT, es la contradicción existente entre el nivel de estima de la población hacia la actividad investigativa y la escasa formación científica de la misma, que es más bien una ignorancia de lo científico, de su necesidad y sus limitaciones. Destacándose en este escenario una realidad donde ni el sistema educativo en su totalidad, ni las políticas públicas, ni las políticas empresariales han logrado sacar a muchos de los países de ALC del subdesarrollo científico.

En el informe de la UNESCO (2010) respecto a las estadísticas mundiales en los campos de la tecnología, educación. ciencia V cultura У comunicación, y presentado desde una perspectiva global, hace mención de la concentración de la I+D en tres países y regiones: Estados Unidos, Unión Europea y Japón; lo que concuerda con lo mencionado en el informe de la RICYT 2011. En el mundo en desarrollo, la producción científica y el gasto en I+D también se concentran en un grupo relativamente reducido de países en cada región. Hecho demostrado en la Figura 4 con los porcentajes de distribución del gasto en I+D en los países de ALC entre los años 2000 y 2009.



Figura 4 : Distribución en I+D en dólares corrientes en países de ALC (2000, 2002 y 2009). Fuente: RICYT, 2011

La intensidad de la I+D, es un indicador utilizado para monitorear los recursos destinados a la Ciencia, Tecnología e Innovación (CTI) en todo el mundo, y se mide tradicionalmente como la relación entre el gasto interior bruto en I+D (GBID) y el producto interno bruto (PIB) expresada como un porcentaje. El mismo informe (UNESCO, 2010), muestra como en 2007, la mediana de la relación GBID/PIB en los Estados Miembros de la OCDE era 1.8% con seis países exhibiendo valores bastantes inferiores al 1%. Actualmente se está produciendo un cambio en la distribución mundial de las actividades de I+D, según se refleja en los aumentos del GBID, el volumen de publicaciones científicas listadas a nivel internacional y la actividad de patentes de los países en desarrollo:

"La proporción de publicaciones científicas en bases de datos bibliométricos reconocidos que se atribuye a autores de países en desarrollo ha aumentado notoriamente. En 1973, los países en desarrollo, como conjunto, representaban el 5% de las publicaciones científicas globales y solamente India, Sudáfrica y Argentina se ubicaban entre los 25 primeros del mundo (Garfield, 1983). Ya hacia el 2006, las publicaciones científicas de estos países alcanzaban el 20% de la participación mundial, en gran medida gracias al aporte de Asia (14,8%) y particularmente de China (7%). En materia de publicaciones, China ha exhibido un crecimiento superior al 100% en los últimos diez años, mientras que en América Latina la contribución que Brasil hiciera a las publicaciones mundiales durante el mismo período fue cercana al 50% (UNESCO, 2010: 12)".

Siguiendo en la línea de trabajos publicados en materia de políticas científicas y tecnológicas, la

UNESCO (2010)¹, muestra la inversión de los países latinoamericanos en investigación y desarrollo experimental, a través de una ilustración georeferenciada (Figura 5) para el año 2007. Solo tres países superan el 1% del PBI: Brasil, Cuba y Venezuela, siendo este último el que más rápidamente ha multiplicado la inversión anual en actividades de I+D en los años recientes mediante la introducción de reformas legislativas que regulan la inversión mínima que deben realizar las empresas en tareas de I+D.



Figura 5 : Inversión en I+D respecto al PIB en Latinoamérica. *Fuente: UNESCO (2010)*

En cuanto a ALC, el número de publicaciones en revistas científicas registradas en el *Science Citation Index* se ha duplicado, crecimiento que se puede atribuir directamente a la cantidad de investigadores en el Sistema Nacional de Investigadores de Brasil. En la Figura 6 se muestra la evolución del número de publicaciones científicas por región englobando el continente americano e Iberoamérica, destacándose el crecimiento que ha experimentado ALC.



^{*} Base Año 2000 = 100

Figura 6 : Evolución del número de publicaciones en el Science Citation Index (SCI). Fuente: RICYT, 2011

Respecto a la cantidad de investigadores, el aumento más significativo se produjo en Asia, que actualmente concentra el 41,4% de los investigadores del planeta, mientras que en 2002 este continente sólo representaba el 35,7% del total. Ese incremento se debe ante todo a la rápida evolución registrada en China, cuyo porcentaje pasó del 14% al 20% en el espacio de cinco años. Asia cobró una mayor importancia a expensas de Europa y América, cuyos porcentajes disminuyeron del 31,9% al 28,4% y del 28,1% al 25,8%, respectivamente (UNESCO, 2010).

¹ La UNESCO, en 2010, publica el documento referente a Sistemas Nacional de Ciencia y Tecnología, editado por Guillermo Lemarchand, donde se presenta la figura 5, respecto de la inversión de los países latinoamericanos en I+D/PIB.

La Importancia del Fortalecimiento de los Sistemas Nacionales de Investigadores en América Latina y el Caribe. Caso del Programa Nacional de Incentivo al Investigador del Paraguay (PRONII)



Figura 7 : Distribución de los investigadores en EJC en ALC (2009). Fuente: RICYT, 2011

Para el año 2009, la inversión en I+D por investigador EJC de los países de Iberoamérica, expresada en Dólares Por Paridad de Compra (PPC) fue de US\$143,76 y es apreciable el hecho de que Paraguay por primera vez tiene una participación visible (RICYT, 2011) (Figura 7 y 8).



Figura 8 : Inversión en I+D por investigador en EJC, expresada en PPC en países seleccionados (2009). *Fuente: RICYT, 2011*

De las dos fuentes, UNESCO y RICYT (Figura 9), se desprende claramente el constante aumento en la participación mundial en el número de investigadores que tiene América Latina y el Caribe, pasando del 1,5% en 1990 al 3,5% en el 2009. Esto demuestra que la tasa de crecimiento en el número de investigadores en la región es mayor que el promedio de crecimiento de los mismos en el mundo. Pese a ello, debemos tener en cuenta que ALC representa un 8,6% de la población mundial, si el número de investigadores deseable siguiera una distribución espacial homogénea en todo el mundo, ALC debería tener una proporción de investigadores con respecto al mundo, de al menos un factor 2,5 veces el actual. Con las tasas de crecimiento del número de investigadores con dedicación exclusiva o de jornada completa (EJC) con respecto al mundo, mostradas entre 1990 y 2009 y asumiendo una función del tipo exponencial, sería necesario esperar hasta el año 2030 para que la región llegue a tener un número de investigadores con respecto al mundo similar al de la proporción de su población con respecto al mismo.

La Importancia del Fortalecimiento de los Sistemas Nacionales de Investigadores en América Latina y el Caribe. Caso del Programa Nacional de Incentivo al Investigador del Paraguay (PRONII)



Figura 9 : Distribución de investigadores en EJC por bloques geográficos seleccionados (2000 y 2009). *Fuente: RICYT, 2011*

El estudio de la UNESCO (2010) infiere que existe una importante debilidad estructural en la formación de nuevos investigadores y tecnólogos en ALC. Sin embargo, algunos países han venido implementando políticas de Estado que están comenzando a revertir esa situación (por ejemplo, Brasil). Cuando comparamos la fracción de investigadores equivalentes de jornada completa en la región, sobre el total mundial, se observa claramente que la tasa de crecimiento es mayor en ALC que en el promedio mundial (Figura 10).



Figura 10 : Distribución del Número de Investigadores por cada millón de personas en ALC. Fuente: UNESCO (2010)

Un aspecto que merece destaque en el afán de fortalecimiento de los Sistemas Nacionales de Investigadores, es que un pequeño grupo de países que ha exhibido niveles de crecimiento relativamente altos – liderados por India y China – han comenzado a impulsar campañas orientadas a la recuperación de científicos nacionales arraigados en el extranjero a través de intensas políticas de CTI. Otros países han optado por organizar la diáspora CTI a través de "movilizaciones remotas" (UNESCO, 2010), por ejemplo, creando bases de datos de científicos expatriados, con el objetivo de movilizar, organizar y restablecer vínculos con la comunidad científica del país de origen.

La idea es motivar a los científicos expatriados a utilizar las instalaciones y redes extranjeras y, simultáneamente, abrir canales que permitan compartir sus competencias y resultados de investigación con sus connacionales. Las distintas suertes que han corrido varias diásporas CTI – particularmente en América Latina (los casos de Chile, Argentina, Colombia, entre otros) - recuerda que no importa lo simple y atractivo que pueda parecer la propuesta de recuperar científicos, los integrantes de la mencionada diáspora no son necesariamente fáciles de reclutar, como lo plantean Gaillard y Gaillard (2003), en el documento de la UNESCO (2010).

El Instituto Interamericano de Cooperación para la Agricultura (IICA, 2004) realizó un estudio específico de los programas de incentivos a los investigadores. Este trabajo del IICA, menciona que estos sistemas de incentivos son de creación reciente y la mayoría tienen cerca de ocho años de conformados, teniendo en cuenta que aquel trabajo es del 2004. En la actualidad, en 2012, ya ha pasado de una década de dichos establecimientos, empero, el Sistema Nacional de Investigadores de México es el más antiguo, y ha servido de modelo para la creación de otros sistemas o programas como los de Colombia, Uruguay, Venezuela y recientemente, en 2010, el de Paraguay.

Estos incentivos están dados en un mejoramiento del ingreso, reconocimiento por la labor cumplida, captación de recursos, publicaciones y productividad. Los incentivos para la investigación pueden ser de varios tipos, y el informe del IICA (2004) los clasifica en tres categorías:

- a) Económicos directos: Se remunera al investigador;
- b) Indirectos: Financian los proyectos, su publicación o la presentación de los resultados;
- c) No económicos: Como la capacitación en metodología de investigación o la liberación de algunas responsabilidades para que se dediquen a la investigación.

Es importante enfatizar que la actividad investigativa se puede ver como el mecanismo efectivo para la superación profesional de quienes la ejercen (IICA, 2004: 8).

Continuando en este contexto más específico, se relata el caso mexicano, y en el cual Barrera Saldaña (2000) expone sobre la importancia de un Sistema Nacional de Investigadores, y hace alusión al Sistema Nacional de Investigadores de México (SNI-Mx), creado en 1984, y que desde aquella fecha sufrió varias modificaciones, pero en todo momento busca:

"...fomentar el desarrollo científico y tecnológico; incrementar el número de investigadores; estimular la eficiencia y la calidad de la investigación; propiciar la innovación tecnológica; apoyar la formación de grupos de investigación y contribuir a integrar sistemas de información sobre ciencia y tecnología (Barrera Saldaña, 2000: introducción p. VI).

Además se establece, continúa Barrera Saldaña, que como criterios fundamentales para el

ingreso de los investigadores al Sistema se consideran: la productividad científica; la capacidad de formación de otros investigadores y la contribución al desarrollo científico, tecnológico, social y cultural.

Leyva & Sandoval Barraza (2007), llevan a cabo un análisis de la Política de Ciencia y Tecnología de México y toman como uno de los objetos de estudio la formación de recursos humanos tendientes al fortalecimiento del Sistema Nacional de Investigadores. En todo este estudio ha sobresalido la promoción de estudios de posgrado y la consolidación del Sistema Nacional de Investigadores (SNI-Mx), a través del otorgamiento de incentivos. Puede visualizarse en la tabla 1, que presenta las dimensiones establecidas para el análisis de la Política de Ciencia y Tecnología, durante el período 2001 a 2006, como en la dimensión correspondiente a la formación de recursos humanos dedicados a la Ciencia y Tecnología, las metas trazadas horizonte de cinco (5) años fueron en un principalmente: 1) triplicar el número de personas dedicadas a la ciencia y tecnología, pasando de 25.000 personas en 2001 a 80.000 para el 2006; 2) duplicar la cantidad de doctores para el 2006; y 3) duplicar la cantidad de investigadores que desarrollan su actividad en o para el sector productivo (Tabla 1).

Tabla 1 : Indicadores de Ciencia y Tecnología de México (entre 2001 – 2006) Estudio de la Política de Ciencia y Tecnología de México

| Áreas | 2001 | 2006 | |
|--|--|------------------|--------|
| Indicadores de financiamiento | Inversión nacional en C y T como % del PIB | 0.60% | 1.50% |
| | Gasto en I y D como % del PIB | 0.4% | 1.00% |
| | Porcentaje del gasto total del gobierno federal destinado a C y T | 2% | 4% |
| | Participación del sector productivo en el gasto en I y D | 26% | 40% |
| Indicadores en la formación de recursos humanos | Número de personas dedicadas a I y D | 25 000 | 80 000 |
| | Número de personal dedicado a I y D por cada 1 000 de la PEA | 0.70 | 2.0 |
| | Porcentaje de investigadores en el sector productivo | 20% | 40% |
| | Formación de doctores por año | 1 100 | 2 300 |
| Indicadores de competitividad | Posición mundial en infraestructura científica | 48 | 37 |
| | Posición mundial en infraestructura tecnológica | <mark>4</mark> 6 | 34 |
| | Índice de competitividad | 34 | ≤34 |

El aumento en el número de doctores, fue la dimensión que experimentó el mayor crecimiento relativo pues comparando el año 2004 con 1995, resulta superior la matrícula en 2004 con 162%. La maestría lo hizo en 136% y la especialización en 62%. En México, este crecimiento es producto de un conjunto de políticas que en los últimos años se siguieron mediante instrumentación del Programa Integral la de Fortalecimiento al Posgrado (PIFOP). Aunque los investigadores del SNI-Mx, Leyva S & Sandoval Barraza (2007), durante el periodo de 11 años estudiado, de 1996 a 2006, lo reportan como un período en el cual no se han logrado las metas, pues solo 13,368 doctores lograron graduarse, a ojos vista de los demás países latinoamericanos, esto es un avance significativo.

Se destaca sin embargo, en el informe del Consejo Nacional de Ciencia y Tecnología de México (CONACYT, 2003), el aumento de la productividad de los científicos mexicanos que se ha incrementado en forma considerable en lo que respecta a su contribución de artículos para los países de la OCDE (de 0,44 % a 0,77 %), y que a nivel de Latinoamérica sólo es superado por Brasil que tiene 1.42% del total de la producción científica mundial. Así también, el número de investigadores del Sistema Nacional de Investigadores mexicano ha experimentado en todo momento una tendencia creciente.

Tomando el indicador de investigadores por cada 1000 habitantes de la población económicamente activa PEA se podría año a año visualizar el impacto que tienen las políticas de incentivo a los investigadores de ALC. Actualmente, la situación es aproximadamente como lo demuestra la Tabla 2 y se infiere que Paraguay está muy lejos de la media del ALC 1,65 personas físicas o 0,84 en EJC; razón por la cual se espera que la implementación del Programa Nacional de Incentivo al Investigador del Paraguay sea un propulsor de este indicador.

Tabla 2 : Número de Investigadores en Equivalentes de Jornada Completa (EJC) entre los años 2007 y 2011, para Estados Unidos, América Latina y el Caribe e Iberoamérica

| País | 2007 | 2008 | 2009 | 2011 |
|-------------|------|------|------|------|
| Argentina | 2,41 | 2,57 | 2,67 | |
| Bolivia | | | 0,35 | |
| Brasil | 1,18 | 1,20 | 1,26 | |
| Canadá | 8,35 | 8,18 | | |
| Chile | 0,80 | 0,83 | | |
| Colombia | 0,41 | 0,41 | 0,34 | |
| Costa Rica | | 0,58 | 0,63 | |
| Cuba | | | | |
| Ecuador | 0,16 | 0,26 | | |
| El Salvador | | | | |
| España | 5,52 | 5,75 | 5,82 | |

La Importancia del Fortalecimiento de los Sistemas Nacionales de Investigadores en América Latina y el Caribe. Caso del Programa Nacional de Incentivo al Investigador del Paraguay (PRONII)

| Estados Unidos | 9,18 | | | |
|--------------------|------|------|------|------|
| Guatemala | 0,08 | 0,10 | 0,10 | |
| Honduras | | | | |
| México | 0,83 | 0,83 | 0,91 | |
| Nicaragua | | | | |
| Panamá | 0,33 | 0,25 | 0,27 | |
| Paraguay | | 0,16 | | 0,32 |
| Perú | | | | |
| Portugal | 5,02 | 7,18 | 7,73 | |
| Puerto Rico | | | 1,93 | |
| Trinidad y Tobago | | | | |
| Uruguay | | 0,72 | 1,09 | |
| Venezuela | 0,36 | 0,42 | 0,41 | |
| ALC | 0,78 | 0,80 | 0,84 | |
| Iberoamérica | 1,23 | 1,31 | 1,35 | |
| Fuente, DIOVE 0011 | | | | |

Fuente: RICYT, 2011.

a) Diagramando el Sistema Nacional de Investigadores del Paraguay

El relevamiento de indicadores que CONACYT realiza cada año, y desde el 2002, se percibe una importante brecha entre el dato de la cantidad de investigadores reportados en estos indicadores (804 personas) y los que se categorizan por primera vez en 2011, que alcanza a 238 personas. Esta última cifra se aproxima considerablemente a los primeros indicadores 2006), bibliométricos (Duarte Masi, donde se visualizaban de manera internacional а 149 investigadores de diversos sectores.

En la misma línea y considerando el trabajo de Galeano, Amarilla & Parra (2007) "Productividad científica del Paraguay en el área de biomedicina", que se enmarca dentro del área con mayor publicación científica del país, da cuenta la distancia que existe entre el Paraguay frente al resto de las naciones de la región. Este trabajo tuvo como premisa que para medir la producción científica de un país es necesario que se contabilice la cantidad y calidad de artículos científicos publicados por sus investigadores.

Entre los principales resultados de Galeano ME se encontró que el 67% (71/106) de los artículos hallados fueron publicados en los últimos 10 años (1996-2005), indicando el fortalecimiento de las ciencias biomédicas en este periodo. Las tres instituciones paraguayas con mayor número de publicaciones pertenecen a la Universidad Nacional de Asunción y son el Instituto de Investigaciones en Ciencias de la Salud (IICS), Facultad de Ciencias Médicas(FCM) y Facultad de Ciencias Químicas (FCQ) con el 39,6%, 16% y 15% de todas las publicaciones, respectivamente (Galeano, Amarilla & Parra, 2007). Estos datos significativamente coinciden con hallazgos bibliométricos de Duarte Masi (2006).

Esta tendencia, en la que el sector de la salud se percibe como el más desarrollado, se considera como un posible comportamiento para la inminente categorización de los 273 postulantes presentado para la convocatoria del Primer Programa Nacional de Incentivo a Investigadores del Paraguay (PRONII) en 2011.

La metodología utilizada para este trabajo partió de un análisis documental sobre las diversas experiencias de los Sistemas Nacional de Investigadores y sus mecanismos de incentivo, tomando en consideración muy especial a la propuesta mexicana, por ser la más antigua y luego la del Uruguay, por ser una de las más recientes y originado en un contexto muy semejante al paraguayo.

Para definir las cuatro categorías del PRONII (nivel de Candidato, Nivel I, II y III), en las que fueron posicionados los investigadores paraguayos, se elaboró un cuestionario que ha relevado los aspectos de la trayectoria, la producción científica de los postulantes, así como su formación y participación en actividades y redes para el desarrollo de la ciencia, con las siguientes preguntas para cada categoría que se presentan a continuación:

- i. Candidato a investigador
- ¿Participa en actividades de investigación (grupos de investigación, proyectos, congresos), poseyendo incipientes publicaciones o comunicaciones científicas?
- ¿Se encuentra cursando o ha culminado recientemente cursos de postgrado?
- ii. Investigador de NIVELI
- ¿Posee producción en un área determinada demostrando capacidad de desarrollarse científicamente de manera independiente?
- ¿Participa en el juzgamiento de trabajos científicos (artículos para revistas científicas, proyectos, comités editoriales de congresos)?
- iii. Investigador de NIVEL II:
- ¿Posee una producción científica significativa en un área determinada?
- ¿Se evidencia una línea definida de investigación en el tiempo?

- ¿Ha iniciado actividades de formación de investigadores?
- ¿Ha iniciado actividades de creación de capacidades institucionales para la investigación?

iv. Investigador de NIVEL III

- ¿Es reconocido en la comunidad científica nacional e internacional (premios, distinciones, honores en su área de conocimiento), siendo un activo referente en su área?
- ¿Trabaja o lidera redes con pares internacionales?
- ¿Dirige, coordina o es mentor de grupos de investigación con destacada formación de recursos humanos?
- ¿Posee una producción significativa en revistas de impacto, de libros o capítulos de libros científicos?
- ¿Ha creado capacidades institucionales para la investigación?

La metodología utilizada para la implantación y categorización del Sistema Nacional de Investigadores del Paraguay, fue la de "análisis de contenido" y evaluación de las hojas de vida de los investigadores que realizan sus trabajos en territorio paraguayo.

Para este efecto, se contó con la plataforma informática denominada CVPy (que significa *Curriculum Vitae* Paraguay), que es una plataforma cedida por la Agencia Nacional de Investigación e Innovación del Uruguay (ANII) y desarrollada en manera colaborativa mediante el convenio realizado entre el CONACYT de Paraguay y la institución mencionada. El software fue modificado y adaptado a las necesidades de los posibles usuarios del Paraguay.

La plataforma CVPy, en contenido se asemeja a las demás plataformas latinoamericanas, ya que es un estándar iniciado por el CNPq de Brasil, luego validado por la Red SCIENTI y asumida por los países que integran esta Red, incluido el Paraguay. Los datos que se almacenan en esta plataforma podrán luego ser utilizados para diversos estudios y análisis referentes a los investigadores del Paraguay.

Para el "análisis de contenido" y evaluación de las hojas de vida de los investigadores paraguayos, se conformaron primeramente tres órganos de evaluación, que los describe el Reglamento del Programa Nacional de Incentivo a los Investigadores, aprobado el 08 de marzo del 2011, y ellos son: la Comisión Científica Honoraria (CCH); el Comité de Selección (CS) y las Comisiones Técnicas de Área (CTAs), una para el área de las Ciencias Agrarias y Naturales, denominada CTA l; otra para el área de las Ingenierías, Tecnologías, Ciencias Exactas (Física, Matemáticas e Informática) y que se la denominó CTA II; la tercera, el CTA III, conformado para evaluar al área de las Ciencias de la Salud, más Química y Biología; y por último el área de las Ciencias Sociales y Humanidades, con el CTA IV. Estos tres órganos (la CCH, el CS y los CTAs), en la etapa de arranque y fundacional del PRONII, fueron conformados con 22 investigadores previamente categorizados por pares uruguayos e integrantes del Sistema Nacional de Investigadores del Uruguay.

El "análisis de contenido" y evaluación de las hojas de vida de los investigadores paraguayos se realiza en tres etapas: 1) la primera, a cargo de las CTAs, que en primera instancia y de manera sectorial analizan la trayectoria y producción científica de cada postulante a investigador, para emitir una "propuesta de categorización" al Comité de Selección (CS); 2) el Comité de Selección analiza la propuesta recibida de los CTAs, con una visión holística e integradora. pudiendo aceptarla o rechazarla. Si la propuesta es aceptada, el CS eleva la misma a la CCH o bien, remite nuevamente a instancia de los CTAs, con las recomendaciones respectivas; 3) finalmente quienes aprueban las categorizaciones son los miembros de la CCH, para solicitar su homologación al Consejo del CONACYT.

Cabe señalar, que para esta etapa fundacional y de arranque del PRONII, se ha contado con la participación presencial de los pares evaluadores del Sistema Nacional de Investigadores del Uruguay, a manera de guiar y validar los procesos sucedidos entre el 28 de Setiembre y el 19 de Octubre de 2011, fecha en la que se establece finalmente el ranking y categorización de los postulados al Sistema Nacional de Investigadores del Paraguay.

Los resultados del proceso de evaluación de cada postulación, considerando las preguntas presentadas en el apartado de metodología, fue la categorización de 250 postulantes: 133 en la posición de "candidatos a investigador" y 117 en alguna de las posiciones establecidas para los Niveles I, II, y III. Todos estos datos se reúnen en la Tabla 3.

Tabla 3 : Desglose de postulaciones para el PRONII (2011)

| Total presentados para integrar el SNI | 273 | |
|---|-----|----------------|
| Nivel I | 89 | |
| Nivel II | 26 | |
| Nivel III | 13 | |
| Candidatos | 110 | |
| Total categorizados | 238 | investigadores |
| | | |

Fuente: CONACYT- Paraguay, 2011

Lo mismo mostrado en la Tabla 3 se presenta en la figura 11, y en la que ya se establecen porcentajes: 50 % representan los "candidatos a investigador"; 44 % los categorizados como "investigadores" y el 5 % aún no presentan méritos suficientes para ser categorizados. La Importancia del Fortalecimiento de los Sistemas Nacionales de Investigadores en América Latina y el Caribe. Caso del Programa Nacional de Incentivo al Investigador del Paraguay (PRONII)



Figura 11 : Distribución porcentual de integrantes del Sistema Nacional de Investigadores del Paraguay. Convocatoria PRONII 2011. *Fuente: CONACYT- Paraguay, 2011*

Si a estos 250 categorizados y clasificados, los graficamos como pirámide, se puede establecer por primera vez, la "Pirámide de Investigadores del SIN de Paraguay", conformada para la convocatoria del PRONII, año 2011 y que se muestra en la Figura 12:



Figura 12 : Pirámide del SNI del Paraguay – PRONII 2011. Fuente: CONACYT- Paraguay, 2011

III. Conclusiones

En general todos los Sistemas de Incentivo – algunos institucionales y otros nacionales - instalados en el ámbito de los Sistema Nacionales de Investigadores (México, Brasil, Chile, Argentina, Colombia, Uruguay, Venezuela) han tenido una favorable repercusión para el fortalecimiento de la investigación científica (Parra, 2001), facilitando al investigador la obtención de financiamiento para su trabajo, al definir un perfil del investigador y afianzar la carrera del mismo, y que al final, los Programas de Incentivo dan más reconocimiento al investigador que la institución a la cual está adscrito.

El impacto del PRONII tal vez pueda medirse en unos diez (10) años de funcionamiento, tal como lo reporta el Sistema Nacional de Investigadores del CONACYT de México. Ahora bien, la masiva concurrencia deja entrever el interés que tiene la comunidad científica en demostrar su producción y establecerse como investigador, así como la credibilidad que otorga al CONACYT. La diferencia del investigadores reportados número de en los indicadores desde el 2001 al 2009 (804 investigadores), en CONACYT (2010), respectos de los ahora

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categorizados (238); y de estos, los 128 rankeados en los 3 niveles principales, demuestran la coherencia de la primera medición bibliométrica del 2006, donde apenas se hallaban visibles a 149 investigadores, de los cuales aproximadamente 30 se llevaban la mayor parte de la producción científica y que justamente coincide con los 36 investigadores ubicados entre los Niveles II y III de la actual evaluación (PRONII, 2011).

Se cumple la tendencia esperada, en la que la mayor cantidad de investigadores pertenecen al sector de ciencias agrarias y ciencias naturales (92); le sigue el sector de salud, biología, química (80); luego el de las ciencias sociales y humanidades (38), y por último el de las ingenierías y tecnologías, matemáticas y física (28) con investigadores.

Los comentarios por parte de los integrantes de los órganos de evaluación y de los beneficiarios, han sido cuanto sigue:

La Plataforma CVPy permitirá, ha permitido y obligará el ordenamiento de la información por parte de los investigadores para participar de esta y subsiguientes convocatorias.

Que el PRONII contribuirá al fortalecimiento de los postgrados, dando validez e importancia a la actividad de tutoría y acompañamiento de tesis de maestría y doctorado.

Se obligará a los candidatos a investigador e investigadores pertenecientes actualmente al Nivel I a focalizar sus acciones para seguir progresando en esta "carrera del investigador" que ahora se inicia.

Se potenciará el surgimiento de nuevos postgrados (maestrías y doctorados) para que más postulantes y candidatos fortalezcan su formación en investigación.

Muchos de los investigadores residentes en el Paraguay no han completado o han subestimado este primer proceso de establecimiento del PRONII, pero que en breve, y para sub-siguientes convocatorias se acercarán a este emprendimiento.

Que el incentivo permitirá a que científicos paraguayos que están en el extranjero tengan interés en volver a Paraguay para continuar con sus investigaciones, sean iniciados, sean ya posicionados.

Los niveles establecidos por el PRONII no responden a ninguna teoría, tienen que ver con el avance, desarrollo personal y aporte que el científico paraguayo ha brindado y brinda a la ciencia y a su contexto. Para comprender mejor esta categorización, se debe considerar que para posicionarse en el Nivel I, el candidato debía haber definido e iniciado su línea de investigación; además demostrar solvencia y formación para lograr su independencia y por supuesto, tener una producción científica incipiente.

Para el Nivel II, el investigador debería tener fortalecida su línea de investigación en el tiempo y además estar formando recursos humanos para la investigación, haber iniciado actividades para fortalecer capacidades institucionales y participar activamente en el juzgamiento de actividades científicas; y para acceder al Nivel III, el investigador, aparte de su producción científica significativa y de los demás atributos de los niveles anteriores, deberá ser referente en su tema; demostrar su gran capacidad de mentor y formador de investigadores; establecer redes nacionales e internacionales y haber recibido premiaciones. Todas estas consideraciones se plasman en el set de preguntas que se presentan en el apartado dedicado a la metodología.

Para terminar, y en la línea de los demás países que han aportado al fortalecimiento de sus Sistemas Nacional de Investigadores, los esfuerzos no son pocos, pero aún insuficientes. Se debe lograr que estos esfuerzos sean sustentables y analizar profundamente el rol de patronazgo del estado, como ya lo habían mencionado Schot y Rip en 1997.

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Benjamin Franklin Fitch the Forgotten Developer of the Container System in US of America

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Abstract- The objective of this paper is to present the works of Benjamin Franklin Fitch, the author of the concept of containers in US of America before the Second World War, together with a brief biographical note.

Keywords: containerization, developer, USA.

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BENJAMINFRANKLINFITCHTHEFORGOTTENDEVELOPEROFTHECONTAINERSYSTEMINUSOFAMERICA

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Benjamin Franklin Fitch the Forgotten Developer of the Container System in US of America

Krzysztof Lewandowski

Abstract- The objective of this paper is to present the works of Benjamin Franklin Fitch, the author of the concept of containers in US of America before the Second World War, together with a brief biographical note.

Keywords: containerization, developer, USA.

I. INTRODUCTION

Ontrary to the assertions of contemporary literature in the field of containerization, it should be noted that USA can boast of container production before World War II. In many articles is suggestion that first developer of the container transport systems in USA was Malcolm Mclean in 1956. Research revealed evidences that the development of such structures in USA has been already in 1917. The author of this paper is Benjamin Franklin Fitch, who isn't mentioned in present in the contemporary technical literature in USA.

II. EDUCATION AND EXPERIENCE

Benjamin Franklin Fitch (BFF) was born in Louisville, KY) on day March 2, 1877. In this city he was educated 1895-1908. Later (1908-12), he worked as wholesale hardware bus and then (1912-14) he was vice-president and general manager of axe and tool manufactory plant, In 1914 he started experience as travel sales manager for motor truck Industry [26].

a) The equipment invented by Benjamin Franklin Fitch for shipping containers

On 17 May 1917 he inaugurated exploitation of the experimental installation for transfer of the demountable bodies (Figure 2) based on his own design in Cincinnati city, Ohio (Figure 1) [4]. This installation consisted of one 5-ton White motor truck chassis, nine removable truck bodies with a capacity of 5 tons each, 12 sets of lifting chain hoists and five overhead superstructures [12]. In 1919 BFF has been ordered for extended by the United States Railroad Administration to complete co-ordination of Cincinnati railroad terminals for relief of congestion during the war period [4]. In 19 May 1919 Fitch System was extended. 21 railway stations were served by 14 freight trucks with 225 containers. Results help save 15 cent per each reloaded ton [24]. This kind of the terminal was also proposed to build in New York City. Estimated cost and economic profits can help to save \$45,000,000 in freight costs yearly [2].

In 1920 BFF described in Engineer World newspaper an idea of the motorized terminal (Figure 3a, b and Figure 4) [3]. His motorized terminal was designed to transfer freight between terminals of different transport modes railroad and roads many kinds of "traps", "transfer" or "ferry" cars by the horizontal shifting [17].

Based on his conception of was established a short range container connection between Cincinnati and Aurora on distance 30 miles. This transport system was established in January 10, 1922 (Figure 5, Figure 6). There were used 5 tons containers with 17 ft. 6 in. long, 8 ft. wide and 7 ft. 3 1/2 in dimensions [13].

This similar system of containers were later used by the Cincinnati and Lake Erie Railroad. BFF patronized build cranes to handling containers at terminals in Cincinnati, Dayton and Toledo, with fleet of trucks for carrying the containers into Michigan and Kentucky [12][25].

From 1929 BFF was the President of the Motor Terminals Company, New York City, an engineering and financing organization, and also was the President of The Cincinnati Motor Terminals Company, the operating medium of all railroads at Cincinnati, Ohio [4]. In April of 1929 in Washington three railroads companies spoke about provides for container transport [16]. In 1930 the Cincinnati Motor Terminals Company had 150 containers with capacity 10 tons [17].

In Thursday, October 24, 1929 has been the Wall Street Crash of 1929, which caused economic collapse and reduction in all modes of transport in the whole world (Figure7, Figure 8). Railroads was sought a possibility to find a cargo, and container was a big chance. Government of USA decided to do public work and start built a network of highways similarly as European countries Germany and Italy [9][10]. The Cincinnati, Lawrenceburg and Aurora that's transport system collapsed in 1930 but in the Cincinnati and Lake Erie it followed into oblivion in 1939 [12][25].

Fitch continued on, developing a container system. He designed the biggest and heaviest containers in this time in the whole world.

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Fig. 1 : Sketch of freight truck with container from BFF patent, 1924 [23]



Fig. 2 : Freight truck with BFF container, 1917 [12]



Fig. 3a,b : Sketches of the warehouse with transfer station for containers, from BFF patent 1918 [18]



Fig. 4: Sketch of motorized terminal of Benjamin Franklin Fitch, 1920 [27]



Fig. 5 : Sketch of gantry crane for container terminal from BFF patent, 1922 [22]



Fig. 6 : View of part the Fitch System between Cincinnati and Aurora, 1922 [15]



Fig. 7 : Seaships without cargo [5]



Fig. 8 : Rail wagons without cargo [6]

As first, in 1929-30, the Fitch System were used by Cincinnati & Lake Erie, between Cincinnati, Dayton, Toledo, Cleveland and Detroit. For this were designed 30 all-steel 15-ton containers. Later, in 1931, the Fitch System has been applied on the Pennsylvania Railroad. In 1931 he established container transport system based on construction of 40 all steel construction big containers with seizes (17'6" X 8'0" X 8'0', Capacity: 30,000 pounds — 890 cubic feet) for the Pennsylvania Railroad between New York, Philadelphia, Baltimore and Richmond, similarly to use on the Lake Shore Electric, the Eastern Michigan Lines and the Cincinnati and Lake Erie Railroad earlier. Also in 1931 another kind of 28 all steel construction big containers with seizes (20'0" X 8'0" X 8'0", Capacity: 50,000 pounds — 1,000 cubic feet.) were used by Pennsylvania Railroad which carried them between New York, Philadelphia, Baltimore and Richmond, Va. (Figure 9) These railroads companies also have used 2 other kinds container in total number of 10 summary. The Pennsylvania Railroad used similarly aluminum containers type TD and TD1. 51 Containers TD has the same weight as Fitch containers, but have different sizes (19'0" X 7'0" X 7'4", capacity 30,000 pounds - 795 cubic feet) (Figure 10) [17].

The distances of transport of the containers The Fitch Systems were: from Cincinnati on the Ohio River through Dayton and Toledo to Detroit on the Great Lakes, and through Columbus to Cleveland, on Lake Erie, distances was of about 250 miles; and from the New York City metropolitan district through Philadelphia, Baltimore and Washington to Richmond, was nearly 300 miles [1].

In November 1932 in Enola PRR opened first rail container terminal in the world (Figure 11) [18]. This terminal used for reloading containers two overhead cranes with an automatic lifting coupler quite present spreader called in this time as spreaders [17].

For handling containers in Enola terminal was used two overhead cranes with spreaders. Interesting is that hooking has been taken from Fitch solution but was adopted for PRR container. Originally Fitch container had the hooks on the bodies for engagement to the spreader are spaced longitudinally at 12 ft., which is in uniformity with Fitch bodies, and though only 7 ft. wide, permit overhead handling by the same spreader used to handle the Fitch bodies, by applying lifting links with double eyes spaced at 7 ft. and 8 ft. respectively [17].



Fig. 9 : The 20 feet full steel container of Benjamin Franklin Fitch, 1931 [17]



Fig. 10 : The 19 feet aluminum container The Pennsylvania Railroad, 1931 [17]

In 1935 family of Malcolm McLean bought for him first secondhand freight truck for 120\$ [29].

Structure of Enola terminal is very similarly to conception of BFF from patent from 1924. In Enola container terminal we see two cranes with hooking systems - early construction of spreaders (Figure 11).

In patent of BFF the crane is astride the railway sidings with a narrow maneuvering yard. (Figure 12).

Before the forklift trucks and reach stackers was created the cranes, gantry or overhead, were the basics equipment for reloading containers in container terminals.



Figure 11 : Enola rail container terminal, opened by Pennsylvania Railroad in November 1932 [8]



Fig. 12 : Sketch of container terminal by Benjamin Franklin Fitch patent, 1924 [7]

In 1935 the Cincinnati Motor Terminals Company, employed 21 five-ton motor trucks, had 250containers, and 66 electric cranes, and 13 sets of hand hoists [17].

In 1939 Benjamin Franklin Fitch (BFF) has designed new transfer system for big containers. The body of 25 ton milk container moved on cross channels on the trailer frame and on the floor of the flatcar. Upright stops or anchorages on the car at the sides of the body then prevented lateral displacement. With the trailer driven closed alongside the rail car, the body, which has a gross weight with load of 25 tons, was pushed from trailer to car by means of a push-pull bar and two cross chains that moved in channels on the trailer. These chains had lugs that engage with stops under the body and are driven by a longitudinal shaft and gears on the trailer (Figure 13). In this year BFF had over 20 years' experience and over 160 patents covering equipment developed for use in the container system [1].



Fig. 13: View of new reloading system of by Benjamin Franklin Fitch, 1939 [13]

To 1947 Benjamin Franklin Fitch (BFF) was president and camembert of Motor Terminals, Inc. also he was president of the Natl. Fitch Corp. and Term. Motor-Rail Corp., New York. Member of the N. Y. Railroad Club. N. Y. He was author of numerous articles In technology and trade publications on coordinated transport Episcopalian. Independent. Club»: Kentuckians, Metropolitan (New York); N. Y. Southern Soc.; Pendennis (Louisville. Ky.) with Home address: Ocean Lawn, Newport, R. I. [26].

In 26 April 1956 Malcolm McLean's Ideal -X ship carried fifty-eight trailer vans from Port Newark, NJ, to Huston, TX, as the new concept in shipping [28].

Benjamin Franklin Fitch dead May 2 1956 in New York City. After his death newspaper The New York Times mentioned about him as an inventor of equipment for shipping and handling freight. His age was 79 [11].

In report from 1958 were noticed that BFF also developed two big size containers. First type with sizes: 22'9 $\frac{3}{4}$ "*8', with internal diameter 5'4", with capacity 3000 gallons, i.e. liters, made from stainless steel wit stains doors. Second type with sizes 16'4"*8', with capacity 2500 gallons, i.e. liters, with 18 numbers in use [19].

III. DISCUSSION

When we compare the whole life activity of Benjamin Franklin Fitch with the Malcolm Mclean' we see a the big influence of the outsides factors for their activity.

Benjamin Franklin Fitch wasn't a first who had used containers in USA. The first transport of containers through the Atlantic Ocean were in 1902. It was linked the Great Emigration from Europe to USA at the end of XIX and beginning the XX century [10]. Benjamin Franklin Fitch started his work with container system in time of First World War, called in this time as Great War. After this event in many countries were the economic depressions, 1921-1922. In Europe this evoked creation a fascism, first in Italy. In US in this time the railways companies had a big problems with the robbers. That was source to wide exploitation of the containers by railways companies in USA, but that is subject for the another analysis. Second economic depression is known as Dig Depression in 1929. It had strongly influence for economy in whole world. The USA in this time didn't the big influence for world policy. In USA this event was source for a big competition between modes of transport, road and railways. Many countries in Europe did the protectionist of their country economy that was source of trade wars also with USA which stopped the free trade across Atlantic Ocean. Only things of emigrants were free without restrictions for transport in sea containers called in this time as the liftvans [5][6].

Different prices of own activity from these two modes of transport changed the social point of view about economy in USA. Road transport had seemed as the cheaper and faster. This changed a policy of the technicians. They concentrated on road transport. Another case to this change was developing of the highways' system on territory of USA. It changed availability of the territory of USA. Before the Second World War, the US Government didn't promoted the use of container system in the country and the world. In the time of Second World War the road transport stayed game ruler of the modes of the land transport.

Malcolm McLean started this activity in 1934 when economy of USA was growth. He also used as first freight truck on roads, but without containers. His patent was created after World War II, when European countries and Japan are still rebuilding for 10 years and Korea after the Korean War ended needed of everything and a lot of companies shipping cargo transported them [19]. It was filed in US Patent Office in 1954 and patented in 1958. Malcolm McLean was an author only the one patent.

Benjamin Franklin Fitch had over 100 patents in the year of his death, 1956.

After the Second World War USA stayed w big ruler in world policy. The big policy tensions in 1950' and 1960' changed conditions for the development of loading units in transport. The container system of Malcolm Mclean's has been established on 1960' as fundamental technical system for support system of the USA Army [9].



Fig. 14 : Benjamin Franklin Fitch [4]

IV. Conclusion

The Forgotten Developer of the Container System in US of America, inventor of many equipment's for reloading of containers - Benjamin Franklin Fitch, (Figure 14),

b. March 2, 1877 (Louisville, KY) – d. May 2, 1956 (New York City, NY), worked in harder conditions than Malcolm McLean.

His wide experience and knowledge was fundamental for developing the container system in USA before the Second World War.

The name of Benjamin Franklin Fitch should be entered in books on containerization in USA in order to organize knowledge about the development of this process before the Second World War.

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Vinculando La Investigación Con La Sociedad a Través de Los *Living Labs.* Una Experiencia Paraguaya

By Sergio Duarte Masi, Antonieta Rojas De Arias, Diego Dorigo, Francisco Arias Rojas, María Celeste Vega & Miriam Rolon

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Resumen- El modelo de los Laboratorios Ciudadanos o Vivientes, concentran su esfuerzo por apoyar a los actores, ofreciendo un espacio neutral en el que los interesados puedan conocer y co-desarrollar innovaciones en contextos del mundo real. Para ello, autores como Etzkowitz (2003) e Irizar y MacLeod (2008) mencionan la concurrencia de la triple hélice: la administración, el sector universitario y la empresa. Esta experiencia que se presenta a continuación se basa en la vinculación de cuatro sectores y que constituye un cambio de modelo en los sistemas de innovación (Arnkil et al, 2010, Kaivo-oja, 2011 y Serra 2013), en los que interviene, además de los tres sectores anteriormente citados, la comunidad.

El objetivo del este artículo es mostrar, una experiencia de vinculación y de gestión de proyectos a partir de los interesados reales, siguiendo las orientaciones del nuevo modelo de la cuádruple hélice, considerando al Centro de Desarrollo para la Investigación Científica CEDIC como núcleo propiciador de esta experiencia.

Palabras clave: innovación abierta, transferencia tecnológica, laboratorios ciudadanos.

GJHSS-H Classification: FOR Code: 169999

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Vinculando La Investigación Con La Sociedad a Través de Los *Living Labs.* Una Experiencia Paraguaya

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Resumen- El modelo de los Laboratorios Ciudadanos o Vivientes, concentran su esfuerzo por apoyar a los actores, ofreciendo un espacio neutral en el que los interesados puedan conocer y co-desarrollar innovaciones en contextos del mundo real. Para ello, autores como Etzkowitz (2003) e Irizar y MacLeod (2008) mencionan la concurrencia de la triple hélice: la administración, el sector universitario y la empresa. Esta experiencia que se presenta a continuación se basa en la vinculación de cuatro sectores y que constituye un cambio de modelo en los sistemas de innovación (Arnkil et al, 2010, Kaivo-oja, 2011 y Serra 2013), en los que interviene, además de los tres sectores anteriormente citados, la comunidad.

El objetivo del este artículo es mostrar, una experiencia de vinculación y de gestión de proyectos a partir de los interesados reales, siguiendo las orientaciones del nuevo modelo de la cuádruple hélice, considerando al Centro de Desarrollo para la Investigación Científica CEDIC como núcleo propiciador de esta experiencia.

Palabras clave: innovación abierta, transferencia tecnológica, laboratorios ciudadanos.

I. INTRODUCCIÓN

I conocimiento juega un papel significativo en las actividades de todo ser humano, tal que el mismo se ha constituido en el recurso que permite mayores niveles de agregación de valor en la producción de bienes y servicios, la inserción sostenible de las economías emergentes en la aldea global y la mejora de las condiciones de vida de los individuos (Ordoñez, 2002).

En ese escenario sistémico (Arias Pérez y Aristizábal Botero, 2011), la universidad es el segmento social que lidera la generación de conocimiento, al cual además de asignársele la responsabilidad de la docencia y la investigación, le demanda soluciones a sus problemas. Por ende, la vinculación y transferencia de conocimiento a la sociedad, al sector productivo y al Estado constituye uno de los grandes desafíos de la organización académica.

Por tanto, en la mayoría de los foros sobre investigación, un tema central siempre es la transferencia de resultados con un especial énfasis hacia la acción y de la importancia de integrar a los investigadores a las necesidades reales de la población. Este reclamo social, para que se haga investigación que repercuta en la solución de problemas relacionados directamente con la sociedad y que funcione en un mundo real ha cambiado el paradigma original de conducir únicamente investigación básica, para muchos denominada de excelencia (en la búsqueda de la verdad) por el de además de excelencia- incorpore "la pertinencia" (Macías-Chapula, 2013).

El cambio, continúa Macías-Chapula (2013), implica vincular de una manera más estrecha la investigación con las necesidades pertinentes de la población y la sociedad en general (salud, educación, vivienda, infraestructura, etc). Queda claro que en ese proceso la información y el conocimiento que derivan de la investigación científica se deben transferir a todos los actores que participan en un sistema o contexto determinado. De hecho, los problemas vinculados con dicha transferencia se han convertido en un nuevo foco de interés del sistema académico, y es más, ha generado estructuras de interface en las universidades -con diversas nomenclaturas- cuya misión es la de transferir dichos resultados, pero históricamente más volcados a hacerlo hacia los sectores productivos y empresariales. En este sentido, cabe plantearse como viabilizar la transferencia de conocimientos y que dichos conocimientos permitan alternativas de solución a los problemas de la sociedad en países menos favorecidos?.

Una de estas estructuras de interface y que se han posicionado como novedades dentro de la innovación e integración social son los Living Labs o Laboratorios Ciudadanos, como lo menciona Ståhlbröst (2012).

Un Living Lab, es un modelo en donde todos los actores envueltos activamente en un proceso de innovación, ya sea el Estado, una sociedad civil, una organización social, la academia y los investigadores, etc, interactúan en la forma de un laboratorio de Innovaciones, ya sea co-creando y/o validando las necesidades y soluciones que allí se presentan mediante el uso de las Tecnologías de la Información y

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Comunicaciones (TIC) como el medio para ello. En este sentido, Ståhlbröst (2012) hace mención de cómo los Living Labs han comenzado a crecer rápidamente por toda Europa. Esto se complementa con la posición de Katzy, Baltes y Gard (2012), en la cual los Living Labs son espacios que además pueden reducir los riesgos en la inversión del desarrollo de nuevos productos, ya que trabaja como "intermediarios" en la aceptación de lo nuevo por parte de los usuarios y clientes.

Lo que se busca en definitiva es generar un lugar donde puedan encontrarse tanto usuario (o consumidor final) y los investigadores en la búsqueda de estas soluciones. Lo más encomiable de este método, es la obtención de resultados con aplicación inmediata, puesto que metodológicamente a través de esta experimentación se obtiene datos provenientes del mundo real, o sea de los usuarios y ciudadanos y no de proyecciones teóricas obtenidas solo del papel. En este sentido, *entre más intervención de los ciudadanos exista en los distintos procesos de innovación, más participativos y colaborativos resultarán estos*.

Trabajar con ciudadanos (Galaso, 2013) es un reto de las administraciones públicas que se ha convertido en los últimos años en igual objetivo para el tejido empresarial. Bien sea por buscar técnicas de mercadotecnia (como puede ser el *focus group*), o bien sea por buscar estrategias de innovación como pueden ser el *Lead-User Innovation* y alguna más enfocada a grupos concretos como *Open Innovation*, lo cierto es que los ciudadanos (en formato usuario, trabajador, miembro de una asociación) están entrando en los circuitos de innovación de las empresas y también quieren tomar un papel activo en la vida social de su comunidad (llamamos a esto el empoderamiento ciudadano).

Desde su paradigma de buscar el co-diseño y la co-creación con las partes implicadas, los *Living Labs* encajan en el modelo de la cuádruple hélice (Arnkil et al, 2010, Kaivo-oja, 2011 y Serra 2013) y permiten a todos los implicados encontrar tanto un lugar de encuentro para desarrollar este tipo de actividades como las herramientas para aprender a crear estos ecosistemas de innovación, a los que aportan cuatro componentes y como se muestra en la Figura No 1:

- La administración pública como parte interesada en mantener un modelo de innovación que permita el crecimiento y el desarrollo económico del territorio, al mismo tiempo que se acerca a la sociedad al empoderarla.
- Las universidades y los centros de generación de conocimiento (fundaciones, institutos, plataformas de transferencia tecnológica) que pueden aportar conocimientos para buscar nuevos usos y funcionalidades, al mismo tiempo que los ponen en valor.

- Las empresas privadas que pueden manejar modelos de innovación exógenos que busquen nuevos mercados o nuevas líneas de negocio.
- Los ciudadanos que tiene inquietudes personales y laborales que pueden ser satisfechas desarrollando proyectos de innovación cercanos a ellas.



Figura No. 1 : Modelo de la Cuádruple Hélice (Serra, 2013:284)

Un punto clave y recurrente es la sostenibilidad y ella debe ser propiciada, es decir, que el Living Labs debe tener un sustento económico y un modelo de gestión apropiado para delinear un presupuesto viable con las condiciones sociales que presenta el país, donde el Estado debiese asumir un rol preponderante y comprometido con proyectos de esta envergadura (Proenza, Bastidas y Montero, 2011).



Figura No. 2 : Proceso de Transferencia de Conocimiento (Arias Pérez y Aristizábal Botero, 2011:145)

Yendo al modelo de transferencia que se muestra en la Figura No 2, el conocimiento científico y tecnológico constituyen las salidas del proceso de investigación y desarrollo experimental (I+D), el cual diversas forma: publicaciones. toma procesos. tecnología. know-how. innovación y materiales. habilidades (Libraryhouse, 2008), y que configuran las entradas del proceso de transferencia compuesto de una serie de actividades o mecanismos por los cuales éste llega al Estado, a la industria o a las comunidades, generando el cambio esperado.

Introduciendo más en un contexto específico, es importante indicar que Paraguay tiene un crecimiento desigual entorno a la población, puesto que ésta aumenta pero el crecimiento económico se mantiene estanco. A pesar de ello, el país también se está impulsando e invirtiendo cada vez más en Ciencia y Tecnología. Muestra de ello es el reciente Programa Nacional de Incentivo a los Investigadores (PRONII), implantado en 2011 y que categoriza a los primeros 238 científicos del Paraguay, otorgándoles un "premio financiero", para que continúen haciendo ciencia y produciendo conocimiento (CONACYT, 2012). Esto es siguiendo la línea de Rutherford (2003) que argumenta que se debe incentivar a la comunidad científica para que haga más por incrementar y mejorar las oportunidades disponibles para que las personas participen en el mundo de la ciencia.

Ahora bien, ¿Cómo vinculamos y transferimos todo este conocimiento generado y que se seguirá generando, para la solución de las necesidades de la población, dentro de un modelo de innovación abierta?

La posible respuesta a esta pregunta son los Living Labs, adaptados al contexto paraguayo, pues originariamente éstos se basan en las TICs, y en el caso particular del Paraguay, su foco será la misma social –es decir. el trabaio problemática con vulnerables"-y la fortaleza "ciudadanos es la interdisciplinariedad, siguiendo al autor Stichweh (2001 y 2003), que manifiesta la tendencia actual desde la diferenciación interna en teorías en las disciplinas científicas hacia la inter-disciplinariedad y finalmente hacia la trans-disciplinaridad.

Como problemática social y ciudadanos vulnerables se sitúa a las familias indígenas del Paraguay que un alto grado presentan de vulnerabilidad, y que de no tener solución, esto traerá consecuencia el incremento de dicha como vulnerabilidad, siguiendo la línea de, que es justamente como se presenta en el país la situación: de "vulnerabilidad progresiva" (Pérez, 2005).

II. Metodología

El objetivo del este artículo es mostrar una experiencia de vinculación y de gestión de proyectos a partir de los interesados reales, siguiendo las orientaciones del nuevo modelo de la cuádruple hélice, considerando al Centro de Desarrollo para la Investigación Científica CEDIC como núcleo propiciador de esta experiencia.

El caso del CEDIC y el proyecto "Abordaje participativo con enfoque étnico para el Desarrollo Comunitario de la etnia *Maskoy* Diez Leguas en el Chaco Central Paraguayo". A continuación, se presenta paso a paso la metodología propuesta:

a) Paso1- Descripción de los stakeholders y la percepción del problema

La etnia indígena "los Maskoy", que habita el territorio paraguayo, son grandes conocedores de plantas medicinales, pero las condiciones de sequía extrema y la falta de agua, no les permiten cultivar alimentos ni estimular la producción de plantas medicinales, actualmente en extinción. Se encuentran confinados en sus tierras, rodeados de agricultura mecanizada, por lo que la conservación de su bosque original es perentoria (Rojas de Arias, 2003 y 2007).

La etnia *Maskoy*, autodenominados *Angaité* y guaraní hablantes, viven en su gran mayoría en la total indigencia y dependen casi exclusivamente de la ayuda del estado o de las ONGs para su sobrevivencia. Los *Maskoy* llegaron a estas tierras hace 27 años, como consecuencia de una donación de 4.090 hectáreas de la empresa taninera de Casado, quien los trasladó a estos lugares desde Puerto Casado en Alto Paraguay. Son grupos originalmente cazadores y recolectores, por lo que la transitoriedad de sus viviendas y la escasa o casi nula producción de alimentos caracterizan sus asentamientos, actualmente en situación de hambruna.

El analfabetismo y la falta de un oficio específico ocasionan la falta de producción económica para las familias, acarreando los problemas de desnutrición severa, falta de producción de alimentos familiares y malas condiciones sanitarias. El alimento es la principal necesidad, no poseen huertas y muy pocos producen algún cultivo para autoconsumo. El área es una zona endémica para la enfermedad de Chagas y los niveles históricos de infestación de las viviendas. Actualmente la infestación es baja, pero al no mantener un sistema de vigilancia vectorial la re-infestación de las mismas es inminente (Rolón, Vega, Román, Gómez, y Rojas de Arias, 2007).

b) Paso 2- La vinculación con los stakeholders y el abordaje participativo para la profundización del problema

La vinculación con las familias indígenas pertenecientes a la comunidad de Diez Leguas se realiza a partir de Programa Nacional de Chagas del Ministerio de Salud Pública y Bienestar Social, que éste instala un sistema de vigilancia entomológica para evitar la re-infestaciones tempranas en las viviendas de estos pobladores.

Así se realizan talleres comunitarios con enfoque étnico y participativo para alcanzar los objetivos deseados: el mejoramiento y ordenamiento de la vivienda indígena. En los mismos también se recaban otras necesidades y problemas tales como: la falta de acceso a los servicios existentes (agua y alimentos seguros), el desempleo y sub-empleo, se confirma la falta de oficio y formación, la desnutrición provocada por el desmantelamiento del sistema de producción de alimentos y la destrucción de los medios de supervivencia, entre otros.

- c) Paso 3– Elaboración de la propuesta (proyecto) y participación de la comunidad investigativa – la cuádruple hélice
 - i. Los usuarios/ciudadanos, como centro y foco: la etnia *Maskoy*, desde la cual se relevan las necesidades, se validan los problemas a partir de talleres participativos
 - ii. Los investigadores/academia, como generadores del conocimiento y la solución: El CEDIC, centro sin fines de lucro, con 8 investigadores de diversas áreas de la ciencia: área de la salud (epidemiología, eco-epidemiología molecular); área de ingenierías y tecnologías (ingeniería civil, ambiental, agronómica y química); área social (ecología humana, antropología, innovación empresarial y social). Carrera de Diseño Gráfico de la Universidad Americana.
- iii. La empresa/financiación: La Empresa Temha que transferirá el nuevo conocimiento y convertido en tecnología apropiada con la construcción de filtros cerámicos y Sistema de Riego Yambui; La Fundación Sanofi-Aventis, con el financiamiento.
- iv. El gobierno/municipio, como facilitadores y cooperadores: El Ministerio de Salud Pública y Bienestar Social, con su programa Nacional de Chagas; la Municipalidad de Teniente Irala Fernández, con el aprovisionamiento de materiales e insumos para la construcción y medios para la movilización.

Esta conformación y vinculación de los cuatro sectores, posicionan al CEDIC como un Living-Labs, para el tratamiento y solución de un problema real, a partir de los ciudadanos/usuarios.

d) Paso 4- La investigación-acción

El proyecto propone la capacitación a grupos de mujeres y hombres de las aldeas en la construcción de viviendas por autogestión, así como utilizar la tecnología básica para el acopio de agua y para producción de alimentos básicos.

Para el modelo de vivienda de autogestión la comunidad será adiestrada con técnicas de construcción de bloques suelo cemento y en el proceso de construcción a cargo de los investigadores, que transferirán la técnica de construcción, la evaluación de los acabados. Simultáneamente se abrirá una línea de investigación con la academia sobre aditivos que puedan reemplazar al cemento con el fin de usar bloques ecológicos en la construcción y abaratar costos.

Para las *huertas orgánicas de alimentos de autoconsumo*, se transferirá una tecnología apropiada para el riego, llamado "sistema de riego Yambui" y la

implantación de filtros cerámicos bacteriológicos para el consumo de agua segura.

Para utilizar a la escuela como puerta de entrada de la educación para la salud, y difundir el aporte del diseño gráfico a problemáticas sociales y acercar la academia a los potenciales inversores y la sociedad, el CEDIC y la Escuela de Diseño Gráfico de la Universidad Americana iniciarán un emprendimiento en la creación de una serie de materiales educativos relativos a la enfermedad de Chagas, con el propósito de iniciar la educación para la salud en el periodo primario sobre una de las enfermedades más prevalentes del área.

III. Resultados

A continuación se presentan los resultados logrados a partir de la investigación-acción realizada en el marco del proyecto desarrollado por el CEDIC y los involucrados e instituciones y que tuvo la denominación: "Abordaje participativo con enfoque étnico para el Desarrollo Comunitario de la etnia Maskoy 10 Leguas en el Chaco Central Paraguayo".

a) Del acopio de agua y huertas orgánicas para producción de alimentos básicos

Para viabilizar el acopio del agua de lluvia, se implementaron los techos de zinc con canaletas que recogen el agua en tanques. Esta fue la opción escogida por la comunidad, no obstante se están experimentando otras modalidades como carpas de acopio y el acceso a agua segura para el consumo humano mediante filtros de cerámica elaborados localmente. Se instalaron dos (2) filtros cerámicos bacteriológicos desarrollados por la Empresa Temha uno en el Puesto de Salud y el otro en la Escuela de Educación Primaria en la Aldea "12 de Junio".

Se han capacitado 12 mujeres indígenas de ésta aldea, en huertas comunitarias para lugares de extrema sequía, mediante el uso de vasijas de barro denominadas "Yambui", las cuales funcionan como un sistema de riego con capacidad de evitar la evapotranspiracion en un 60-80%. Las vasijas fueron construidas por las propias mujeres y se ha realizado el seguimiento por espacio de cinco (5) meses, durante los cuales se afianzan los conocimientos para la obtención de productos alimenticios.

b) Modelo de vivienda

En la aldea 12 de Junio se ha construido una vivienda modelo con paredes y techos que permiten eliminar los lugares de acceso al vector transmisor de la enfermedad de Chagas; además de utilizar los techos como colectores de agua para la época de sequía. Los bloques fueron construidos con maquina manual para suelo cemento. En la aldea Karandillas¹, donde no hay agua, se ha establecido un convenio con otra etnia, la comunidad indígena "*Nivaclé* de Casuarina", quien posee bloqueras manuales para la fabricación de ladrillos. Los indígenas de Karandillas han sido adiestrados en el uso de las máquinas y han fabricado los bloques necesarios para su vivienda modelo y han construido bajo supervisión y permanente capacitación, el cimiento, las paredes y el piso. Actualmente, la comunidad ha destinado el local construido para su escuela primaria.

c) Educación para la salud

Se han desarrollado un total de 18 propuestas sobre juegos lúdicos y cuentos. Los mismos fueron elaborados por los estudiantes de la carrera de Diseño Gráfico, luego de una investigación previa sobre la enfermedad de Chagas. Estos juegos fueron posteriormente validados en escuelas del Chaco.

El Programa Nacional de Control de la enfermedad de Chagas ha propuesto recientemente la impresión de cuatro de estos juegos para distribuirlos dentro del marco de su programa de vigilancia en las escuelas durante la *Semana de Chagas*. La iniciativa demuestra la importancia y complementariedad de las interdisciplinas, lo cual fortalece las experticias para la promover la vinculación universidad-sociedad.

IV. Conclusión

A partir de los interesados reales (la etnia *Maskoy* Diez Leguas en el Chaco Central Paraguayo), y siguiendo la aplicación y experimentación del modelo de vinculación de la cuádruple hélice (Academia, Gobierno, Empresa y Sociedad) la experiencia fue exitosa, pues se pudo aplicar el "enfoque étnico", el cual permitió mayor involucramiento y apropiación de las tecnologías y capacitaciones transferidas por el grupo de investigadores del CEDIC, el cual ha posibilitado la conjunción de la cuádruple hélice o "sectores", convirtiéndolo en un Living labs piloto.

Esta conjunción permitió la innovación abierta y social en la comunidad angaité de 10 Leguas donde los propios pobladores aprenden la tecnología para alcanzar el producto requerido y observan sus resultados, y que ha traído mejoras significativas.

La comunidad cuenta, a partir de esta intervención en la aplicación de nuevos conocimientos y obtención de productos con:

 Construcción de un modelo de vivienda con bloques de suelo cemento y capacitación para replicarla, Year 2015

53

¹ Karandillas o Karantillas, es el nombre de una de las aldeas intervenidas con el proyecto, situada en el Departamento de Presidente Hayes (Paraguay). La misma no tiene agua potable y escuela. Los niños asisten a la escuela de otra aldea cercana, llamada Palo Blanco y también se desplazan a esta aldea en busca de agua diariamente.

- capacitación en albañilería para colocación de tanques y canaletas, y ensayos en nuevas ideas de acopio de agua,
- construcción de huertas orgánicas para zonas de gran estrés hídrico, y
- uso y capacitación de filtros de cerámica para consumo de agua segura.

Con este modelo aplicado en el proyecto "Abordaje participativo con enfoque étnico para el Desarrollo Comunitario de la etnia *Maskoy* 10 Leguas en el Chaco Central Paraguayo", se comprueba que los *"Living Labs"*, son espacios ideales para la innovación abierta y la transferencia de tecnología, así como de los resultados de la investigación y una alternativa para la vinculación Universidad-Sociedad o Investigación-Sociedad, y que conlleva el planteamiento de soluciones a los diversos problemas sociales a partir del conocimiento generado por los investigadores.

También se comprueba el desarrollo de las condiciones mencionadas por Katzy, Baltes y Gard (2012): el valor, la apertura, el realismo, la influencia y la sostenibilidad para reducir los riesgos en la inversión del desarrollo de nuevos productos, ya que trabaja como "intermediarios" en la aceptación de lo nuevo por parte de los usuarios y co-propietarios, en nuestro caso: la etnia *Maskoy*.

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Factors Influencing Antenatal Care Services Utilization in Empowered Action Group (EAG) States, India: A Spatial and Multilevel Analysis

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Factors Influencing Antenatal Care Services Utilization in Empowered Action Group (EAG) States, India: A Spatial and Multilevel Analysis

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Abstract-The study investigated individual-household, community and district level factors associated with antenatal care services utilization in Empowered Action Group states, India. Nationally-representative data, drawn from the District Level Household Survey (2007-08), were used. A sample of 116,973 currently married women, aged 15-49 years, who delivered a child during the three years preceding the survey was considered for analysis. Both descriptive and multivariate analysis were used to analyze the data generated and level of significance was set at 5% (0.05). The findings revealed that household socio-economic status and mother's education were the most important factors associated with antenatal care services utilization. The adjusted model showed that the place of residence, community education, community impoverishment were significantly associated with antenatal care services utilization. Spatial analysis finding revealed that districts with higher urban percentage and higher proportion of antenatal care services utilization were clustered together and low-urban percentage-low proportion in the space.

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I. INTRODUCTION

he maternal mortality ratio (MMR) has registered a decline rate from 212 per 1000,000 births in the period 2007-09 to 178 in 2010-12 [1]. It has declined further to 167 per 100,000 live births in the period 2011-13 [2]. This means an estimated 44,000 maternal deaths (death of a woman during pregnancy or within 42 days of termination of pregnancy) occur in the country every year. The MDG 5 set target to reduce MMR by 75 per cent between 1990 and 2015. Based on the United Nation's Inter-Agency Expert Group's MMR estimates in the publication, Trends in Maternal Mortality: 1990 to 2013, India's target of MMR is 140 per 100,000 live births by 2105, taking a baseline of 560 per 100,000 live births in 1990 [3].

The government of India has introduced specific health plans, such as the National Rural Health Mission (NRHM), for decentralized areas based on the needs assessment in the 10th Five-Year Plan for improving the conditions of rural areas and rural population focusing on maternal and child health. NRHM was launched in April 2005 throughout the

country with special focus on 18 states, including eight Empowered Action Group (EAG) states, the northeastern states, Jammu and Kashmir and Himachal Pradesh with the objective to provide accessible, affordable and quality health care services to rural population, especially the vulnerable sections [4]. However, the progress is below national average in all the Empowered Action Group (EAG) states. One of the key determinants in reducing maternal mortality is access to quality health care services for antenatal and natal care. Antenatal care is one of the component of maternal health care services, it is a systemic supervision of women during pregnancy to monitor the progress of foetal growth and to ascertain the well-being of the mother and the foetus [5]. A proper antenatal check-up provides necessary care to the mother and helps identify any complications of pregnancy such as anaemia, pre-eclampsia and hypertension etc., and slow/inadequate growth of the foetus. A number of studies have shown that lack of antenatal care services has been identified as one of the risk factors for maternal mortality [6-7]. Moreover, many studies have demonstrated the association between lack of antenatal care and perinatal mortality, low birth weight, premature delivery, pre-eclampsia, and anaemia [8-9]. Every pregnant woman should get a regular check-up as an integral part of maternity care and the care that is given to an expectant mother from the time that conception is confirmed until the beginning of labor [10]. It offers pregnant woman for the timely management of complications through referral to an appropriate facility for further treatment and an opportunity to get different services which alerts the woman to the risks associated with pregnancy, provides opportunity to prepare a birth plan and identify the facility for delivery and for discussion her options for safe delivery [11, 12]. Antenatal care (ANC) is an important determinant of safe delivery [13] and may have a positive impact on the utilization of postnatal healthcare services [14]. During antenatal care visits, essential services such as tetanus toxoid immunization, iron and folic acid tablets, and nutrition education are also provided [15]. One of the most important functions of ANC is to offer health information and services that can significantly improve the health of women and their infants [16]. For women with normal pregnancies, WHO recommends a 2015

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minimum of four ANC visits, ideally at 16, 24-28, 32, and 36 weeks [17].

The Government of India (GOI) has prepared a list of eight states which are very poor in respect of demographic as well as the socioeconomic indicators and given a name to these eight states as Empowered Action Groups or EAG states. Empowered Action Group (EAG) states comprised of eight socioeconomically backward states of Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, Uttarakhand and Uttar Pradesh [18]. Table 1 shows the sociodemographic profiles of the eight EAG states. The present study was conducted to assess the utilization pattern of antenatal care services and to identify factors affecting the utilization of antenatal care among currently married women of reproductive age (15-49 years) with a focus on individual, household, community and district level characteristics in EAG states of India.

Table 1 : Profiles and Demographic Characteristics of States in Empowered Action Group States, India

| Demographic characteristics | Uttar Pradesh | Uttarakhand | Bihar | Jharkhand | Odisha | Chhattisgarh | Madhya Pradesh | Rajasthan |
|--|------------------|-------------|--------|-----------|--------|--------------|-------------------|-----------|
| Land Ares (sq.km.) ¹ | 240928 | 53483 | 94163 | 79716 | 155707 | 135192 | 308252 | 342239 |
| Total population in million ¹ | 199.58 | 10.11 | 103.80 | 32.97 | 41.95 | 25.54 | 72.60 | 68.62 |
| Population size-% of national population ¹ | 16.5 | 0.83 | 806 | 2.72 | 3.47 | 2.11 | 6.00 | 5.66 |
| Population density ¹ | 828 | 189 | 1102 | 414 | 269 | 189 | 236 | 201 |
| Urban percentage ¹ | 22.3 | 30.6 | 11.3 | 24.0 | 16.7 | 23.2 | 27.6 | 24.9 |
| Female literacy rate (%) ¹ | 59.26 | 70.70 | 53.33 | 56.21 | 64.36 | 60.59 | 60.02 | 52.66 |
| Schedule Caste (%) ¹ | 20.7 | 17.9 | 15.7 | 23.2 | 22.8 | 30.6 | 21.1 | 13.5 |
| Schedule Tribe (%) ¹ | 0.6 | 2.9 | 1.3 | 26.2 | 22.8 | 30.6 | 21.1 | 13.5 |
| Sex ratio–Females per 100 males ¹ | 912 | 963 | 918 | 948 | 979 | 991 | 931 | 928 |
| Birth rate ² | 27.2 | 18.2 | 27.6 | 24.6 | 19.6 | 24.4 | 26.3 | 25.6 |
| Death rate ² | 7.7 | 6.1 | 6.6 | 6.8 | 8.4 | 7.9 | 8.0 | 6.5 |
| Natural growth rate ² | 19.5 | 12.1 | 21.0 | 17.8 | 11.3 | 16.5 | 18.4 | 19.1 |
| Infant mortality rate ² | 50 | 32 | 42 | 37 | 51 | 46 | 54 | 47 |
| Sources: 1-Census of India. 2011. 2-Sample Registration System, vol. 49 No.1, 2014 | | | | | | | | |

Sources: 1-Census of India, 2011, 2-Sample Registration System, vol. 49 No.1. 2014.

II. Methods

a) Data, sampling design and study size

The data was derived from the District Level Household and Facility Survey (DLHS-3) conducted during 2007–08. The DLHS is a nationally representative and one of largest ever demographic surveys conducted in India to obtained reproductive and child health outcome indicators [19]. DLHS-3 adopted a multi-stage stratified systematic sampling design. The survey interviews 643,944 ever-married women aged 15-49 years from 720.320 sampled household (about 78% from rural and 22% from urban areas) spanning 601 districts of India. The overall response rate for evermarried women at the national level is 89%. Out of these 643,944 ever-married women, a total of 215,048 have had a still or live birth during three years preceding the survey [19]. For the analysis reported in this paper, a total of 116,973 currently married women aged 15-49 years in EAG states who delivered a child during the three years preceding the survey were derived. Thus, 116973 currently married women from 13250 cluster (PSU) units in 265 districts were included in this study. In addition to using the individual data from DLHS-3, district level census data published by the Registrar General of India were also collected and included in the analysis.

b) Outcome variables

Three outcome variables were considered for this analysis: (a) Any antenatal care service, (b) Four or more antenatal care and (c) Full antenatal care. Any antenatal care variable was coded as 1 if the woman received antenatal care service from a health professional at least once during her most recent pregnancy in the last three years preceding the survey and 0 if otherwise, based on 116,973 women. A measure of whether a woman had received antenatal care four or more times during her most recent pregnancy was constructed on the number of antenatal care visits who received any antenatal care (sample, N=73,839) during pregnancy. All values of four or higher ANC visits were recoded as 1 (N=15,555), while all other valid codes were relabelled as 0 (N=58,284). Full antenatal care has been defined as at least three antenatal care checkup, consumed 90+ Iron and Folic Acid tables and two or more tetanus toxoid injections taken and it indicates whether a woman received all the recommended antenatal care, coded as 1 (sample, N=8,704) and if care was not received, it is coded as zero (N=65,135) for the women who received any antenatal care (N=73,839).

c) Independent variables

i. Individual and household level characteristics

Mother's age at last birth was recoded as into three categories: under 20 years, 20-34 years and 35 years or older. Under 20 years is the reference category. Rather than use years of completed schooling, this study looked at two educational attainment levels: non literate and literate. Non-literate is taking as the reference category. Social status of the women was categories into four categories: scheduled caste, scheduled tribe, other backward classes and others. Others is taking as reference category. The total number of living children was recorded into three categories: no living children, 1-3, and ≥ 4 ANC. The reference category is no living children. Women's working status was classified as working who engaged in any work in the last twelve months and those not engaged in any work as not working. The reference category is does not work. Exposure to antenatal care messages is categorized as no exposed, only through mass media (newspaper, radio, television and cinema, etc.), only through interpersonal communication (ANM/Doctor /Health worker Drama etc.) and both. The reference category is no exposure to ANC messages. Household's economic status which has been captured in wealth quintile was categorized into poorest, poorer, middle, richer and richest. The reference category is poorest wealth quintile. Religion is categories as Hindu and non-Hindu. The reference category is non-Hindu.

ii. Community and District level characteristics

Five community level indicators such as type of residence, proportion of illiterate women in PSU (or community), proportion of women from belonging to the poorest wealth quintile in PUS, mean number of children ever born per woman in the PSU and mean age at marriage among respondent in the PSU were considered. Place of residence was defined as urban or rural. The reference category is urban areas. Proportion of illiterate women in the PSU was defined as percentage of illiterate women in the PSU categorized as 0-25% (reference category), 26-50% and >50%. And proportion of women from lowest wealth quintile is defined as percentage of women in the PSU belonged to the lowest wealth quintile and categorized as 0-25% (reference category), 26-50% and >50%. Three district level variables which may have more influence on outcome variable like percentage of scheduled caste and schedule tribe population, percentage of urban population and female literacy in the district of residence, were included.

iii. Analytical approach

The analysis included descriptive, spatial visualization, spatial autocorrelation and multilevel logistic. Descriptive analysis was done to show the use of antenatal care by place of residence and selected background characteristics. In spatial analysis, Moran's

I is commonly used statistic to assess global spatial auto correlation for a given variable. The value of this statistics ranges from -1 to 1, where positive values indicate observations with similar values being close to each other and negative values suggest observations with high values are near those with low values, or viceversa. The Local Indicator of Spatial Association (LISA) [20] effectively decomposes a global measure of spatial autocorrelation for each spatial unit, enabling assessment of statistical significance for each unit. This study used the ArcGIS 10.1 software [21] to generate choropleth maps for use of antenatal care services and assessed the spatial dependence in district level characteristics using Moran's I Index (Global) value and LISA [21]. The spatial pattern of antenatal care services across sample districts were analyzed using rook's weight (uses common boundaries to defined neighbour) in GeoDa software.

Women experiencing the outcomes of study are not independent because they share common psu/community and district characteristic. To take into account the hierarchical structure of the sample, where individuals are nested within communities (PSUs) and communities are nested within districts, a multilevel modeling was approached that accommodates the hierarchical nature of the data and corrects the estimated standard errors to allow for the clustering of observations within units [22-25]. This study examined factors influencing utilization of antenatal care with a focus on individual, household, community and district level. Thus, a multilevel logistic regression model with three levels, individual and household (level 1), nested within communities (level 2), and communities nested within districts (level 3), was fitted to assess the influences of measured individual, community and district factors (fixed effects) on antenatal care services utilization [26]. Variance inflation factor (VIF) of all the variables are computed to check collinearity prior to inclusion in multilevel logistic regression. Problem of collinearity among independent variables not found (highest VIF, 2.73). The results of multilevel logistic regression are presented in the form of estimated oddsratios with 95% Cl. The R-CRAN version 3.2.2 with survey and R2MLwin library package was used for analysis DLHS-3 survey data.

iv. Ethical statement

The study is based on data available in public domain, therefore no ethical issue is involved.

III. Results and Discussion

The socio-demographic characteristics of the women are presented in table 2. The minimum age of respondents was 15 years while the maximum age was 49 years with mean age of 26.55 (95% CI=26.51-26.60)) years. The majority of the mother's age at last birth were 20-34 years (82.8%). Educational attainment levels was

59.2% for non literate and literate (40.8%). 48.4% of the respondent were from other backward classes. 65.5% of women having 1-3 living children and 89.9% of women was not engaged in any work in the last twelve months. Household's economic status which has been captured

in wealth quintile was categorized into poorest (29.3%), poorer (26%), middle (18.3%), richer (15.1%) and richest (11.3%). Majority of the respondents were Hindu (84.6%) and not working (90%), and majority of the respondents 86.3% were living in the rural areas.

 Table 2 : Percent distribution of currently married women who had a childbirth during the last three years preceding the survey by selected background characteristics

| Background Characteristics | Nominal categories | Weighted | Weighted proportion of sample | | |
|---|-----------------------------|----------|-------------------------------|--|--|
| (N=116717) | - | Sample | estimate (95%Cl) | | |
| Individual characteristics | | • | | | |
| Maternal Age | 15-19 | 7869 | 6.7 (6.5-7.0) | | |
| | 20-34 | 96600 | 82.8 (82.4-83.1) | | |
| | 35-49 | 12248 | 10.5 (10.3-10.7) | | |
| Women's education | Non-literate | 69072 | 59.2 (57.6-60.8) | | |
| | Literate | 47645 | 40.8(39.2-42.4) | | |
| Number of living children | 0 | 458 | 0.4 (0.3-0.4) | | |
| | 1 - 3 | 76487 | 65.5 (64.9-66.2) | | |
| | 4 + | 39773 | 34.1 (33.4-34.7) | | |
| Working status | Working | 11815 | 10.1 (9.7-10.6) | | |
| | Not working | 104902 | 89.9 (89.4-90.3) | | |
| Exposure to ANC messages | No exposure | 21444 | 18.4 (17.6-19.2) | | |
| | Through mass media | 7216 | 6.2 (5.7-6.7) | | |
| | Through interpersonal comm. | 59232 | 50.7 (49.5-51.9) | | |
| | Both | 28824 | 24.7 (23.3-26.1) | | |
| Household characteristics | | | | | |
| Wealth quintile | Poorest | 34194 | 29.3 (27.8-30.8) | | |
| | Poorer | 30395 | 26.0 (25.0-27.1) | | |
| | Middle | 21410 | 18.3 (18.0-18.7) | | |
| | Richer | 17542 | 15.0 (14.4-15.7) | | |
| | Richest | 13175 | 11.3 (9.4-13.5) | | |
| Religion | Hindu | 98702 | 84.6 (83.8-85.4) | | |
| | Non-Hindu | 18015 | 15.4 (14.6-16.3) | | |
| Social status | Scheduled caste | 22822 | 19.6 (18.8-20.4) | | |
| | Scheduled tribe | 16467 | 14.1 (13.3-14.9) | | |
| | Other backward class | 56442 | 48.4 (47.6-49.1) | | |
| | Other | 20986 | 18.0 (17.1-18.8) | | |
| Place of residence | Urban | 16020 | 13.7 (9.3-19.8) | | |
| | Rural | 100697 | 86.3 (80.2-90.7) | | |
| Sources: Based on author's computation from DLHS-3 (2007-08). | | | | | |

Utilization pattern of antenatal care among currently married women is presented in table 3. Of the total sample 116,717 of women 63.1 % received at least once antenatal care during pregnancy from a health professional. Rural women were less likely to receive the care (60.8%) as compared to urban women 77.6% received antenatal care service from health professional. Out of 73,659 women who received at least once antenatal care, 21.1% of women received \geq 4 ANC. Urban women were more than two times more likely to receive \geq 4 ANC care (38.3%) as compared to rural women (17.6%). Full antenatal care service received from health professional during pregnancy were 19.5% women living in urban areas and less likely to women living in rural areas (10.2%).

About 65% of women 20-34 years age group received at least once antenatal care service as

compared to others age groups, women who received ≥4 ANC care was 22.1% and full antenatal care was 12.4% for 20-34 years age group as compared to others age group among the women who received any ANC during her most recent pregnancy (Table 4). 77.3% of women with literate in education used at least once ANC service as compared to women with no education (53.5%). Literate women had higher percentage of received ANC (30.7%) and full ANC (18%) when compared to those women who had no education≥4 ANC(11.5%) and full ANC(5.6%). This was also seen in the distribution of social status by components of antenatal care that scheduled caste, scheduled tribe and other backward class women were less likely to use ANC care service compared with other social status women. About 73% of others women received at least once ANC care service compare with others social

 Table 3 : Percent distribution of antenatal care services utilization among currently married women who had a childbirth during the three years preceding the survey by place of residence

| Variables Description | | Total | | Urba | Urban | | Rural | |
|---|-----|--------|------|--------|-------|--------|-------|--|
| (N=116717) | | Sample | % | Sample | % | Sample | % | |
| Received antenatal care service from health | Yes | 73659 | 63.1 | 12436 | 77.6 | 61223 | 60.8 | |
| professional at least once during pregnancy | No | 43058 | 36.9 | 3584 | 22.4 | 39474 | 39.2 | |
| Total | | 116717 | 100 | 16020 | 100 | 100697 | 100 | |
| Received four or more antenatal care service from | Yes | 15529 | 21.1 | 4757 | 38.3 | 10772 | 17.6 | |
| health professional during pregnancy | No | 58130 | 78.9 | 7679 | 61.7 | 50451 | 82.4 | |
| Received Full antenatal care service from health | Yes | 8683 | 11.8 | 2428 | 19.5 | 6255 | 10.2 | |
| professional during pregnancy | No | 64976 | 88.2 | 10008 | 80.5 | 54968 | 89.8 | |
| Total | | 73659 | 100 | 12436 | 100 | 61223 | 100 | |
| Sources: Based on author's computation from DLHS-3 (2007-08). | | | | | | | | |

status group women. 32% and 19% of others women received \geq 4 ANC and full ANC compared to scheduled caste women, 15.7% and 8.4% for ≥4 ANC and full ANC. Women having 1-3 living children received relatively higher percentage of any ANC (69.4%), ≥ 4 ANC (25.1%) and full ANC (14.1%) as compared to those women having four or more living children, 51.2%, 10.5% and 5.7% for any ANC, \geq 4 ANC and full ANC. Women with exposure to ANC messages had received higher percentage of any ANC care (79.1%), \geq 4 ANC (33.5%) and full ANC (18.9%) when compared to those women who had no exposure to ANC messages, any ANC(37.8%), ≥4 ANC(10.2% and full ANC(4.9%). About 64% of Hindu women received at least once ANC care service, 21.8% received \geq 4 ANC and 12.3% received full ANC as compared to non-Hindu, 17.5% and 9.1% for \geq 4 ANC and full ANC. It is also seen that a relatively higher percentage of use of ANC care service by higher socio-economic group compared to those who are in lower socio-economic group. 87.6% of women in the richest wealth quintile category received higher percentage of any ANC while only 51.1% of those in the poorest category used the service. Women the richest wealth quintile had higher percentage of received ≥ 4 ANC (43.3%) and full ANC (24.5%) when compared to those women in the poorest quintile ≥ 4 ANC (11.5%) and full ANC (7.2%).

a) Spatial autocorrelation

This study also concerned with exploring and better understanding factors that determine the use of antenatal care services, especially, the influence of geographical factors. Figure 1.1 based on all women, 2.1 and 3.1 based on those women who reported using any antenatal care shows the mapping of proportion of women received any ANC, \geq 4 ANC and full ANC in each district and components of antenatal care received

among currently married women were shown varied substantially across the districts. Throughout the EAG districts, most women received antenatal care, although, the proportion less than 50 percent were showed in some districts of Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan and Uttarakhand. Almost all districts of Odisha, Chhattisgarh and some districts in eastern parts and northern parts of Uttar Pradesh, central parts of Rajasthan, and southern parts of Madhya Pradesh women received 60 to 70 percent and 70 percent above ANC. 60 percent and above of women received \geq 4 ANC only in few districts in Odisha, Chhattisgarh and Madhya Pradesh. Figure 3.1 shows the levels of use of full ANC, proportion of women who received full ANC were less than 30 percent in almost all districts. In the eastern region, central region, western region had the lowest levels of use of full ANC, whereas most of the district in the southern region and south eastern region, women received higher full ANC.

Table 4 : Percentage of currently married women who had a childbirth during the three years preceding the survey according to use of antenatal care and by selected background characteristics

| Background Characteristics | | Womer | n who received antenata | al care |
|---------------------------------------|----------------------|-------------------------------|----------------------------|-------------------------------|
| | Nominal categories | Any ANC 63.1% (N=73659) | ≥ 4 ANC 21.1% (N=15529) | Full ANC 11.8% (N=8683) |
| Individual-household Level variables | | | | |
| Maternal Age | 15-19 | 66.0 (5195) | 16.5 (855) | 8.0 (414) |
| | 20-34 | 64.7 (62589) | 22.1 (13821) | 12.4 (7765) |
| | 35-49 | 48.7 (5965) | 14.3 (854) | 8.4 (504) |
| Education | Non-literate | 53.3 (36826) | 11.4 (4215) | 5.6 (2064) |
| | Literate | 77.3(36833) | 30.7(11314) | 18.0(6619) |
| Number of living children | 0 | 64.6 (296) | 22.8 (68) | 11.6 (34) |
| | 1 - 3 | 69.4 (53068) | 25.1 (13335) | 14.1 (7494) |
| | 4 + | 51.0 (20295) | 10.5 (2127) | 5.7 (1155) |
| Working status | Working | 61.3 (7244) | 14.6 (1056) | 8.9 (645) |
| | Not working | 63.3 (66415) | 21.8 (14473) | 12.1 (8038) |
| Exposure to ANC messages | No exposure | 37.7 (8089) | 10.1 (819) | 4.9 (392) |
| | Through mass media | 74.2 (5353) | 32.4 (1735) | 17.4 (933) |
| | | 63.2 (37431) | 14.9 (5585) | 8.2 (3055) |
| | Poth | 70 1 (00706) | 22.4 (7200) | 100 (4202) |
| Wealth quintile | Bourast | 79.1 (22700) 50.0 (17416) | 32.4 (7390) | 7.2 (1250) |
| Wealth quintile | Poorer | 50.9 (17410) | 12.9 (2441) | 7.2 (1230) |
| | Middle | 55.2 (17087) 65.3 (13083) | 10.2 (2687) | 7.0 (1343) |
| | Bicher | 7/ 3 (13030) | 26.1 (3410) | 14 4 (1876) |
| | Richest | 87.5 (11533) | 43 3 (4994) | 24 5 (2824) |
| Beligion | Hindu | 63 7 (62874) | 21 7 (13647) | 12.3 (7707) |
| Religion | Non-Hindu | 59 9 (10785) | 17 5 (1882) | 9.0 (976) |
| Social status | Scheduled caste | 58 5 (13354) | 15.7 (2096) | 8.3 (1114) |
| | Scheduled tribe | 55 5 (9142) | 17.7 (1621) | 12 5 (1144) |
| | Other backward class | 63 5 (35857) | 19.3 (6915) | 9.9 (3541) |
| | Other | 72.9 (15306) | 32.0 (4898) | 18 8 (2884) |
| Community Level variables | | . 2.0 (10000) | | |
| Place of residence | Urban | 77.6 (12436) | 38.3 (4757) | 19.5 (2428) |
| | Rural | 60.8 (61223) | 17.6 (10772) | 10.2 (6255) |
| Proportion of illiterate women in | 0-25% | 81.1 (13824) | 40.9 (5660) | 24.4 (3369) |
| the PSU | 26-50% | 70.0 (17887) | 23.4 (4178) | 12.9 (2308) |
| | > 50% | 56.6 (41948) | 13.6 (5692) | 7.2 (3006) |
| Proportion of women belonging to | 0-25% | 68.8 (42995) | 25.5 (10983) | 13.7 (5894) |
| poorest wealth quintile | 26-50% | 60.0 (18419) | 15.4 (2830) | 8.6 (1590) |
| | > 50% | 52.0 (12245) | 14.0 (1716) | 9.8 (1200) |
| Mean no. of children ever born in PSI | U | 3.0 ± 0.003 | 2.6 ± 0.006 | 2.6 ± 0.008 |
| Mean age of marriage in PSU | | 16.6 ± 0.005 | 17.7 ± 0.015 | 17.9 ± 0.012 |
| District Level variables | | | | |
| Urban percentage | 0-25% | 61.8 (59954) | 19.5 (11690) | 11.0 (6599) |
| | 26-50% | 68.9 (10309) | 26.4 (2719) | 15.1 (1558) |
| | > 50% | 72.2 (3396) | 33.0 (1119) | 15.5 (526) |
| SC & ST percentage | 0-25% | 65.8 (10335) | 24.9 (2575) | 17.4 (1796) |
| | 26-50% | 61.7 (29605) | 24.3 (7179) | 13.0 (3840) |
| | > 50% | 63.6 (33718) | 17.1 (5774) | 9.0 (3047) |
| Mean female literacy percentage | | 57 ± 0.034 | 59.6 ± 0.042 | 59.9 ± 0.037 |

Summarization of no. of children ever born, marriage in PSU and district female literacy percentage are given in mean and SE. Sources: Based on author's computation from DLHS-3 (2007-08).

In the figures 1.1, 2.1 and 3.1, the mapping of proportion of use of antenatal care i.e., any ANC, \geq 4 ANC and full ANC reveals clear pattern of spatial clustering of among districts. To measure the extent of

this neighborhood clustering in the use of antenatal care across 265 districts, Global Moran's/and Local Indicator Spatial Autocorrelation (LISA) has been computed using rook's weight matrix and 999 permutations for

randomization to observe univariate clustering and bivariate clustering (that is liking two variables, like proportion urban percentage in the district with corresponding district's proportion of use of antenatal care separately). The overall Global Moran's spatial autocorrelation index is computed 0.167 (p<0.05) implying a slight but significant positive autocorrelation in the proportion of use of antenatal care at least once in the district level and \geq 4 ANC (Moran's I=0.169, p<0.05) and full ANC (Moran's I=0.119, p<0.05).

LISA maps of spatial clustering and their significance map has been generated using the GeoDa univariate LISA maps. Figures 1.2, 2.2 and 3.2 illustrate the spatial outliers, high-high clustering (in red color), low-low clustering (in blue color) which is greatly helpful in identifying the district with significant neighborhood clustering. Thus, from the cluster map and corresponding significance may (map not shown), we found that one district in Bihar and one district in MP (in red color) have high proportion of use of ANC at least once surrounded by high value neighbors. The low-low clustering is noticed the six districts as district having low proportion of use of ANC at least once surrounded by other low value neighbors (at 5% level of significance). For \geq 4 ANC, two districts (in red color) have high-high clustering and six districts (in blue color) have low-low clustering at 5% level of significance (significance map not shown). The low-low clustering at 5% level of significance (significance map not shown) is noticed in eight districts for full ANC. Moran's / index affirms the significance positive association between the like value neighboring districts in all the components of antenatal care services and hence it indicate that whether proximity to urban percentage has adverse impact on the proportion of ANC care service in the district clustered together on the map. The bivariate Moran statistic taking urban percentage in the district gives a high positive spatial autocorrelation of 0.025 (p<0.05) for women received at least once ANC, \geq 4 ANC (I=0.028, p<0.05) and (I=0.05, p<0.05) implying that districts with higher urban percentage and higher proportion of use of antenatal care services were clustered together in the space and low-urban percentage-low proportion of use of antenatal care services were clustered.

b) Factors associated with utilization of antenatal care services

In table 5 below the multilevel logistic regression results are presented. Maternal age, women's education, number of living children, exposure to ANC messages/information's, household wealth, religion, social status significantly predicated received any ANC, \geq 4 ANC and full ANC (Table 5). Community/psu variance partition coefficient (VPC) for random effect for the multilevel model (random intercept only model, without covariates) for any anc \geq 4 ANC and full ANC were computed 15.7%, 15.1% and 11.3% and district VPC for anc, \geq 4 ANC and full ANC were 6.5%, 6.7% and 3.1%. The variable working status in not included in the final model as not showing any significant difference. Study in south India found that mothers under age 18 years were less likely to receive antenatal care [27], but first-order pregnancies were more likely to receive antenatal care. Women are generally considered at greater obstetric risk when they give birth before age 18 year or after age 35 years and older [28-29]. The present study is shows that likelihood of women availing themselves of any ANC, \geq 4 ANC and full ANC were 24%, 11% and 17% higher among 20-34 years maternal age group compared to women with 15-19 years, but among women of 35-49 year age group were 9% for an ANC, 10% for \geq 4 ANC and 9% for full ANC respectively, lower compared with women 15-19 year maternal age group. Many studies found an association between education and use of antenatal care after controlling for others covariates [30-33]. Further, women's education is an important predictor of the use of antenatal care services [34-36]. Rather than use years of completed schooling, this study looked at two educational attainment levels: non literate and literate. The odds of receives any ANC, \geq 4 ANC and full ANC were 15%, 42% and 42% higher among literate women compared to women with non-literate. Older women and women with higher number of living children may not seek antenatal care because of their experience with pregnancy-related matters. In India, women having their first child were more likely to receive antenatal care [18, 37]. The likelihood of receiving any ANC and \geq 4 ANC were 39% and 51% higher among those women having 1-3 living children than women who had no living children and those women having 4+ living children had 14% and 4% lower compared with women who had no living children. Women having 1-3 living children are more likely to use any ANC and \geq 4 ANC.

Electronic media can be an important source of information regarding the benefits of preventive care for maternal health [33, 37] and suggested that exposure to electronic media can influence cultural barriers to using modern health care. Women with higher living standards may also have better access to mass media informing them of the benefits of antenatal care [38]. The odds of any ANC, \geq 4 ANC and full ANC were 25%, 34% and 16% higher among women who had exposure to ANC messages/information through mass media, 19%, 25% and 20% higher among women who had exposure to ANC messages/information through mass media and interpersonal communication both than women who had no exposure. This study results shows that utilization of antenatal care services are more likely higher among those women with exposure ANC to messages/information through mass media and through interpersonal communication and both. The use of antenatal care services in a given population depend not only the availability and accessibility of services but also the socio-economic status of the household [39]. Economic status of the household also may help determine the use of health services insofar as it reflects the ability of the household to pay for health care costs. Usually families belonging to a higher economic class are more aware of and have easier access to sources of health care [40]. Several studies have shown a relationship between the use of health care services and



the financial stability of the household [41-42]. The odds of any ANC, \geq 4 ANC and full ANC were 48%, 62%

and 13% higher among women in middle wealth quintile, 72%, 84% and 58% higher among women in richer

2015

wealth quintile as compared with women belongs to poorest wealth quintile. The likelihood of utilization of \geq 4 ANC and full ANC were 2.2 times and 2.4 times higher among women belongs to richest wealth quintile as compared with women belongs to poorest wealth quintile. A strong association of the caste system with the utilization of maternal health care services was documented [39] and also shown from a comparative study on reproductive and child health status of the scheduled castes and scheduled tribes of West Bengal [43]. Scheduled caste women (15%), scheduled tribe (17%) and other backward classes (13%) were less likely to receives any ANC, and SC(21%), ST(31%) and OBC(35%) were less likely to utilizes \geq 4 ANC and SC(4%) and ST(13%) were less likely to utilizes full ANC compared with women from other social groups. Significant difference was also observed between the social status and antenatal care services utilization.

Table 5 : Result of the multilevel analysis showing odds ratio with 95% CI for antenatal care services utilization among currently married women who had a childbirth during the last three years preceding the survey

| Background | Nominal | Any ANC | \geq 4 AN C | Full ANC |
|---------------------------------------|-----------------------|------------------------|------------------------|---|
| Characteristics | categories | Adjusted OR (95%Cl) | Adjusted OR (95%Cl) | Adjusted OR (95%Cl) |
| Individual-household Level variables | | | | |
| Maternal Age | 15-19 (ref) | 1.000 | 1.000 | 1.000 |
| | 20-34 | 1.240 (1.185-1.297) | 1.112 (1.020-1.212) | 1.169 (1.144-1.194) |
| | 35-49 | 0.914 (0.86-0.965) | 0.897 (0.827-0.972) | 0.989 (0.966-1.013) |
| Women's education | Non-literate (ref) | 1.000 | 1.000 | 1.000 |
| | Literate | 1.151 (1.114-1.190) | 1.423 (1.353-1.498) | 1.416 (1.394-1.439) |
| Number of living children | 0 (ref) | 1.000 | 1.000 () | 1.000 |
| | 1 - 3 | 1.388 (1.345-1.432) | 1.514 (1.431-1.603) | 0.982 (0.967-0.998) |
| | 4 + | 1.145 (0.930-1.409) | 0.856 (0.641-1.145) | 0.957 (0.874-1.047) |
| Exposure to ANC messages | No exposure (ref) | 1.000 | 1.000 | 1.000 |
| | Through mass | 1.247 (1.199-1.297) | 1.344 (1.280-1.412) | 1.156 (1.140-1.172) |
| | media | | | |
| | I nrougn interper. | 1.098 (1.032-1.170) | 1.226 (1.138-1.321) | 1.142 (1.116-1.169) |
| | comm. | | 1 045 (1 105 1 065) | 1 002 (1 170 1 000) |
| Moolth quintile | BOIN Decreat (ref) | 1.180 (1.139-1.230) | 1.245 (1.135-1.365) | 1.203 (1.178-1.229) |
| weath quintile | Poorest (rei) | | | |
| | Middle | 1.207 (1.207-1.331) | 1.139 (1.070-1.213) | 0.900 (0.948-0.980) |
| | Richar | 1.470 (1.400-1.551) | 1.022 (1.024-1.728) | 1.131 (1.107-1.150) |
| | Richer | 1.723 (1.000-1.849) | 1.838 (1.097-1.992) | 1.578 (1.541-1.015) |
| Poligion | Hindu | 1.733 (1.044-1.027) | 2.133 (2.014-2.302) | 1 015 (0 007 1 022) |
| Religion | Non Hindu (rof) | 1.170 (1.122-1.232) | 1.129 (1.006-1.204) | 1.013 (0.997-1.033) |
| Conciel atotuo | | | | |
| Social status | Scheduled tribe | 0.850 (0.813-0.890) | 0.788 (0.749 - 0.829) | 0.963 (0.948-0.978) |
| | Other backward | 0.823 (0.784-0.808) | 0.694 (0.650-0.743) | 0.958 (0.939 - 0.977) |
| | | 0.075 (0.020-0.955) | 0.047 (0.392-0.700) | 0.878 (0.859-0.900) |
| | Other (ref) | 1 000 | 1 000 | 1 000 |
| Community level characteristics | | 1.000 | 1.000 | 1.000 |
| Place of residence | Lirban | 1 113 (1 0/1-1 100) | 1 283 (1 200-1 371) | 1 303 (1 278-1 320) |
| Thate of residence | Bural (ref) | 1 000 | 1.203 (1.200-1.371) | 1 000 |
| Proportion of illiterate women | 0-25 % (ref) | 1.000 | 1.000 | 1 000 |
| in the PSU | 26-50% | 1 099(1 018-1 186) | 0.990 (0.914-1.073) | 0.969 (0.949-0.991) |
| | > 50% | 1 035(1 058-1 218) | 0 869 (0 812-0 931) | 0.918 (0.901-0.937) |
| Proportion of women belonging | 0-25 % (ref) | 1.000 | 1.000 | 1.000 |
| to poorest wealth quintile in the | 26-50% | 0.985(0.938-1.035) | 0.999 (0.938-1.064) | 1.008 (1.002-1.014) |
| PSU | ≥ 50% | 0.821(0.770-0.876) | 0.850 (0.777-0.929) | 0.968 (0.948-0.990) |
| Mean no. of children ever born in PSU | | 1.081(1.052-1.111) | 0.897 (0.866-0.929) | 0.985 (0.977-0.993) |
| Mean age of marriage in PSU | | 1.047(1.031-1.064) | 1.045 (1.027-1.064) | 1.010 (1.005-1.013) |
| District level characteristics | | · · · · | · · · · · | × , , , , , , , , , , , , , , , , , , , |
| Urban percentage | 0-25 % (ref) | 1.000 | 1.000 | 1.000 |
| · - | 26-50% | 1.038(0.647-1.664) | 1.088 (0.773-1.530) | 1.122 (1.077-1.169) |
| | $\geq 50\%$ | 1.261(0.947-1.679) | 1.212 (0.979-1.500) | 1.425 (1.389-1.462) |
| SC & ST percentage | 0-25 % (ref) | 1.000 | 1.000 | 1.000 |
| | 26-50% | 0.988(0.800-1.221) | 0.783 (0.665-0.924) | 0.978 (0.958-0.997) |
| | $\geq 50\%$ | 0.581(0.432-0.781) | 0.715 (0.569-0.900) | 0.867 (0.842-0.893) |
| Female literacy percentage | | 1.041(1.030-1.054) | 1.001 (0.999-1.003) | 1.012 (1.010-1.014) |

(ref.)=reference category ; Sample size: at level 1 (individual)=116,717 for ANC any, 73,659 for $4 \ge ANC$ and Full ANC; level 2 (community)=13,250; level 3 (district)=265. Sources: Based on author's computation from DLHS-3 (2007-08).

Women living in urban areas may not need additional costs for transportation and other costs related to distance to access health care services. Many studies have found that urban women were more likely to use antenatal care services than rural women [44-45]. At community level, residence in urban area was consistently associated with increased likelihood of the antenatal care services utilization [46]. The result of this study is also found sufficient amount of variation of antenatal care services utilization at community of residence.

Association between contextual/neighbourhood (or shared community) with maternal health outcome has been shown in several studies [47-49]. The contextual variables proportion of illiterate women in the psu, proportion of women belonging to poorest wealth quintile in the psu and SC & ST percentage, seem to provide a better overall explanation for the variation of antenatal care services utilization. The adjusted model show that the place of residence, community education, community impoverishment, urban percentages, SC & ST percentages were significant factors associated with utilization of any ANC, \geq 4 ANC and full ANC

IV. Conclusion

The purpose of this study was to determine the factors influencing antenatal care services utilization among currently married women in EAG states. The significance of the results of this study is that household socio-economic status and mother's education were the most important factors associated with antenatal care services utilization. Therefore empowering women and promoting mother's education would yield greater results in increasing the use of antenatal care services in order to achieve the Millennium Development Goal 5 of reducing maternal mortality.

V. Additional Information and Declarations

a) Acknowledgements

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b) Competing interests

The authors declare that they have no competing interests.

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

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

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

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

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

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

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

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

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

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

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

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

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

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

INFORMAL GUIDELINES OF RESEARCH PAPER WRITING

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

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

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- Separating a table/chart or figure impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

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- \cdot Keep on paying attention on the research topic of the paper
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- \cdot Align the primary line of each section
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- \cdot Use past tense to describe specific results
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· Shun use of extra pictures - include only those figures essential to presenting results

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The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript-must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

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- Reason of the study theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including <u>definite statistics</u> if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

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Introduction:

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- Shield the model why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

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This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

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- Report the method (not particulars of each process that engaged the same methodology)
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- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
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- Leave out information that is immaterial to a third party.

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The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

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



Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.

• Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form. What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
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Figures and tables

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- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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| Methods and Procedures | Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads | Difficult to comprehend with embarrassed text, too much explanation but completed | Incorrect and unorganized structure with hazy meaning |
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| Discussion | Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited | Wordy, unclear conclusion, spurious | Conclusion is not cited, unorganized, difficult to comprehend |
| References | Complete and correct format, well organized | Beside the point, Incomplete | Wrong format and structuring |
INDEX

Α

Aristocracy · 7

С

Commemorate · 3

D

Desalination · 13, 23

Ε

Encroaching · 7

I

Inclination \cdot 21 Invasion \cdot 1, 3, 5, 6, 8, 9

Μ

Moist · 13

Ρ

Permutations · 78 Persuaded · 6

R

Rebellion \cdot 2

S

Saline · 13

T

Terrain · 2

V

Veterans · 1, 5, 6



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