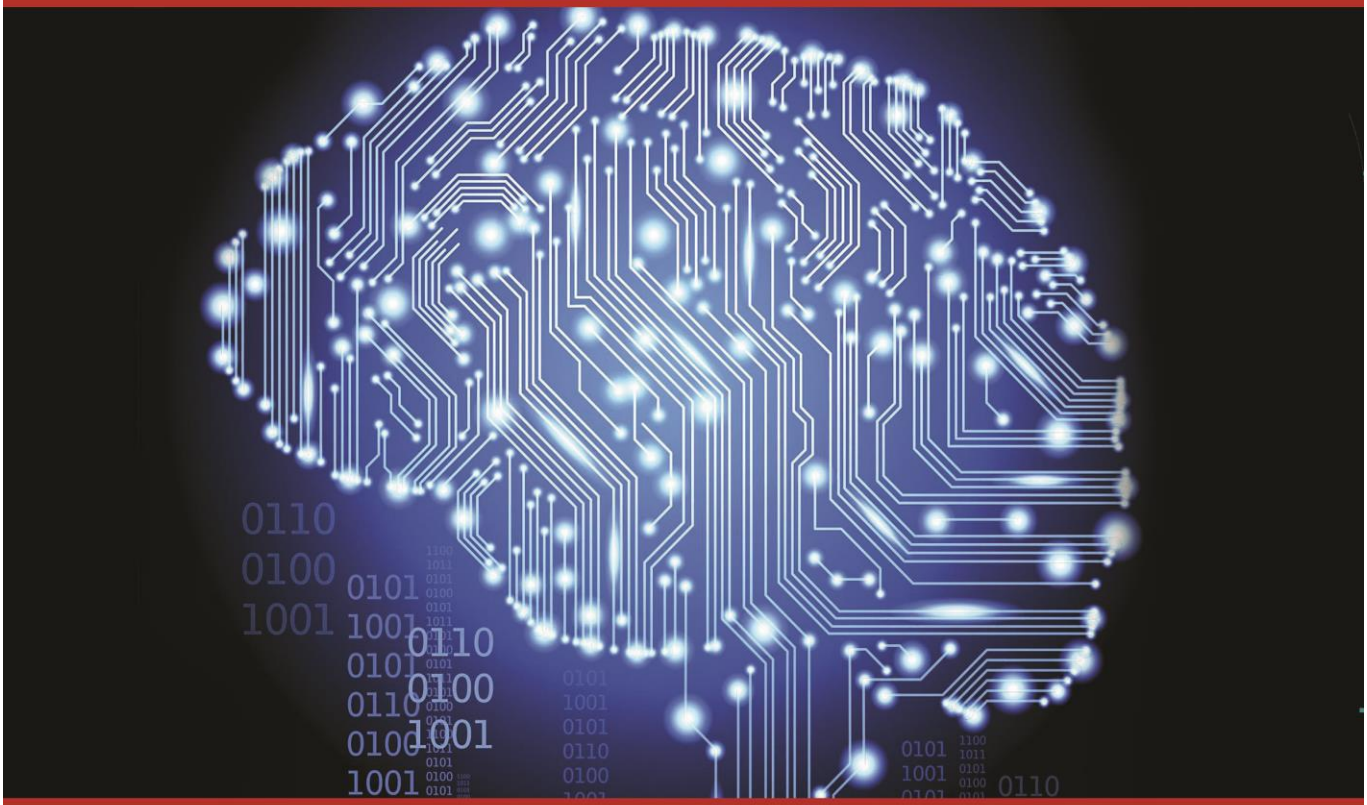
ISSN : 2454-1311

International Journal of Advanced Engineering Management and Science

(IJAEMS)

An Open Access Peer Reviewed International Journal

Vol. - 4 Issue - 6 Jun, 2018



Journal DOI: 10.22161/ijaems

Issue DOI: 10.22161/ijaems.4.6

INFOGAIN PUBLICATION

http://www.ijaems.com/ | editor@ijaems.com

Editorial Board

Dr. Amit Rathi
Department of ECE, SEEC, Manipal University Jaipur, Rajasthan, India

Dr. Elsanosy M. Elamin
Dept. of Electrical Engineering, Faculty of Engineering. University of Kordofan, P.O. Box: 160, Elobeid, Sudan

FOREWORD

I am pleased to put into the hands of readers Volume-4; Issue-6: Jun, 2018 of **"International Journal of Advanced Engineering, Management and Science (IJAEMS) (ISSN: 2354-1311)" ,** an international journal which publishes peer reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers.

I thank all the authors of the research papers for contributing their scholarly articles. Despite many challenges, the entire editorial board has worked tirelessly and helped me to bring out this issue of the journal well in time. They all deserve my heartfelt thanks.

Finally, I hope the readers will make good use of this valuable research material and continue to contribute their research finding for publication in this journal. Constructive comments and suggestions from our readers are welcome for further improvement of the quality and usefulness of the journal.

With warm regards.

Dr. Uma Choudhary
Editor-in-Chief
Date: July, 2018

Vol-4, Issue-6, June, 2018

https://dx.doi.org/10.22161/ijaems.4.6.1 *ISSN: 2454-1311*

A Legal Punisment by Judgement in Prosecuting Minor Commited of Criminal Act of Murdering

Herlina Panggabean

E-mail: *linagabe53@gmail.com*

Abstract— *This research was conducted by statutory and case approach method. The purpose of this study is to find out "How the legal analysis of sentencing by judges in prosecuting murder which is committed by minors in court.Based on the result of the analysis, or as the answer to the above problem is that in the case of the Court which was decided by the Panel of Judges namely Article 340 and Article 351 (2) with the punishment of 20 (twenty) years imprisonment. In the case of applying, the law applied by the panel of judges is appropriate based on article 26 (1) number 2 letter a, Law. No. 3 Year 1997 on Juvenile Justice, at the minimum half of adult punishment or 10 (ten) years imprisonment.*

Keyword— Crime, Killing, Child.

I. INTRODUCTION

The development of children delinquency recently is very high. Children's misbehavior creates anxiety within the community and is concerned and highlighted by the mass media and government, in which the problem of violence occurs resulting in a devastating effect on the future of life and education in the country. The crimes committed by children at the present time draw attention from the government in performing special handling. Through the approach and extension conducted by the government, it is expected to reduce criminal acts in the community for the comfort and public stability.Murder is defined as a deliberate and illegal killing of a person. This resulted, the victim suffered of stabbing injuries, while the eye witnesswas woundedon the left hand due to the fending off the defendant's actions.On the verdict, the Panel of Judges sentenced the accused to imprisonment for eight years which has been fully deducted from the period of his detention. Internal factors that influence the background of the occurrence of this murder are: (1) The existence of social gaps against the fellow workers in the workplace; (2) There is a sense of envy and resentment that is affected by the abusive and unpleasant treatment of fellow workers; (3) The existence of fellow workers' dispute and lack of good communication at work.

External factors that influence the background of the murder are: (1) economic factor is one of the factors that affects the children to commit a criminal act, triggered by the inability of the parents to meet the needs of the children which encouraged children to commit criminal acts; (2) Environmental factors is one of the main determinants of personal formation of children as the development of maturation process; (3) The association factor is one of the supporting factors of children in getting the quality of education and maturity of mindset, both personality and friendship.The purpose of the punishment contains elements such as: (1) Humanity, in the sense that the punishment upholds one's dignity; (2) Educative, in the sense that punishment is able to make people fully aware of the actions done and cause him to have a positive attitude of the soul for the crime prevention; (3) Justice, in the sense that the punishment is perceived as fair (whether by the convict or by the victim or the community).The inclusion of threats of penalty or sanction accompanying the presence of the regulation is necessary to support the regulations imposed on criminal acts, in the hope that they will not repeat the act in addition to the same acts and not being imitated by others. The criminal psychological view of murder that an act of evil is placed on a person's soul and his conduct so as to commit perverse acts contrary to the norms prevailing in society. If viewed in terms of juridical "Murder" is defined as forms of behavior that is contrary to moral humanitarian and harmful to society and its nature violates law and Criminal Law.Criminal acts committed by a person are divided into two groups that can not and can not be accounted for. Against actions that cannot be accounted, itcannot be sentenced to criminal. Against the less reliable, the penalty can be reduced or charged. Criminal is a reaction to the offense that deliberately imposed by the state on the maker of the offense.The penalty system for minors should include legal protection for children. In which, a child is an immature individual, incapable of acting in law. Therefore, it is needed various role of government or society in understanding legal problem experienced by a child.The function of criminal justice in children is necessary for balanced law enforcement

https://dx.doi.org/10.22161/ijaems.4.6.1 *ISSN: 2454-1311*

on each case and child's independence. However, the legal system can function optimally if it is updated with a system appropriate to the conditions of the society.The judge's duty of giving his judgment must be objective. In carrying out their duties, it must be firm and responsible for action when making the right decision. Judge's consideration in imposing criminal penalties is very important, because it is important for the future of a child as the nation's next generation and human resource for national development. In bringing a criminal verdict to the defendant, the judge must be able to consider the willingness of the parents to care for the child, because the willingness of the parents is crucial in controlling the attitude of the child not to commit another criminal act.Efforts and the prevention of crime of murder committed by the child can be executed appropriately if based on the role of the government, whether in conducting coaching, supervision, and legal protection.The research problem identification is: the basis of judges' consideration in prosecuting murder and severe maltreatment perpetrated by minors, with the limitation of the problem is; to know the basis of the judge's consideration in considering the punishment of the child, as well as to know the legal efforts and protection of the rights of the child in prison. For Legal Science, it is as a contribution of thought for students / academic students in developing the science inside or outside the community as well as providing the right solution in murder problems. For the public, is to know the accountability of criminal behavior of murder crime.

II. THEORETICAL FRAMEWORK

1. The Crime Definition

The definition of a criminal offense is derived from the Dutch term in the Criminal Code, namely "StrafbaarFeit" all elements of unlawful acts that violate the law by a person and can be accounted for. Some expert of jurists try to interpret the meaning and the terms as the appropriateness and the principles of law. ProdjodikoroWiryono, formulates that: Criminal act is a criminal act that the perpetrator may be subject to criminal penalties in accordance with applicable regulations. Simons, formulates that: Criminal acts are an unlawful act that has been deliberately committed by a person who can be held accountable for his actions, expressed as punishable. Moeljatno, formulates that: Criminal acts are all acts that are prohibited by law and can be punishable by criminal punishment to persons violating them. According to Moeljatno, Crime is an act that is prohibited by a rule of law, which prohibition is accompanied by a particular criminal threat, for anyone who violates the prohibition. The elements of the criminal act are: (1) The act that the action is prohibited (human actions in an event caused by the behavior of people). The prohibition is directed at his actions and his criminal threat is directed against his person. (2) Prohibited restrictions aimed at his actions and criminal penalties aimed at those who commit his actions. (3) The criminal penalty is the imposition of a punishment in accordance with the actions of that person.

2. The Definition of Murder

The term of a criminal act of murder is defined as one of the unlawful acts related to intentional or wrongly done by a person and can be accounted for. Crimes against life in the Criminal Code can be distinguished or grouped on two grounds, namely: (1) Crimes against life intentionally, contained in Chapter XIX of the Criminal Code in Articles 338 to 350. (2) Crimes against life which are not intentionally committed (CulposeMisdrihven), contained in Chapter XXI (Special Article 359).Crimes against life committed deliberately (murder) in basic form, published in Article 338 which formulation is:Anyone who deliberately deprives the life of another person is convicted of a penalty with a maximum imprisonment of 15 (fifteen) years. In this aggravated formation, there are two kinds of criminal offenses at once, the one being ordinary murdering in basic form (Article 338) and the other is a crime other than murder. The crime must happen, not the test. If the murder has occurred, but other crimes that have not happened, then the crimes that have been set in Article 339 it does not happen. In the act of encouragement, the initiative to commit suicide is not from the suicide person but from someone else who pushes. In contrast to the deeds of helping and providing the means, because in this act, the initiative for suicide comes from the victim himself. In both these acts there is no influence (inner) whatsoever on the formation of the will for the victim to commit the suicide.

3. The Development of the Rights of the Child and its Law in the Criminal Justice Process

The development of children's rights in criminal justice is very important in order to promote and realize legal protection for children. Begin by looking at the mental, physical, social, economic aspects to find out the problems that arise from the pressure or the environment. In this case, the participation of government and parents is needed through the process of proper development and dedication and the noble values of the nation. This can be realized by compiling social data about the child's personality, family, social and economic conditions. Then the pattern of coping with each child and the situation is private.The implementation of rights and obligations for children who commit crimes need to get help and protection to be balanced

https://dx.doi.org/10.22161/ijaems.4.6.1 *ISSN: 2454-1311*

and humane. The obligation of the child should always be considered in accordance with the situation, condition, physical, and social circumstances in order to avoid the implementation of law by an improper judge to children in conflict with the law. The following are rights that need to be fought in the process of the Criminal Court and the matters that the Judge must consider include: (a) Rights are required as unproven; (b) The right of protection from harmful acts, causing mental, physical, and social suffering; (c) The right to obtain counsel from the legal counsel; (d) The right to have transport facilities and counseling in participating counseling, in facilitating the examination; (e) The right to express an opinion; (f) The right to obtain a humane coaching according to Pancasila and the act 1945 and correctional ideas. (g) The right to be in contact with parents and their families.Some of the supporting factors in the efforts to develop the rights of children in criminal justice are: The rationale that supports Pancasila, the 1945 Constitution. The outline of the State's direction of religion, the positive social values of the child, the norm (Declaration of child rights, Child Welfare Act).The growing awareness that children's problems are a national issue that must be addressed as early as possible together.

Counseling, coaching, education and teaching on children including the development of the Child Protection Law courses, child protection efforts concerning the interests of the child; The government together with the community is expanding real efforts in providing facilities for child protection. Some of the constraining factors in the efforts to develop the rights of children in criminal justice are: Lack of proper understanding of the coaching, supervision and prevention efforts that constitute the realization of child protection efforts; Lack of legal belief that children's issues are a national problem that must be handled together as a national responsibility.

4. The Factors Cause Children in Conflict with the Law

Factors causing children to deal with the law (1) poverty, This factor is a structural problem that until now there is no proper recipe to fix it. In which, the state can not create enough jobs and decent income for parents who have many children then, the children become drop out. Because the education of the child is low and the child is looking for an important job that can earn money and then can meet the needs of his life. Not being able to resist the consumptive appetite and lack of money on the other hand sometimes make the child become ‘dark eyes’ to commit a criminal act such as theft, robbery even killing to get the goods or needs he wants. (2) Family Environment, All child problems come from family problems. When parents educate children too hard to make a beating so that between children and parents are hostile to each other.Frequently the child came to the conclusion that he is no longer loved. In addition, there is also a parental ignorance of the fate of his son, so that soon let the child mingle with people whose behavior diverges. There is no control and no affection parent who encourages children since childhood is used to wandering and join their friends who have grown up. This is where the child begins to learn the courage to commit an unlawful act.

5. The Role of the Law Enforcement Officials

The system of criminal imprisonment on the children's case and the application of the law by the judge of punishment sanction is divided into two kinds of crime and action. Criminal is divided into two kinds, namely: principal criminal and additional criminal. Criminal Penalty is imprisonment, fine, or criminal supervision. Additional criminal punishment may include the expropriation of certain goods or payment of indemnity, whereas the action is: return to the parent guardian, or foster parent, submit to the state for education, coaching and work training. With regard to the sanction of punishment, the judge shall not impose the accumulated sentence of the accused, meaning that criminal punishment of action shall not be imposed simultaneously. In the science of criminal law, a judge shall not impose a prison sentence that exceeds the maximum limit established by law. The judge can only decide the most severe punishment equal to the amount of imprisonment as set out in the relevant regulations. For the children's case, in Law no. 3 of 1997 has stipulated that the maximum limit of jail sentences for children is set lower than the criminal penalty against adults.If the naughty boy as referred to in Article 1 sub-article 2 letter a, hasn’t reached the age of 12 (twelve) years, he commits a crime that is not threatened with death or is not subject to life-long penalty, then the child is imposed one of the actions as meant in Article 24: This provision applies only to a defendant of a child aged 12 (twelve) years, to an age of 18 (eighteen) years who has not committed a criminal offense punishable by death penalty or life imprisonment, such as a criminal offense, or extortion, the maximum imposed penalty is half the criminal penalty stipulated by the articles.A child committing a criminal offense under death penalty or life imprisonment when he is between 12 (twelve) years old and up to 18 (eighteen) years old, the judge can only impose a maximum imprisonment of 10 (ten) years. For example, the defendant committed a criminal act of premeditated murder. For a defendant aged 8 (eight) years up to before the age of 12 (twelve) years whose criminal offenses are threatened with capital punishment or life imprisonment, the judge can only impose penalties in the

https://dx.doi.org/10.22161/ijaems.4.6.1 *ISSN: 2454-1311*

form of submitting to the state for education, coaching and vocational training .For the case of a child, the conditional penalty has been self-regulated in Article 29 of the Juvenile Court Law: The Judge may be subject to conditional imprisonment if the imprisonment is 2 (two) years imprisonment. A maximum of 2 (two) years is not the magnitude of criminal threats from a provision of the Law which is for the child, but the maximum sentence imposed by a special judge for a conditional penalty. In the court's decision on the conditional penalty, the Law requires that the judge determine two conditions: (1) The general requirement that a naughty child will not commit another criminal offense during a conditional period. If a crime is committed again, then the provision that it is mandatory to undergo the criminal law after there is an order from the judge, and (2) A special requirement is the determination of the attitude to perform or not to do certain matters specified in the judge's decision with due regard to the freedom of the child.What is meant by criminal penalty of supervision is a special punishment imposed on the child, namely the supervision made by the prosecutor against the child's behavior in daily life in the child's home, and the guidance provided by the correctional supervisor. The punishment by the judge in the form of the defendant's act is left to the state, then the naughty boy is subsequently placed in a child prison, the position of the convicted person as a child of the state. After being admitted to a Child Correctional Institution, the fate of the child is not left alone, but the head of the relevant institution should pay attention to the child's personally.

III. RESEARCH METHODOLOGY

This research was statutory approach, and case approach method. The purpose of this study is to find out "How the legal analysis of sentencing by judges in prosecuting murder committed by minors in the court.

IV. DISCUSSION

Basic Punishment

The Basic Judgment of Judge Sentence in Judging Criminal Acts and Severe Persecution by Minors, Judgment Considerations Based on the facts revealed in the court has been proven to violate Article 340 of the Criminal Code and Article 351 (2):Whosoever element: whosoever in this element is the subject of: individuals, communities, groups allied together, or legal entities that first planned to eliminate the lives of others for personal and certain interests . Whereas against the defendant who has been brought before the court he / she has been able to answer all questions well and capable of acting in law and can be held legally accountable for his actions and there is no foundation for forgiving or justifying elements.Elements perform planning plans and threats of violence or maltreatment. Referred to as "making plans and threats of violence, or persecution" in accordance with the facts revealed in the hearing are related to the statements of witnesses and statements of the accused. Thus, these elements have been satisfied and proven legitimate and convincing according to the law.The grounds of the judges' considerations against the defendant include: That the defendant has violated the Criminal Code Article 340 and Article 351 paragraph (2) stateing: "Every person who commits a crime to eliminate the life of another person who first planned, either alone or group which resulted in severe injury, such person is duly convicted for 8 (eight) years, or a fine of up to Rp. 1,000,000 - (one thousand rupiah) ". That the defendant has committed acts of violence against the child of the Criminal Code Article 351 yat (2) about the persecution. Based on the analysis through KUHP Section 340 and Article 351 (2) concerning Planning investigated from judges' considerations, if it is related to Law no. 3 of 1997 on the Process of Procedures for Juvenile Justice and Child Protection Act no. 23 of 2002, it can be concluded that "the determination of the verdict is less precise, considering the defendant in which his age is still a teenager or younger, it needs better guidance and education in order to uphold the rights of children in Indonesia".

V. CONCLUSION

The conclusion of the research is that the criminal act of planning and severe maltreatment committed by the 16-year-old child is one of the serious crimes, resulting in the death of the victim. In the demand of the Public Prosecutor in accordance with Article 340 and Article 351 (2) of the Criminal Code with the threat of imprisonment for a maximum of 10 (ten) years. Judges in prosecuting the case punishment of children in the ruling must be based on Law no. 3 of 1997 in Article 26 referred to Article 1 sub-article 2 letter a, shall be a maximum of a half year. Through some consideration, because considering the age of the defendant is still 16 (sixteen) years old and has never committed a previous criminal act, finally the Panel of Judges sentenced to 8 (eight) years imprisonment to the defendant. The judge's decision is appropriate that it has been based on the justice and wisdom, in order for rights to work properly. The judge should examine the background of life as well as the mental and psychological state of a child in the judicial and court proceedings and in its punishment.

https://dx.doi.org/10.22161/ijaems.4.6.1 *ISSN: 2454-1311*

REFERENCES

[1] Adami, C. (2004). Kejahatan Terhadap Tubuhdan Nyawa. Jakarta: Rajawali Pers.
[2] Arifin. (2007). Pendidikan Anak Berkonflikdengan Hukum. Bandung: Alfabeta.
[3] Bonger, W.A. (1982). Pengantar Tentang Kriminologi. Indonesia, : Pembangunan
[4] Ghalia,B. W. (2000). Pidanadan Pemidanaan.Jakarta: RinekaCipta.
[5] Moelajatno.(2002).Azas-azas Hukum Pidana. Jakarta: RinekaCipta.
[6] Prints, D. (2003). Hukum Anak Indonesia. Bandung : Citra Aditya bakti,
[7] Sudarsono.(1991). KenakalanRemaja. Jakarta. : RinekaCipta.
[8] Soesilo, R. (2007). Kitab Undang-Undang Hukum Pidanadan Komentar-komentarnya. Bogor : Polite
[9] Wagiati, S. (2005). HukumPidanaAnak. Bandung: RefikaAditama.

https://dx.doi.org/10.22161/ijaems.4.6.2 *ISSN: 2454-1311*

Intelligent Healthcare Monitoring in IoT

Kaviya P[1], Antony Seba P[2]

[1,2] Assistant Professor, Department of Information Technology, Kamaraj College of Engineering and Technology Madurai, Tamil Nadu, India

[1]kaviyaap@gmail.com, [2]sebaantony97@gmail.com

Abstract— *The developing of IoT-based health care systems must ensure and increase the safety of the patients, their quality of life and other health care activities. We may not be aware of the health condition of the patient during the sleeping hours. To overcome this problem. This paper proposes an intelligent healthcare monitoring system which monitors and maintains the patient health condition at regular intervals. The heart rate sensor and temperature sensor would help us analyze the patients' current health condition. In case of major fluctuations in consecutive intervals a buzzer is run in order to notify the hospital staff and doctors. The monitored details are stored in the cloud "ThingSpeak". The doctor can view the patient health condition using Virtuino simulator. This system would help in reducing the random risks of tracing a patient medical highly. Arduino UNO is used to implement this intelligent healthcare monitoring system.*

Keywords— Arduino UNO, Heart Rate Sensor, Temperature Sensor, Buzzer, ThinkSpeak, Virtuino simulator.

I. INTRODUCTION

Nowadays Internet of Things based health care systems play a significant role in Information and Communication Technologies. It has a remarkable contribution in the development of medical information system. The tracking, tracing, and monitoring of the patients health care activities are challenging research directions. With the development of world, Health monitoring system is used every field such as hospital, home care unit, sports. This health monitoring system use for chronicle diseases patients who have daily check-up. Normally it is difficult to keep track on abnormalities in heartbeat count for patient itself manually. The average heartbeat per minute for 25-year old ranges between 140-170 bpm while for a 60-year old it is around between 115-140 bpm and body temperature is 37degree Celsius or 98.6 Fahrenheit. Patients are not well versed with manual treatment which doctors normally use for tracking the count of heartbeat. There are various instruments available in market to keep track on internal body changes.

Different platform like Microcontrollers are used to design the system based on this performance. Different biomedical sensors like temperature sensor, heart rate sensor are used for monitoring the health condition which is integrated on single system on chip. If any varied change takes place it is notified.

This notification would help to take an appropriate action at an instance of a time. This would save patients from the future health problem which would arise. This would also help patient's concern doctor to take an appropriate action at proper time.

Another issue, we may not be aware of the health condition of the patient during the sleeping hours. To overcome this problem, this paper proposes an intelligent healthcare monitoring system which monitors and maintains the patient health condition at regular intervals. The heart rate sensor and temperature sensor would help us analyze the patients' current health condition. These two sensors are used to monitor the health condition of the patients especially at the hospital at equal intervals. In case of major fluctuations in consecutive intervals a buzzer is run in order to notify the hospital staff and doctors. These monitored details are stored in the cloud "ThingSpeak". The doctor can monitor the patient health condition through Virtuino simulator using the IP address of the cloud. This project would help in reducing the random risks of tracing a patient medical highly**.**

The rest of the paper is categorized as follows. We discuss previous works on related topics in Section II. Section III describes proposed system in detail. Section IV provides the system methodology. Section V provides the results. Section VI finally concludes the paper.

II. RELATED WORKS

Ghulam Muhammad, et al [1] have proposed an automatic voice disorder detection system is used to monitor the resident of all age group and professional backgrounds. To analyze the difference between intensity of normal and disorder subjects, the LP co- efficient based spectrum is computed. This leads to high risk of prevalence of voice disorders. Voice complications have the negative impacts over the life of individuals. A smart health care system can assist the residents of different professions and of different age groups. To avoid these circumstances, a smart healthcare system is proposed and developed. The proposed system detects the voice disorder by determining the source signal from the speech through the linear

https://dx.doi.org/10.22161/ijaems.4.6.2 *ISSN: 2454-1311*

prediction analysis. The analysis calculates the features from normal and disordered subjects. The proposed system used the computed spectrum to differentiate between normal and disordered subjects.

Prashant Salunke, et al [2] have proposed a Patient's physiological information is managed and recorded for long time using wearable sensors. This system is expected to reduce costs, increase the quality of life, and enrich the user's experience. This system reduces the time of patient to visit to doctor every time he/she needs to check ECG and temperature and pulse oxygen in blood. Doctors and hospitals could make use of real-time data collected on the cloud platform to provide fast and efficient solution. Doctors who are overwhelmed with patient load can use this system and also it is beneficial for rural patients who have less access to health care facilities.

Sumalatha, et al [3] have proposed an IoT based Health Monitoring System which demonstrates collection and interoperation of data. The data provided to the doctor can support the emergency medical service for a patient for the improvement of healthcare. The sensors and Raspberry Pi 3 Model B are the physical objects equipped for communicating with the doctor though internet. It helps the doctor to control the overall state of monitored patients independently and easily. Also the patient information can be monitored from anywhere in the world. The system comprises of web server part. The sensors gather the medical information of the patient that include patient's heart rate, blood pressure, and pulse rate and the physical examine of the patient through the Pi camera, and this information is sent to the Internet through Raspberry Pi which acts as a server.

Prabha Sundaravadivel, et al [4] have discussed an architecture for an ambulatory health monitoring system using a body coupled communication channel. The proposed architecture can be used for smart health monitoring as part of the Internet of Things. The design was validated using Simulink. A 31 % power reduction was observed in the monitoring system when human body communication happened.

S.Amutha et al [5] have proposed an IoT based wireless healthcare monitoring. They have developed a system for remote patient monitoring in healthcare field. In hospitals, patient's physiological parameters are needed to be constantly monitored, usually done by a doctor or other paramedical staff for maintaining a record of it. It is a tedious method. The primary function of this system is to constantly monitor inpatients and outpatients physiological parameters such as pulse rate, temperature using wireless communication. This system continuously reads patient's pulse rate or heart beat rate and body temperature through Fingertip Measuring Heart rate sensor and Thermistor Temperature Sensor. This system enables high risk patients to be timely checked and enhance the quality of a life of patients.

III. PROPOSED WORK

In this work, we monitor the heart beat and body temperature using the heart rate sensor and temperature sensor (LM35). The data are collected and stored in the cloud "ThingSpeak". In case of abnormal change in the heart rate or body temperature the buzzer in the system alerts the nearby person and sends a message to the consultant doctor‘s mobile phone. The stored data in cloud can be viewed by using mobile application. Virtuino simulator which shows the current patient‘s condition to the doctor from anywhere.

The system is a combination of hardware and software components. The hardware part consists of embedded system and software is the mobile app designed using Android Studio.

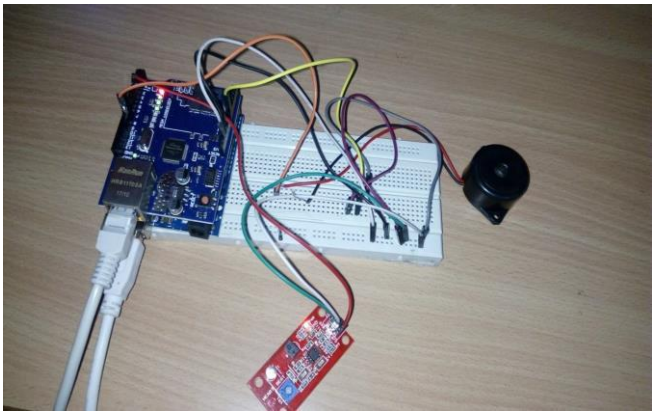


Fig. 1: Hardware Connection

3.1 Reading Inputs

3.1.1 Temperature Sensor

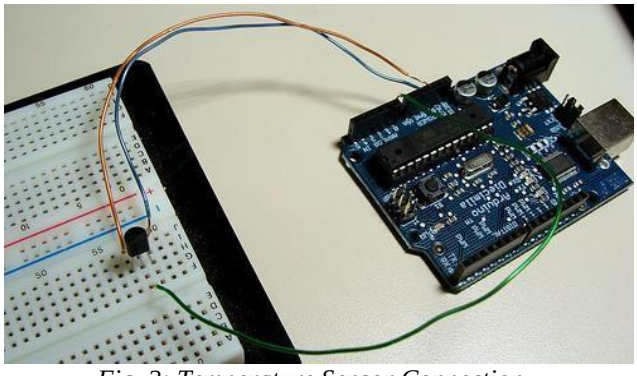


Fig. 2: Temperature Sensor Connection

Fig.2 shows the connection between the Arduino and LM35. Here the green colour wire is connected to the analog pin A1, orange colour wire is connected to Vcc and blue colour wire is connected to ground in the arduino board.

https://dx.doi.org/10.22161/ijaems.4.6.2 *ISSN: 2454-1311*

ALGORITHM

1. Collect body temperature as degree Celsius or degree of Fahrenheit.
2. Convert voltage -> Celsius
3. Temp=(output voltage / 1024) * 5000
4. Cel=Temp / 10
5. Finally display the output in the form of 'C.

3.1.2 Heart Rate Sensor

Fig. 3: Heartbeat Sensor Connection

Fig. 3 shows the connection between the Arduino and heart beat sensor. Here the pink colour wire is connected to the analog pin A1, Red colour wire is connected to Vcc and black colour wire is connected to ground in the arduino board.

ALGORITHM

1. Collect the heart rate from the patient.
2. Check the conditions
   if((millis() - oldTime) > 1000)
   beat=beatCount*60;
   oldTime = millis();
   beatCount=0;
3. Increment the count value
4. Finally the value is displayed in the serial monitor.

3.2 Processing the Data

It analyze the inputs and checks the condition whether the heartbeat, body temperature are normal or abnormal. To display the temperature results on the web server, a ThingSpeak is used.

3.3 Emergency Alerts and Mobile App

If there is a change in the body temperature and heartbeat, the buzzer alters the nearby person and the message will send to the doctor. Doctor can continuously monitor the patient's health condition on his smart phone using a Mobile app.

The patients' history will be stored in the cloud platform. The doctor can access the information from anywhere at any time. Using the IP address of the ThingSpeak, the doctor can view the current health status of the respective patient.

IV. SYSTEM ARCHITECTURE

Temperature sensor and heart rate sensor are used to sense the patients' health condition. Sensors are connected to the Arduino microcontroller which controls the signals. If there is a change in the body temperature and heart beat, the buzzer alerts the nearby people. As soon as the buzzer rings, the message will send to the corresponding doctor.

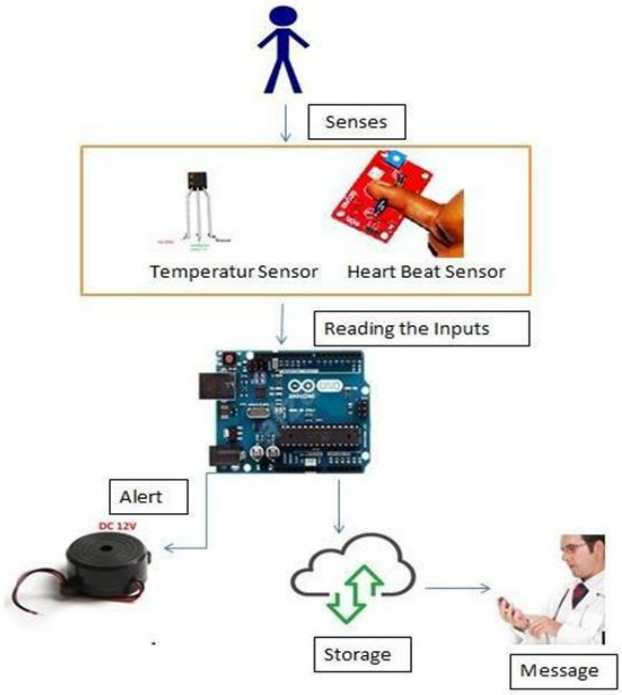


Fig. 4: System Architecture

The sensed data are sent to the cloud (i.e.) ThingSpeak. It is an open source to store and retrieve and the data are been stored in a publically. The data are represented in the form of graph or excel sheet.

The doctor can view the information of the patient at anytime and anywhere using Virtuino Simulator. This Simulator is in-build app in play store. By using the IP address of ThingSpeak channel the doctor can view the current condition of the patient. In this app, it shows the recent temperature and heart beat status of the respective patients.

Finally the doctor can view the patients' details at anytime and anywhere using the Virtuino simulator and ThingSpeak. Health monitoring system architecture is shown in Fig. 4.

V. RESULT AND DISCUSSION

5.1 Temperature Reading

Fig. 5 shows the temperature result which is displayed on the serial monitor. The resultant data will send to the cloud for doctor's reference.

https://dx.doi.org/10.22161/ijaems.4.6.2 *ISSN: 2454-1311*

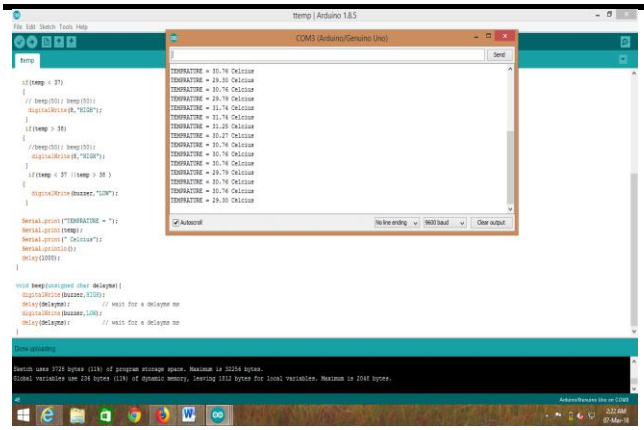


Fig. 5: Temperature Results

Table 1 shows the condition of the human body temperature. If the temperature level increases above 42'C or decreases below 25'C, buzzer alerts the nearby person and message send to the doctor's concern mobile phone.

Table. 1: Temperature data

Temperature	Causes
<25 'C	Low
>42'C	High
37'C	Normal

5.2 Heart Beat Reading

Table 2 shows the condition of the patients' heart beat. If the heart beat level increases above 120 BPM or decreases below 60 BPM, buzzer alerts the nearby person and message send to the doctor's concern mobile phone.

Table. 2: Heart Beat Data

Heart Beat	Causes
<60 bpm	Low
>120 bpm	High
60-120 bpm	Normal

Fig. 6 gives the heart beat result which is displayed on the serial monitor. The resultant data are sent to cloud for doctor's reference.

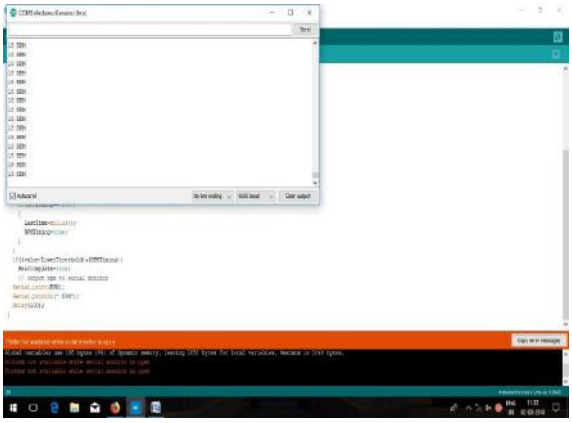


Fig. 6: Heart Beat Results

Table 7.2 shows the condition of the patients' heart beat. If the heart beat level increases above 120 BPM or decreases below 60 BPM, buzzer alerts the nearby person and message send to the doctor's concern mobile phone.

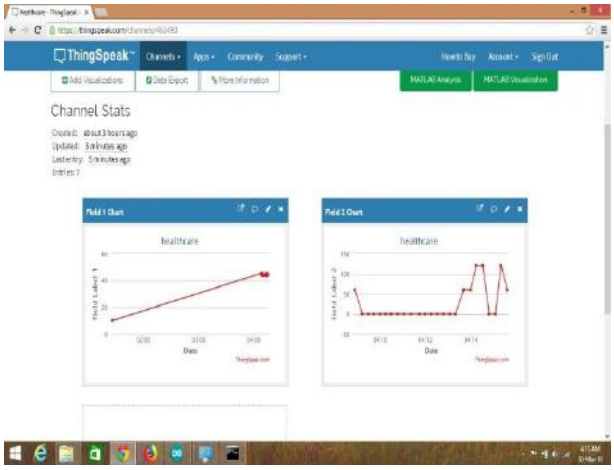


Fig. 7: Data in ThinkSpeak

The data are collected from the system and pushed into the ThingSpeak. In ThingSpeak, we created two channels. Temperature values are stored in first channel whereas heart beat values are stored in second channel.

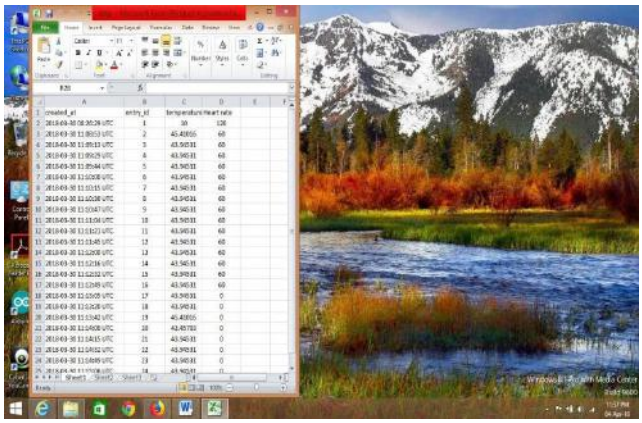


Fig. 8: Data in ThinkSpeak (.CSV)

In Fig. 8, the data are exported in .csv file format to view the health condition of the patients' as show in the Fig. 7.

Fig. 9: Virtuino Simulator Results in Mobile

https://dx.doi.org/10.22161/ijaems.4.6.2 *ISSN: 2454-1311*

Virtuino is an Android app for monitoring sensors or control electrical devices via Bluetooth, local Wi-Fi or Internet. In this Simulator, doctor can check the current heart beat and temperature value for the patient. Figure 7.6 shows the current value of the patients' health conditions. It can be viewed through the doctor's mobile phone by using the IP address.

VI. CONCLUSION

The proposed health monitoring system monitors and tracks the patients' health conditions like body temperature and heartbeat periodically. The buzzer in the system alerts the nearby person and the message is send to the consultant doctor's mobile phone in case of any emergency. The data are stored in the cloud "ThingSpeak". Hence, the health tracking professionals can monitor the patients from anywhere at any time. Thus our intelligent health monitoring system is able to transmit the sensed data to the doctor's PC or mobile Phone. This project would help in reducing the random risks of tracing a patient medical highly.

REFERENCES

[1] Antonio J. Jara, Miguel A. Zamora-Izquierdo, and Antonio F. Skarmeta. (2015). Interconnection Framework for Health and Remote Monitoring Based on the Internet of Things, IEEE Journal On Selected Areas In Communications/Supplement, Vol. 31, No. 9.

[2] Chi-chun Lo, Tsung-yiChien, Jeng-shyang. (2016). Novel Non-Contact Control System for Medical Healthcare of Disabled Patients, Received April 1, 2016, accepted April 13, 2016, date of publication May 11, 2016, date of current version October 6,.

[3] IulianaChiuchisan, Hariton-NicolaeCostin,OanaGeman. (2014). Adopting the Internet of Things Technologies in Health Care Systems, 2014 International Conference and Exposition on Electrical and Power Engineering (EPE 2014).

[4] Natarajan.K. (2016). Smart Health Care System Using Internet of Things, Journal of Network Communications and Emerging Technologies (JNCET) Volume 6, Issue 3, ISSN: 2395-5317.

[5] PrabhaSundaravadivel and Saraju P. Mohanty. (2016). Exploring Human Body Communications for IoT Enabled Ambulatory Health Monitoring Systems, **IEEE International Symposium on** Nanoelectronic and Information Systems (iNIS), **DOI:** 10.1109/iNIS.2016.016.

[6] Prashant Salunke and RasikaNerkar. (2017). IoT Driven Healthcare System for Remote Monitoring of Patients, International Journal for Modern Trends in Science and Technology Vol. 03, Issue. 06.

[7] Saraswathi, S. Amutha. (2016). "IoT Based Wireless Healthcare Monitoring, IJETST-Vol.03., Issue 05May ISSN 2348-9480.

[8] Sumalatha V and Dr. R. C. Biradar. (2016). IoT based Health Monitoring System, IJRT Vol.05., Issue. 05.

[9] Zainab H. Ali. (2017). Internet of Things (IoT): Definitions, Challenges and Recent Research Directions, International Journal of Computer Application, Vol.128., Issue.01., DOI: 10.5120/ijca2015906430.

[10] Zulfiqar Ali, Ghulam Muhammad, And Mohammed F. Alhamid. (2016). An Automatic Health Monitoring System for Patients Suffering From Voice Complications in Smart Cities, IEEE International Conference on Multimedia & Expo Workshops (ICMEW), **DOI:** 10.1109/ICMEW.2016.7574719.

https://dx.doi.org/10.22161/ijaems.4.6.3 *ISSN: 2454-1311*

The Influence of Learning using Contextual Teaching and Learning Approach to Physics Learning outcomes of High School Students

Caroline Claudia Anggina Neftyan[1], Eko Suyanto[2*], Agus Suyatna[3]

[1]Student in Physics Education, Lampung University, Indonesia
[2]*Lecturer in Physics Education, Lampung University, Indonesia
[3]Lecturer in Physics Education, Graduate Program, Lampung University, Indonesia
*Corresponding author: ekosuyanto011@gmail.com

Abstract— *Learning process should be able to attract interest and make students active in learning, which material can be taken directly through the phenomenon experienced in daily life. This study aims to determine the influence of learning using Contextual Teaching and Learning (CTL) approach to physics learning outcomes of Newton's Law about Motion. The sample is students of class X MIA_5 in SMA Negeri 14 Bandarlampung using Pretest-Posttest Control Group Design. Techniques of data collection using cognitive learning outcomes test instrument. The data analyzed by using normality test, N-Gain test, and Paired Sample T-test. The result of research indicates that there is the influence of using CTL approach in improving student learning outcomes of Newton's Law About motion, with p-value significantly different at 95% confidence level so it can be stated that there is the difference of pretest and posttest mean result using CTL approach. The average N-Gain score is 0.73 which included in the high category. It shows that the application of CTL approach has influence in improving student learning outcomes.*

Keywords— Contextual Teaching and Learning Approach, Learning Outcomes.

I. INTRODUCTION

Education in Indonesia is currently moving towards a modern learning era. Conventional learning systems have begun to abandon and now people use innovative, progressive and contextual learning systems. Based on the observation in one of Senior High School in Bandar Lampung, Indonesia, changes of the learning system is not fully perfect. In the application still have learning problems that less difficult to solve, such as less meaningful learning, where most students can not make the relation between the physics concept with its application in daily life. It can be seen through the student learning result that mostly not reach yet the minimum criteria of mastery learning in schools that is equal to 73. Teacher-centered learning confines students to actively involved in the learning process so as to make the learning process unattractive and cause students lose interest in physics learning. The learning process should be able to attract students and make students actively involved in the learning process, which can be done by applying the learning with Contextual Teaching and Learning (CTL) approach.

CTL approach is an approach involving active students in the learning process to find the concepts learned by linking the material with the knowledge possessed and the student experience in daily life[2]. CTL approach leads students to construct their own new knowledge and skills when students learn, and also CTL approach fully engages students in the learning process[3, 4]. Therefore, the students will be more motivated to be actively involved in the learning process in the classroom.

Components in the implementation of learning with CTL approach consist of 1) constructivism, 2) inquiry, 3) questioning, 4) learning community, 5) modeling, 6) reflection, 7) authentic assessment[5]. Implementation of CTL approach is expected to make students find meaning in the learning that has been done in class with its application in everyday life. To develop student thinking, the material learned by students can be taken directly through the phenomenon experienced in daily life.

CTL approach encourages the child to discover the meaning of learning by linking the material learned with real-life situations so that the knowledge gained will be firmly embedded in his memory. CTL approach aims to increase the motivation of learners to take what they have learned and apply it, making it meaningful in the context of actions and interactions within their daily situations, and also students learn through experience instead of memorizing[6, 7]. The contextual learning is a system that stimulates the brain to construct patterns that embody meaning when students are able to find meaning when students will learn and remember what they have

https://dx.doi.org/10.22161/ijaems.4.6.3 *ISSN: 2454-1311*

learned[8]. It is important to apply so that the information received is not only stored in short-term memory, which is easily forgotten, but can be stored in long-term memory so that it will be appreciated and applied in the job task[9]. So that, it is hoped that when students are able to find meaning in their lessons, students will learn and remember what they learn, so it is possible for students to reach learning objectives and gain satisfactory learning outcomes.

Learning outcomes are the learning outcomes that have been achieved from a learning process that has been done by learners, so to know a job is successful or not, it requires a measurement[10]. So through the learning outcomes, it can be seen how far the students can take in and understand the certain subject matter. Through the CTL approach, learning processes that occur in the class will actively involve students and encourage students to discover and build their own concepts so that learning outcomes can be improved[11].

CTL approach has a very close relationship with everyday life, so it is suitable for use in teaching physics material that is easy to find especially by students every day. One such material is Newton's Law of Motion, where its application is often experienced directly without students being aware of it. Based on the explanation, the researcher conducted a study to see whether there is an influence of learning by using CTL approach to student learning outcomes on Newton's Law on Motion material at SMA Negeri 14 Bandarlampung.

II. METHOD

This study uses one experimental class given treatment in the form of learning with CTL approach. The design of this study using One-Group Pretest-Posttest Design. The pretest is used to assess students early and posttest abilities used to assess student learning outcomes after treatment is applied. The study design can be seen in the table below.

O_1	X	O_2

Fig. 1: One Group Pretest-Posttest Design

The population in this study are all student of class X MIA (Mathematics and Science class) in one of senior high school in Bandar Lampung, Indonesia, at the second semester of the academic year 2017/2018. The experimental class is class X MIA_5 as the research sample determined by using classify random sampling technique that is taking 1 class from 6 class population at random. Variable in this study that consists of variable Contextual Teaching and Learning approach and variable of student learning outcomes by applying Contextual Teaching and Learning approach.

The instrument used in this study is the test of cognitive learning outcomes with 15 multiple choices questions on the subject matter of Newton's Law of Motion. Instruments that have been tested for validity and reliability are then given to students at the time of pretest and posttest implemented. It is done to measure student learning outcomes after being given learning treatment with CTL approach. Based on the data obtained, the researchers conducted a data analysis to compare the average of students initial ability (pretest) with the final ability (posttest) in the sample class. Statistical analysis used is normality test and N-Gain test. To test the hypothesis, the researcher used Paired Sample T-test with IBM SPSS 23 for Windows program.

III. RESULTS AND DISCUSSION

This study was conducted at one of Senior High School in Bandar Lampung, Indonesia, in class X MIA_5 which consist of 32 people with time allocation that is 3 times face to face for 3 hours lesson. The researcher first gives the pretest to the students at the beginning of the activity. Then the researchers continue the learning process by acting as a teacher in the classroom. The questioning component is applied when the teacher gives apperception questions to students. Questions are given related to the phenomenon that students often experience directly in everyday life. Then the teacher displays a video related to the learning material and asks the student to reenact a similar act to the video they have watched. This is the application of the modeling component.

Furthermore, as a form of applying the components of learning and inquiry communities, teachers divide students into small groups to design, perform and create experimental reports related to Newton's Law of Motion. The teacher guides the students to relate the results of the experiments obtained and formulate the results of the analysis that has been done as a form of application of the constructivism component. The teacher invites students to communicate with each other about the results of experiments that have been done and then concluded together with the learning that has been done. Teachers also encourage students to give the impression and suggestions related to the learning that has been done as the application of the reflection component in the CTL approach. Then the teacher gives the exercise and questions to measure the learning outcomes obtained by the students as the application of the authentic assessment component.

Analysis of the instrument in the study using the validity and reliability test with the number of 40 questions to determine the level of validity and reliability of the questions used in data collection of student learning outcomes. Based on the result of the validity test, it is known that there are three invalid questions with the acquisition of $r_{hitung} < r_{tabel}$, or the level of validity

https://dx.doi.org/10.22161/ijaems.4.6.3 *ISSN: 2454-1311*

possessed by the three questions does not reach 0.360. So, there are only 37 questions are declared valid and can really measure the student learning outcomes. Then based on the reliability test results, the value of Cronbach's Alpha obtained by 0.950 where the results stated that the questions have a high level of reliability or a high degree of reliability. The value of Cronbach's Alpha is in the range of 0.800 ≤ r <1,000 with the classification of very high-reliability value. Based on the results of the analysis of the instrument, researchers determine the 15 questions that will be used in the data collection pretest and posttest students.

Data obtained from this study is quantitative which obtained based on pretest and posttest result of the students. Based on Table 1, it can be seen that the average of pretest obtained by the students before being given the learning treatment with CTL approach, only 37 points. This indicates that the initial ability of the students before being given treatment can be said to be low. After being given treatment, it is known that the ability of students in the form of posttest average value has increased by 46 points to 83 points. Based on these results, it can be seen directly that there is a significant increase in student learning outcomes after the researchers provide treatment in learning by using CTL approach. After obtained pretest and posttest value, it can be calculated the value of N-Gain students to know the average increase in student learning outcomes obtained. Through the calculation obtained the average value of N-Gain is 0.73 and included in the high category.

Table.1: Data Result of Pretest, Postest, and Gain of The Student

	Parameter	*Pretest*	*Posttest*	Gain
1	The lowest value	13	67	0,38
2	The highest value	67	100	1,00
3	Standard deviation	13,402	8,957	0,134
4	Average value	37	83	0,73

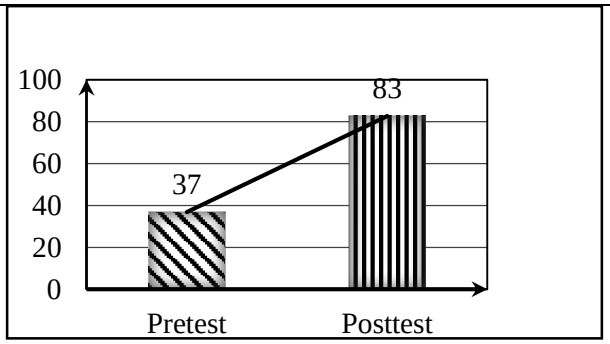


Fig. 2: Graph of Average Comparison of Student Pretest and Posttest Result

After the scores were obtained, the researchers conducted a normality test of the pretest and posttest of the students to determine whether the study sample was normal or not. Based on Table 2, it can be seen that the results of the normality test on pretest and posttest students have a value of p > 0.05. So, it can be concluded that the sample used was normally distributed. Thus, the researcher can continue the next step test that was the Paired Sample T-test.

Table 2. The Result of Normality Test of Pretest and Posttest Value

Value of	*Kolmogorov-Smirnov*	Conclusion
	p	
Pretest	0,089	H_0 accepted
Posttest	0,053	H_0 accepted

Paired Sample T-test or difference test was done to know whether or not the difference in mean learning outcomes of the sample class, provided that the data is normally distributed. Based on Table 3, it can be seen that the p-value obtained is 0,000 < 0.050 is significantly different at the 95% confidence level so that the decision of the null hypothesis is rejected. This indicates that there is the difference of mean result of pretest and posttest of the students before and after learning with CTL approach.

Table 3. The Result of Paired Sample T-Test

Mean	*Std. Deviation*	*t*	*df*	*p*	Conclusion
-45,844	11,060	-23,447	31	0,000	H_0 rejected

The average difference between pretest and posttest results obtained by students shows that there is an influence of CTL approach to student learning outcomes. Then, by combining the results of the analysis of posttest results reduced by pretest results and based on N-Gain value, it can be stated that learning using CTL approach can significantly improve student learning outcomes in Newton's Law about Motion material significantly.

The results of this study are supported by the results of another study [1] which states that there is a significant effect due to the application of contextual learning on student learning outcomes. In addition, [12] it was found that with the use of the CTL approach there was a significant effect on student learning outcomes on Dynamic Fluid materials. Then, supported by other study results [13] that learning by CTL approach can improve student learning outcomes.

In the learning process, the students also showed interest by participating actively in finding their own concepts related to Newton's Law about Motion material that was studied. Students also willing to listen to the teacher's

https://dx.doi.org/10.22161/ijaems.4.6.3 *ISSN: 2454-1311*

directions in order to obtain the meaning of the learning. During the learning process, students work well together in their respective groups to find the meaning of learning and encouraged to learn independently using the help of instructional media provided by the teacher as modeling component of contextual learning. The results of the study [14] suggest that applying the CTL approach to collaboration between students and teachers in harmonious relationships can stimulate students to think creatively in expressing opinions, improving communication skills, responsibility, confidence, and also building student learning interest.

Students help each other to solve the problems given and appreciate the opinions conveyed to each other. Students do not hesitate to ask the teacher to fulfill their curiosity and ask when experiencing difficulties in understanding the relationship between the material learned in relation to the real life. Thus, the learning activities run well and create an active learning community atmosphere. This is supported by the results of the study [15] which states that students will seek solutions to integrate all the learned material concepts with high understanding, skills, and teamwork so that student learning achievement increases significantly.

Students have been motivated to learn Newton's Law about Motion material and stimulate students thinking skills to discover the meaning of their learning so that students are easier to remember the material they have learned. This is supported by the results of the study [16] which states that learning with the CTL approach is effective in improving students critical thinking skills. Active role in learning makes students able to find the meaning contained in the learning and remember the material that has been learned so that students are able to obtain better learning outcomes and achieve learning objectives. This is supported by the results of the study [17] which states that if students activeness increases, student learning outcomes increase, meaning the quality of learning also increases.

Based on the study done, it can be seen that by getting the meaning of learning, then the students were able to get better learning outcomes. This shows that the application of learning by using CTL approach has a good influence in improving student learning outcomes on Newton's Law about Motion material. Thus, CTL approach can be used as an alternative learning that can be applied by teachers in an effort to improve student learning outcomes.

IV. CONCLUSION

Based on the results of the study and the discussion that has been presented, it can be concluded that there is the influence of learning using Contextual Teaching and Learning approach to student learning outcomes, evidenced by the difference of average pretest and posttest result of students significant at 95% confidence level. Contextual Teaching and Learning approach has a very good effect in improving student learning outcomes, as evidenced by the increase of student learning outcomes and high N-Gain value.

REFERENCES

[1] Aritonang, E. S., dan Hakim, A. (2014).Pengaruh Model Pembelajaran Kontekstual Terhadap Hasil Belajar Siswa pada Materi Perpindahan Kalor dan Asas Black di Kelas X Semester II SMA St. Thomas 3 Medan T.A 2013/2014. Jurnal Inpafi (ISSN: 2334-4624), 2(3), 11-19.

[2] Selvianiresa, D., and Prabawanto, S. (2017). Contextual Teaching and Learning Approach of Mathematics in Primary Schools. International Conference on Mathematics and Science Education (ICMScE), IOP Conf. Series: Journal of Physics: Conf. Series 895 012171. doi:10.1088/1742-6596/895/1/012171.

[3] Rusmini, Surya, E. (2017). The Effect of Contextual Learning Approach to Mathematical Connection Ability and Student Self-Confidence Grade VIII SMMP Negeri 8 Medan. International Journal of Sciences:Basic and Applied Research (IJSBAR) (ISSN: 2307-4531), 35(2), 249-262.

[4] Wahyuni, T., Suwandi, S., Slamet, S. Y., and Andayani. (2015). The Implementation of Contextual Approach in Solving Problems Understanding Syntax: Sentence Indonesian at Universities in Surakarta, Indonesia. Journal of Education and Practice (ISSN: 2222-1735 (P)| ISSN: 2222-288 (O)), 6(30), 188-201.

[5] Al-Tabany, T. I. B (2014). Mendesain Model Pembelajaran Inovatif, Progresif, dan Kontekstual: Konsep, Landasan, Implementasinya pada Kurikulum 2013 (Kurikulum Tematik Integratif/KTI). Jakarta: Kencana.

[6] Ilhan, Nail et al. (2016). The Effect of Context-based Chemical Equilibrium on Grade 11 Students' Learning, Motivation and Contructivist Learning Environment. International Journal of Environment & Science Education (ISSN: 1306-3065), 11(9), 3117-3137.

[7] Fadillah, A., Dewi, N. P. L. C., Ridho, D., Majid, A. N., dan Prastiwi, M. N. B. (2017).The effect of application of contextual teaching and learning (CTL) model-based on lesson study with mind mapping media to assess student learning outcomes on chemistry on colloid systems. International Journal of Science and Applied Science: Conference Series (ISSN: 2549-4635 (P) | ISSN: 2549-4627 (O)), 1(2), 101-108.

https://dx.doi.org/10.22161/ijaems.4.6.3 *ISSN: 2454-1311*

[8] Johnson, E. B. 2014. Contextual Teaching & Learning Menjadikan Kegiatan Belajar-Mengajar Mengasyikkan dan Bermakna. Bandung: Kaifa.

[9] Surdin. (2018). The Effect of Contextual Teaching and Learning (CTL) Models on Learning Outcomes of Social Sciences of The Material of Forms The Face of The Earth on Class VII of Junior High School. International Journal of Education and Research (ISSN: 2411-5681), 6(3), 57-64.

[10] Tobing, M. T., Saragi, D., dan Bungana, R. (2017). Influence Of Contextual Teaching Learning (CTL) Learning Model and Critical Thinking ON THE Learning Results of Civic Education for 7th Grade Students of Imelda School Medan School Year 2017/2018. IOSR Journal of Research & Method in Education (IOSR-JRME) (ISSN: 2320-737X (P) | ISSN: 2320-7388 (O)), 7(5), 25-31.

[11] Setyorini, W. dan Dwijananti, P. 2014. Pengembangan LKS Fisika Terintegrasi Karakter Berbasis Pendekatan CTL untuk Meningkatkan Hasil Belajar. Unnes Physics Education Journal (ISSN: 2252-6935 (P) | ISSN: 2503-2313 (O)), 3(3), 63-71.

[12] Situmorang, R., dan Sitinjak, L. 2015. Pengaruh Pendekatan Pembelajaran Kontekstual Terhadap Hasil Belajar Siswa pada Materi Pokok Fluida Dinamis Semester Genap Kelas XI SMA Negeri 9 Medan T.P 2012/2013. Jurnal Inpafi (ISSN: 2334-4624), 3(2), 150-157.

[13] Nurhidayah., Yani, A., dan Nurlina., 2015. Penerapan Model Contextual Teaching Learning (CTL) Terhadap Hasil Belajar Fisika Pada Siswa Kelas XI SMA Handayani Sungguminasa Kabupaten Gowa. Jurnal Pendidikan Fisika (ISSN: 2302-8939 (P) | ISSN: 2527-4015 (O)), 4(2), 161-172.

[14] Ekowati, C., Darwis, M., Upa, H., dan Tahmir, S. (2015).The Application of Contextual Approach in Learning Mathematics to Improve Students Motivation At SMPN 1 Kupang. International Education Studies (ISSN: 1913-9020 (P) | ISSN: 1913-9039 (O)), 8(8), 81-86.

[15] Suryawati, E., dan Osman, K. 2018. Contextual Learning: Innovative Approach towards the Development of Students' Scientific Attitude and Natural Science Performance. EURASIA Journal of Mathematics, Science and Technology Education (ISSN: 1305-8215 (P) | ISSN: 1305-8223 (O)), 14(1), 61-76.

[16] Nasrun. 2014. Contextual Learning Approach in Improving Critical Thinking Skills of Guidance and Counseling Students of State University of Medan. International Journal of Sciences: Basic and Applied Research (IJSBAR) (ISSN: 2307-4531), 18(1), 151-161.

[17] Murtiani., Fauzan, A., dan Wulan, R. 2012. Penerapan Pendekatan Contextual Teaching and Learning (CTL) Berbasis Lesson Study dalam Meningkatkan Kualitas Pembelajaran Fisika di SMP Negeri Kota Padang. Jurnal Penelitian Pembelajaran Fisika (ISSN: 2252-3014), 1(1), 1-8.

https://dx.doi.org/10.22161/ijaems.4.6.4 *ISSN: 2454-1311*

Parametric and Quantitative Analysis on the Development of Shell and Tube Heat Exchanger

Olaiya Kamorudeen Adesina[1], Alabi Ismaila Olanrewaju[2], Okediji Adebunmi Peter[3], Alonge Oluwasanmi Iyiola[4]

[1]Department of Mechatronics Engineering, The Polytechnic, Ibadan, Nigeria
Email: olaiyaexcel@yahoo.com.sg
[2, 3, 4] Department of Mechanical Engineering, Elizade University Ilara-Mokin, Ondo State, Nigeria
[2]Email: ismaila.alabi@elizadeuniversity.edu.ng; alabiismy82@gmail.com
[3]Email: adebunmi.okediji@elizadeuniversity.edu.ng
[4]Email: oluwasanmi.alonge@elizadeuniversity.edu.ng

***Abstract*—** *The importance of mini shell and tube heat exchangers (STHEs) in industrial and other engineering applications cannot be underestimated. Hence, based on the problems associated with the design of STHEs, a mini STHE was developed for transfer of heat between two fluids without mixing on the laboratory scale using locally available materials and technology based on an optimized LMTD technique. The performance of the heat exchanger was assessed and evaluated to determine the optimum combination of design parameters. Copper was utilized for the tube side fluid due to its higher thermal conductivity and anti-microbial property, while galvanized steel was used for the shell side fluid due to its cost and corrosion resistance. Parametric studies were carried out on STHE design parameters to obtain an optimal design for efficiency and effectiveness after relevant design considerations. Experimental results were validated with quantitative models, and it was discovered that both Dell-Belaware and Engineering Science Data Unit (ESDU) approaches produced the optimal results required for the selection of shell side and tube fluid film coefficients, respectively over other correlations. In conclusion, the values of parameters of interest were also presented after rigorous mathematical calculations at optimal level and probable recommendations were later made.*

Keywords*— *Dell-Belaware, ESDU, LMTD, Optimization, STHE.

I. INTRODUCTION

Every living thing is equipped in some way or another with devices that tend to enhance or facilitate the flow of heat (Gawande *et al.*, [7]; Ismael and Kumari, [8]) between two or more fluids at different temperatures (Sandeep and Alkesh, [15]) with maximum rate and minimum investment and running cost (Laxnipriya, [12]). These devices are called heat exchangers. They are highly important equipment in any global scenario due to their wide use on both domestic and industrial scales. Heat exchangers are responsible for the greatest energy demand in power generation, waste heat recovery and power plants, as well as industrial processes in manufacturing, air-conditioning, refrigeration, space applications, petrochemical industries (Sandeep and Alkesh, [15]), food industries (Jaydeep *et al.*, [9]), chemical and petrochemical plants, petroleum refineries, natural gas processing, and sewage treatment (Gawande *et al.*, [7]).

In heat exchangers, there are usually no external heat and work interactions. The essence of heat exchanger is to recover or reject heat, or sterilize, pasteurize, fractionate, distill, concentrate, crystallize, or control a process fluid (Dawit, [6). In a few heat exchangers, the fluids exchanging heat are in direct contact. In most heat exchangers, heat transfer between fluids takes place through a separating wall or into and out of a wall in a transient manner. In many heat exchangers, the fluids are separated by a heat transfer surface, and ideally they do not mix or leak (Ramesh and Shah, [14]); as cited by (Dawit, [6]). Heat exchanger may be classified according to the following main criteria (Sandeep and Alkesh, [15]; Laxnipriya, [12]).

i. Arrangements: parallel, counter and cross-flows.
ii. Shell and tube: Recuperators and Regenerators.
iii. Transfer process: Direct contact and Indirect contact.
iv. Geometry of construction: tubes, plates and extended surfaces.
v. Heat transfer mechanisms: single phase and two phase.

Thus, one of the most utilized heat exchangers in industrial and domestic applications is the shell and tube heat exchangers (STHE) which has a wide variety of process and phenomena (Sandeep and Alkesh, [15]); Shell and tube heat exchanger offer great flexibility to meet almost any service requirement and can be designed for high

https://dx.doi.org/10.22161/ijaems.4.6.4 *ISSN: 2454-1311*

pressure relative to the environment and high pressure difference between the fluid streams.

Hence, due to their resistant manufacturing features and design flexibility, shell and tube heat exchangers are the most used heat transfer equipment in industrial processes. They are also easy adaptable to operational conditions. In this way, their design is a very important subject in industrial processes. Nevertheless, some difficulties are found, especially in the shell-side design, because of the complex characteristics of heat transfer and pressure drop (Lokhande and Kumar, [13]). In reality, shell and tube heat exchanger is not suitable for use in aircraft and automotive purposes because the size is relatively large and also weighty (Kamaruddin, [11]). In this work, the main focus is to design a mini shell and tube heat exchanger on a laboratory scale for experimental purposes. Those difficulties reported earlier are examined to come up with a better facility that will be operating at minimal cost under optimized conditions.

Thus, this work is aimed at developing a prototype shell and tube heat exchanger using locally available technology and materials via design based on optimal combination of parameters using LMTD technique, fabrication, as well as, performance evaluation of the facility. This work gives a general overview of heat exchanger together with the exposure on the basic principle and analysis of shell and tube heat exchanger using the LMTD software. Also, it enhances the practical knowledge of machine assembling.

II. DESCRIPTION OF SHELL AND TUBE HEAT EXCHANGER (STHE)

According to Alok *et al.*, [2], shell and tube heat exchangers are classified upon the following factors: construction, flow arrangement, number of shells, and contact between the processing streams, compactness and heat transfer mechanism. Jurandir [10] classified heat exchanger into two. The first being called 'the recuperative type', in which heat are exchanged on either side of a dividing wall by fluids, while the second is 'the regenerative type', in which hot and cold fluids are in the same space which contain a matrix of materials which work alternately as source for heat flow. However, irrespective of the classifications and types of heat exchangers available in the industry, the Shell and Tube Type heat exchanger is probably the most used and widespread type of the heat exchanger's classification (Vindhya *et al.*, [16]).

Shell and tube heat exchanger is built of a bundle of round tubes mounted in a large cylindrical shell with the tube axis parallel to the shell to transfer the heat between the two fluids. They provide relatively large ratio of heat transfer area to volume and weight and they can be easily cleaned. They offer greater flexibility to meet almost any service requirement they can be designed for high pressure relative to the environment and high pressure difference between the fluid streams (Sandeep, and Alkesh, [15]). Shell and tube type of heat exchanger is said to have originated from the jacketed coil distiller. It is however majorly used in heavy industries as well as in residential hot water heating system (Alfred, [1]), cooling of hydraulic fluids and oil in engines, and other mediums such as swimming pool water or charge air (Asawari, [4]).

Perhaps the most common type of heat exchanger in industrial applications is the **shell-and-tube** heat exchanger, shown in Figure 1. Shell-and-tube heat exchangers contain a large number of tubes (sometimes several hundred) packed in a shell with their axes parallel to that of the shell. Heat transfer takes place as one fluid flows inside the tubes while the other fluid flows outside the tubes through the shell. ***Baffles*** are commonly placed in the shell to force the shell-side fluid to flow across the shell to enhance heat transfer and to maintain uniform spacing between the tubes. Despite their widespread use, shell and tube heat exchangers are not suitable for use in automotive and aircraft applications because of their relatively large size and weight. Note that the tubes in a shell-and-tube heat exchanger open to some large flow areas called ***headers*** at both ends of the shell, where the tube-side fluid accumulates before entering the tubes and after leaving them.

Shell-and-tube heat exchangers are further classified according to the number of shell and tube passes involved. Heat exchangers in which all the tubes make one U-turn in the shell as shown in figure 2a are called *one-shell-pass and two – tube - passes* heat exchangers. Likewise, a heat exchanger that involves *two passes in the shell and four passes* in the tubes as shown in figure 2b is called a two-shell-passes and four-tube-passes heat exchanger (Cengel, [5]).

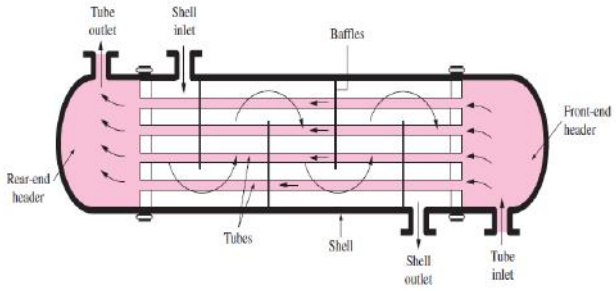
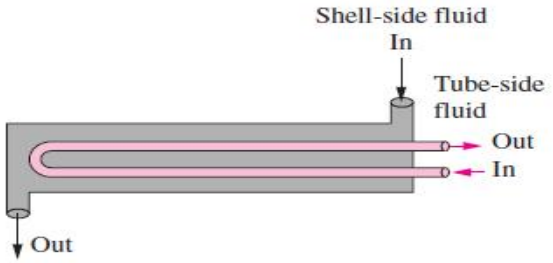
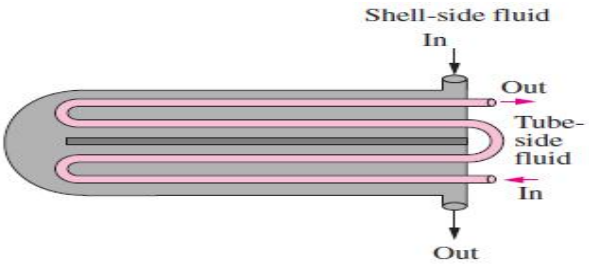


Fig.1: The schematic of a shell-and-tube heat exchanger (Cengel, [5]).

https://dx.doi.org/10.22161/ijaems.4.6.4 *ISSN: 2454-1311*



(a) One-shell pass and two-tube passes



(b) Two-shell pass and four-tube passes

Fig. 2: Classification of shell and tube heat exchanger (Cengel, [5])

III. METHODOLOGY

3.1 Materials

For the development of a shell and tube heat exchanger, the materials utilized were considered based on the factors in figure 3. Heat exchanger tubes are available in variety of materials, which include both ferrous and non-ferrous materials such as carbon steel, stainless steel, copper, admiralty brass, 90-10 copper-nickel, etc. They are available in a number of wall thickness defined by BWG (Ismael and Kumari, [8]). Galvanized steel was used to construct the shell and the two tube sheets/plates. This was because galvanized steel has high resistant to corrosion. Similarly, the main frame was made up of mild steel because of its strength and rigidity to support load and weight of the machine during operation. The tubes used in this project were made of copper due to its high thermal conductivity and anti-microbial property.

3.2 Method

In the present work, the methodology used in the design of the heat exchanger is studied and presented. The thermal design involves the calculation of shell side and tube side heat transfer coefficients, heat transfer surface area and pressure drops on the shell and tube sides. The mechanical design involves the calculations of thickness of pressure parts of the heat exchanger such as the shell, channel, tube etc. to evaluate the rigidity of part under design pressures.

3.2.1 Description of the project/Working Principle

i. The principle of operation is simple enough, two fluids of different temperatures are brought into close contact but they are not mixing with each other.
ii. One fluid runs through the tube, and another fluid flows over the tube (through the shell) to transfer heat between the two fluids.
iii. The hot water run through the shell while glycerin run through the tube side. In order to transfer heat efficiently, a large heat transfer area were used, so there are many tubes.
iv. The temperatures of the two fluids tend to be equal. The heat is simply exchanged from one fluid to another and vice versa. No energy is added or removed.

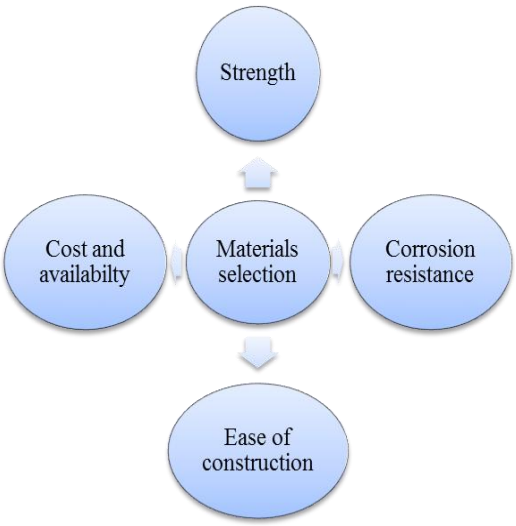


Fig. 3: Materials Selection

3.2.2 Component part of a shell and tube heat exchanger

The following are the component parts of a shell and tube heat exchanger designed:

1. **Tubes:** The tubes are the basic component of the shell and tube exchanger, providing the heat transfer surface between one fluid flowing inside the tube and the other fluid flowing across the outside of the tubes. The tubes utilized in this work were welded and made of copper due to its high thermal conductivity. The tubes are 1000 mm and ϕ 12.7 mm each.
2. **Tube Pitch:** The tube pitch shown in figure 4 is the shortest distance between two adjacent tubes. Tube holes cannot be drilled very close together since too small width of metal between the adjacent tubes structurally weakens the tube sheet. The shortest distance between the two tube holes is the clearance (Ismael and Kumari, [8]). In this work a triangular pitch was adopted because it provides a more robust tube sheet construction

https://dx.doi.org/10.22161/ijaems.4.6.4 ISSN: 2454-1311

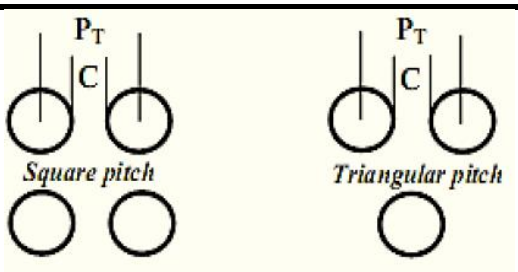


Fig. 4: Tube Pitch (P_T)

3. **Tube Sheet/plates:** They are used to hold the tubes at the ends. The tube sheet used in the construction is made of circular metal (galvanized steel) plate with holes drilled through for the desired tube pattern, holes for the tie rods, grooves for the gaskets and bolt holes for flanges to the shell.
4. **Baffles:** *It is apparent that higher heat transfer coefficient results when the liquid is maintained in the state of turbulence*. To induce turbulence outside the tube it is customary to employ baffles, which cause the liquid to flow through the shell at right angles to the exit of the tubes. Baffles serve two functions: Most importantly, they support the tubes in the proper position during assembly and operation and prevent vibration of the tubes caused by flow-induced eddies, and secondly, they guide the shell-side flow back and forth across the tube field, increasing the velocity and the heat transfer coefficient (Jaydeep *et al.*, [9]). In this project, the baffles machined were made from galvanized steel which is compatible with the shell side fluid. The tube holes must be precise enough to allow easy assembly and field tube replacement, yet minimize the chance of fluid flowing between the tube wall and baffle hole, resulting in reduced thermal performance and increased potential for tube wall cutting from vibration. Baffles do not extend edge to edge, but have a cut that allows shell side fluid to flow to the next baffled chamber. For most liquid applications, the cuts areas represent 20-25% of the shell diameter. In this project cuts areas of 25% was adopted.
5. **Nozzles:** The entrance and exit ports for the shell fluid and tube fluid are referred to as "Nozzles". These nozzles are pipes of constant cross section welded to the shell and channels. They are used to distribute or collect the fluid uniformly on shell and tube sides.
6. **Front-End And Rear End Covers:** They are containers for tube fluids for every pass. In many rear end head designs, a provision has been made to take care of thermal expansion of whole tube bundle. The front-end head is stationery while the rear end head could be either stationary or floating depending upon the thermal stresses between the tubes and shell. But in this project both ends are stationary.
7. **Tie Rods and Spacers:** Tie rods and spacers are other equivalent means of tying baffle system together. They are provided to retain all transverse baffles and tube support plates securely in position. They serve two purposes; one to maintain the spacing between the baffles and second function is to reduce the fluid by-passing.
8. **Shell:** The cylindrical shell made of rolled galvanized steel plate carries flanged connection for water inlet, water outlet, plug and couplings for shell drain and vent. Suitable provisions are made for pressure and temperature measurement. In this project the shell which is cylindrical was produced from the rolling machine.
9. **Fluid Chambers:** Both the inlet and outlet and rear end fluid chambers are fabricated from rolled galvanized steel plate and are of adequate proportions to minimize pressure drop and turbulence. The inlet and outlet fluid chamber carries water and inspection cover was divided internally into inlet and outlet chambers, each having a flanged connection. The rear end fluid chamber consists of a simple dished cover or a flat end cover. If the water passes are more than two it is divided accordingly.
10. **AT-380 AC 220-240V 15W Submersible Water Pump Aquarium Fountain Pond Pump:** A submersible pump shown in figure 5 has a sealed motor closely coupled to the pump body and pushes water to the surface. It functions via its assembly that is wholly submerged in the fluid to be pumped whereas a centrifugal pump uses a rotating impeller to increase pressure of a fluid.

Fig. 5: Submersible Water Pump

11. **12V 45W micro diaphragm pump discharge pressure backflow PLD-1206 thread water**

https://dx.doi.org/10.22161/ijaems.4.6.4 *ISSN: 2454-1311*

pump wash car: "Brandy" brand DC micro-diaphragm pump shown in figure 6 is a self-suction pump with the advantages of chemical pump, using a variety of imported materials synthesis, corrosion resistant, with self-priming function, thermal protection, smooth operation, can long time continuous idling, can long time continuous load operation, small volume, low current, high pressure, low noise, the use of the advantages of long service life, exquisite design, high quality and inexpensive, with oil resistant, heat resistant, acid and alkali resistance, corrosion resistance, chemical resistance properties. Pump body and motor separation, the pump body without mechanical components, no wear. The surface pump used has the following specifications: Rated voltage = 12V DC, Rated power = 45 W, Maximum pressure = 1 MPa, Flow rate = 4 litres/min, Suction diameter 9.2 mm, Discharge diameter = 9.2 mm.

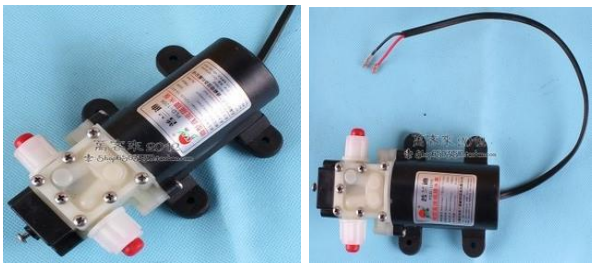


Fig. 6: A Micro-diaphragm pump (self-suction Pump)

3.2.3 Design Consideration

The optimum thermal design of a shell and tube heat exchanger involves the consideration of many interacting design parameters which can be summarized as shown in figure 7.

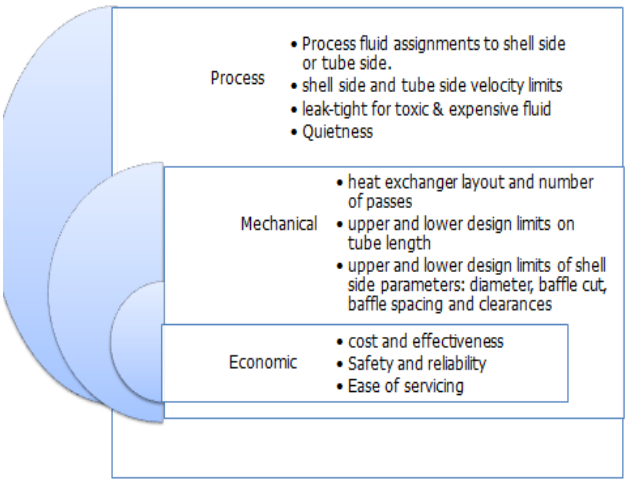


Fig. 7: Design consideration

Highest thermal performance is the key factor determining the efficiency of any Shell and Tube Heat Exchanger. Hence, in the design of Heat Exchanger, the foremost considerations should be given to the cost and effectiveness so as to improve its efficiency (Arjun and Gopu, [3]).

3.3 Design Calculations

3.3.1: Assumptions

A selected shell and tube heat exchanger must satisfy the process requirements with the allowable pressure drops until the next scheduled cleaning of plant. The methodology to evaluate thermal parameters is explained with suitable assumptions. The following are the major assumptions made for the pressure drop analysis;

1) The operating or Flow condition is steady and isothermal, and fluid properties are independents of time.
2) Fluid density is dependent on the local temperature only or is treated as constant.
3) The pressure at a point in the fluid is independent of direction.
4) Body force is caused only by gravity.
5) There are no energy sink or sources along streamline; flow stream mechanical energy dissipation is idealized as zero. i.e. Changes from K.E to P.E of fluid streams are negligible
6) The friction factor is considered as constant with passage flow length.
7) The heat exchanger is well insulated so that heat loss is negligible and thus heat transfers from hot to cold fluids are equal.
8) Heat transfer coefficient and fouling factors are constant and uniform
9) Thermal resistance of the inner tube is negligible, since the tube is thin walled and highly conductive.

3.3.2 Modeling Procedures and Design Calculations

A. Modeling Procedures

The mathematical model has been constructed considering the principles of heat transfer and fluid mechanics. Shell and tube heat exchangers are designed normally by using Nusselts, Eissenberg, McNaught, Colbalt, Kern's, Taborek, Chemstations, VDI film and Bell-Delaware methods, as well as other correlations like Petukov, Chaddock and Chato adaptation, Duckler (downflow) and Hewitt (upflow) adaptations, and Mikheev correlation etc. However, either Kern's method or Bell-Delaware method are mostly adopted in the design of a shell and tube heat exchanger (STHE). The steps of designing a typical shell and tube heat exchanger are described in figure 8.

https://dx.doi.org/10.22161/ijaems.4.6.4 *ISSN: 2454-1311*

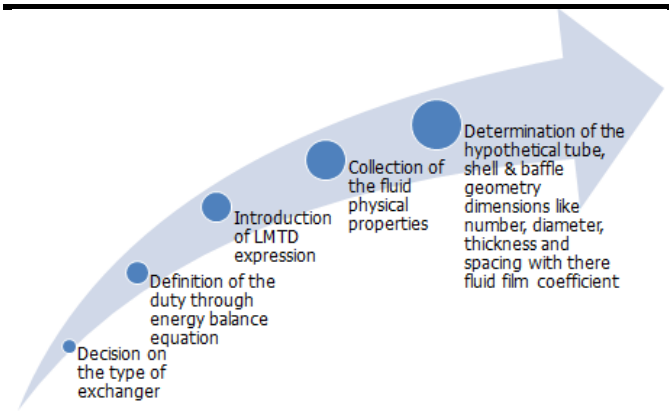


Fig. 8: Modeling Procedure

B. Determination of heat transfer coefficient on the inner and outer surface of the tubes using the above methods to optimized the design

1. Shell-side Transfer Coefficient ($h_0 = h_s$)

i. Kern's Method

$$d_e = \frac{4}{\pi d_{t0}}\left[p_t^2 - \frac{\pi d_{t0}^2}{4}\right]$$

$$Re_s = \frac{M_s}{A_s} \times \frac{D_e}{\mu_s}$$

$$N_u = \frac{h_s d_e}{k_s} = 0.36 {R_e}^{0.55} Pr^{\frac{1}{3}}$$

$$h_s = \frac{N_s k_s}{d_e} = \frac{0.36 ks}{d_e}\ {R_e}^{0.55} Pr^{1/3} \qquad (1)$$

ii. Taborek Method

$$R_{es} = \frac{m_s}{A_s} \times \frac{d_{t0}}{\mu_s}$$

$$h_s = \frac{0.2 ks}{d_{t0}}\ {R_e}^{0.6} Pr^{0.4} \qquad (2)$$

iii. Bell-Delaware Method

$$h_s = j_i C P_S \left(\frac{M_s}{A_s}\right)\left[\frac{K_s}{C P_s \mu_s}\right]^{2/3}\left[\frac{\mu_t}{\mu_s}\right]^{0.14}$$

Neglecting $\frac{\mu_t}{\mu_s} \approx 1$

$$J_i = 0.37 {R_{es}}^{-0.395}$$

$$h_s = j_i c_{ps}\left(\frac{m_s}{A_s}\right)\left[\frac{K_s}{c_{ps}\mu_s}\right]^{2/3} \qquad (3)$$

2. Tube side heat transfer coefficient

i. Petikhov – Kiwlov Correlation

$$f = \left[[1.58\ ln(R_{et})] - (3.28)\right]^{-2}$$

$$R_{et} = \frac{\ell_t U_m d_{ti}}{U_t}$$

$$Nu_t = \frac{\left(f/2\right) Re_t Pr_t}{(1.07) + (12.7)\left(f/2\right)\left(Pr_t^{1/2} - 1\right)}$$

$$h_t = h_i = \frac{Nu_t k_t}{d_{ti}} = \frac{k_t}{d_{ti}} \frac{\left(f/2\right) Re_t Pr_t}{(1.07)+(12.7)\left(f/2\right)\left(Pr_t^{1/2}-1\right)} \qquad (4)$$

ii. Seider-Tate Equation or Colburn Equation

$$h_t = \frac{N_t k_t}{d_{ti}} = \frac{0.023 k_t}{d_{ti}}\ {R_e}^{0.8} Pr^{0.33} \qquad (5)$$

iii. Kern Techniques

$$h_t = \frac{N_t k_t}{d_{ti}} = \frac{0.027 k_t}{d_{ti}}\ {R_e}^{0.8} Pr^{0.33} \qquad (6)$$

iv. Engineering Sciences Data Unit (ESDU) Method

$$h_t = \frac{N_t k_t}{d_{ti}} = \frac{0.0225 k_t}{d_{ti}}\ {R_e}^{0.795} Pr^{0.495} exp[-0.0225(\ln Pr)^2] \qquad (7)$$

3. Calculation on the value of the overall coefficient, U.

$$\frac{1}{\mu_0} = \frac{1}{h_0} + \frac{1}{h_i}\frac{d_0}{d_i} + \frac{r_0 ln\left(r_0/r_i\right)}{k_w} \qquad (8)$$

4. Determination of the area required of the heat exchanger (on the basis of assumed U_0) using

$$Q = UA\Delta TL_m, \qquad (10)$$

5. Pressure Drop in STHE

i. Tube Side Pressure Drop: The tube side pressure drop can be calculated by knowing the number of tube passes (Np) and length (L) of heat exchanger; the pressure drop for the tube side fluid is given by equation

$$\Delta P_t = 4f \frac{LN_p}{d_{ti}} \rho \frac{u_m^2}{2}$$

The change of direction in the passes introduction in the passes introduction an additional pressure drop due to sudden expansions and contractions that the tube fluid experiences during a return that is accounted for allowing four velocity head per pass

$$\Delta P_t = 4N_p \frac{\rho u_m^2}{2}$$

The total pressure drop of the side becomes:

$$\Delta P_t = \left(4f \frac{LN_p}{d_{ti}} + 4N_p\right) \rho \frac{u_m^2}{2} \qquad (11)$$

ii. Shell Side Pressure Drop: The shell side pressure drop depends on the number of tubes, the number of times the fluid passes the tube bundle between the baffles and the length of each crossing. The pressure drop on the shell side is calculated by the following expression (Sandeep, and Alkesh, [15]):

$$\Delta P_s = f \frac{\rho u_m^2 (N_b+1) d_s}{2 d_{to} \phi_s} \qquad (12)$$

Where,

$$\phi_s = (\mu_t + \mu_s)0.14$$

N_b = Number of baffles

$(N_b + 1)$ = Number of times fluid passes to the tube bundle

Friction factor (f) calculated from:

$$f = exp(0.576 - 0.19 \ln Re_s)$$

Where

$$400 < Re_s = \frac{\rho_s u_m d_s}{\mu_s} \leq 1 \times 10^6$$

https://dx.doi.org/10.22161/ijaems.4.6.4 *ISSN: 2454-1311*

The correlation has been tested based on data obtained on actual exchangers. The friction coefficient also takes entrance and exit losses into account (Sandeep, and Alkesh, [15]).

3.4 Testing

3.4.1 Field Test

The shell and tube heat exchanger (STHE) shown in figure 9 was subjected to field test after fabrication. The flow arrangement adopted for the design is the cross flow due to the greater log mean temperature it offers. One yard of 1¼ diameter hose was used to convey the fluid at the tube inlet and clipped to ensure the hose is firmly fitted to the heat exchanger inlet port. The hose connected to the tube inlet in turn connected to the outlet of the submersible pump submerged in the glycerin for easy flow of the fluid (glycerin) into the heat exchanger, while the hose connected to the outlet of the shell side fluid (hot water) was inserted in the retaining container. Similarly, another 1¼ one yard hose was connected to the inlet of the shell side fluid (hot water) and outlet of the cold side fluid which are gripped with a hose clip. The inlet of the shell side fluid (hot water) was connected to the outlet of the surface pump while the inlet of the pump was dipped in the hot water. The submersible pump which utilizes Alternating current (AC) was plugged into the AC socket while the surface pump was powered with a 12v battery.

The hot water used for the experiment was obtained from a 25 litres cooking pot placed on the gas cooker. The observed temperature of the shell side fluid was 100^0c, while that of the tube fluid side (cold fluid) was 26^0c before been allowed to flow into the heat exchanger. The temperature measurements were taken with the aid of an analogue thermometer.

At the end of the experiment, the heat transferred to the cold fluid increased by 6^0c while that of the hot fluid reduced to 60^0c.

Fig. 9: Field Test Demostration of the STHE

3.4.2 Laboratory Test

The shell and tube heat exchanger (STHE) was also subjected to laboratory test after field test. The essence of this is to test the STHE on a large scale. The compartment carrying hot fluid was connected to the boiler so that there will be constant supply of hot fluid to the heat exchanger, but could not be achieved due to the ineffectiveness of that machine (boiler). The STHE fabricated demonstration when connected to the faulty boiler is presented in figure 10.

Fig. 10: Laboratory Test Demostration of the STHE

IV. RESULTS AND DISCUSSION

4.1 Experimental Results

The results obtained from the experimental results are presented below:

Shell side fluid – Hot water

Tube side fluid – Glycerin

Inlet temperature of hot water, $T_{h1} = 100^0C$

Outlet temperature of hot water, $T_{h2} = 90^0C$

Inlet temperature of Glycerin, $T_{c1} = 26^0C$

Outlet temperature of Glycerin, T_{c2} =?

Mass flow rate of Glycerin, $m_t = 0.28kg/s$ m_c

Mass flow rate of hot water, $m_s = 0.07kg/s$ $- m_h$

Thermal conducting of the material, k_w = 16.26 W/m^{0}C

The maximum flow rate through the tube, $U_{max} = 0.82\ mm/s$

Table 1: Thermal properties of shell-side fluid @ average temperature $= \frac{T_{h1}+T_{h2}}{2}$

S/N	Property	Symbol	Unit	Values				
				95 (^{0}C)	90 (^{0}C)	85 (^{0}C)	80 (^{0}C)	75 (^{0}C)
1	Spec. heat cap.	Cp	j/kg/k	4212	4206	4201	4197	4193
2	Thermal conductivity	K	j/kgk	0.677	0.675	0.673	0.670	0.667
3	Pradtl No.	Pr		1.85	1.96	2.08	2.22	2.38
4	Density	ℓ	Kg/m^3	961.5	965.3	968.1	971.8	974.7
5	Viscosity	μ	Kg/m.s	0.298 E-3	0.315 E-3	0.333 E-3	0.355 E-3	0.378 E-3

https://dx.doi.org/10.22161/ijaems.4.6.4 *ISSN: 2454-1311*

Table.2: Thermal and physical properties of tube side fluid @ 26^0C

S/No.	Property	Symbol	Value
1	Spec. heat cap.	Cp	2416 j/kg/k
2	Thermal conductivity	K	0.2860 w/m/k
3	Pradtl No.	Pr	8.392
4	Density	ℓ	1261 Kg/m^3
5	Viscosity	μ	0.9934 Kg/m.s

4.2 Modeling Results

Fig. 11 showed the result obtained from the plot of shell fluid film coefficient (h_o) against Logarithmic Mean Temperature Difference (LMTD). It was observed that there is a direct relationship between h_o and the LMTD. It was also observed that h_o decreases as the shell diameters decreases.

It was observed from fig. 12 that as the shell diameter (d_s) increases, both the overall heat transfer coefficient (U_o) and tube fluid film coefficient (h_i) decreases.

It was observed from fig. 13 that as the LMTD increases the correction factor, irrespective of the tube sizes decreases. It was also discovered that the correction factor increases as the tube diameters increases.

V. CONCLUSION

The importance of mini shell and tube heat exchangers in industrial and other engineering applications cannot be underestimated. Hence in this project, a mini and shell and tube heat exchanger was developed on the laboratory scale using an optimized LMTD technique before embarking on the design and fabrication. The performance of the heat exchanger was assessed and evaluated to determine the optimum combination of design parameters for the transfer of heat between the two fluids involved in the STHE without mixing. It was discovered from the obtained results that the Bell-Delaware correlation produced the optimal value of shell fluid film coefficient over the other correlation techniques at any parametric iterations. Kern technique was the closest with correction factors between 0.8440 and 0.9850. There was also an inverse relationship between the shell fluid film coefficient and heat transfer rate. Though, irrespective of the shell diameters, the heat transfer rate is constant. But there is an inverse relationship between the LMTD and the heat transfer rate under any shell design parameters. In addition, there was a direct relationship between h_o and the LMTD. While h_o decreases as the shell diameters decreases. It was observed that as the shell diameter (d_s) increases, both the overall heat transfer coefficient (U_o) and tube fluid film coefficient (h_i) decreases. The LMTD increases, the correction factor, irrespective of the tube sizes decreases. It was also discovered that the correction factor increases as the tube diameters increases. In conclusion, the Values of parameters of interest were also presented after rigorous mathematical calculations at optimal level. It was also discovered that Engineering Science Data Unit (ESDU) approach produced the optimal results required for the selection of tube fluid film coefficient over other correlations.

The design techniques and procedure adopted in this research work should be strictly adhere to by the Thermal and Fluid Engineers that are interested in the design of shell and tube heat exchangers (STHE) in order to come up with an optimum results. Other correlation techniques required for the determination of shell and tube fluid film transfer coefficients should be considered in the future research since this work is limited to only few.

REFERENCES

[1] Alfred, M.K. (2015). Article in Applied Thermal Engineering. Retrieved from www.researchgate.net/publication/279178955

[2] Alok, S., Prakash, K. and Deo, R.T. (2015). Design Procedure of Shell and Tube Heat Exchanger vol. 3, issue 12, pp. 116-119.Retrieved from www.erpublication.org

[3] Arjun, K.S. and Gopu, K.B. (2014) Design of Shell and Tube Heat Exchanger Using Computational Fluid Dynamics Tools, Research Journal of Engineering Sciences, Vol. 3(7), pp. 8-16

[4] Asawari, B. (2016). An Overview of Shell and Tube Heat Exchanger Performance, International Journal of Research in Aeronautical and Mechanical Engineering, Vol.4 Issue 2, pp. 58-66.

[5] Cengel, Y.O. (2003) Heat Transfer A practical Approach (second edition), McGraw-Hill, pp. 667-716

[6] Dawit, B. (2014). Design and Development of Shell and Tube Heat Exchanger for Harar Brewery Company Pasteurizer Application (Mechanical and Thermal Design), Volume-03, Issue-10, pp. 99-109 www.ajer.org

[7] Gawande, S.H., Wankhede, S.D., Yeerrawar, R.N, Sonawane, V.J. and Ubarhande, V.B. (2012). Design and Development of Shell and Tube Heat Exchanger for Beverage. Mordern Mechanical Engineering, vol. 2, pp121-125. Retrived from http://dx.doi.org/10.4236/mne.2012.24015

[8] Ismael, B.R. and Kumari, A. (2014) Design and Analysis of Heat Exchanger, International Journal of

https://dx.doi.org/10.22161/ijaems.4.6.4 *ISSN: 2454-1311*

Scientific Engineering and Technology Research, Vol. 03, Issue 20 pp. 4181-4187.

[9] Jaydeep, B., Abhesinh, P. and Mahesh, V. (2013). A project Report on Designing and Analysis of Shell and Tube Heat Exchanger, pp. 1-36.

[10] Jurandir, P.P. (2012) Shell and Tube Heat Exchangers Basic Calculations, pp. 1-35. Retrieved from www.PDHonline.org

[11] Kamaruddin, R. (2010). Report on Design of a Small Heat Exchanger (Shell-And-Tube Type), pp. 1-11.

[12] Laxnipriya, S. (2014). CFD Analysis of Heat transfer in a Helical coil Heat Exchanger with constant Wall Heat transfer Coefficient, pp. 1-40.

[13] Lokhande, H.K.. and Kumar, P.V. (2013). Review Paper on Design & Analysis for Shell & Tube Evaporator for Dairy Application, Vol 3. pp. 117-118. Retrieved from www.ijetae.com

[14] Ramesh, K. and Shah, D. P. (2003). Fundamentals of Heat Exchanger Design. New Jercy

[15] Sandeep, K.P. and Alkesh, M.M. (2012). Shell and Tube Heat Exchanger Thermal Design with Optimization of Mass flow rate and Baffle Spacing. Patel et al, International Journal of Advanced Engineering Research and Studies, vol. 2, pp. 130-135.

[16] Vindhya, V.P.D., Raj, R.V., Piyush, S.V. and Srivastava, A. K. (2014). Steady State Thermal Analysis of Shell and Tube Type Heat Exchanger to Demonstrate the Heat Transfer Capabilities of Various Thermal Materials using Ansys, Global Journal of Researches in Engineering: A Mechanical and Mechanics Engineering Volume 14 Issue 4 Version 1.0, pp. 24-30.

APPENDIX

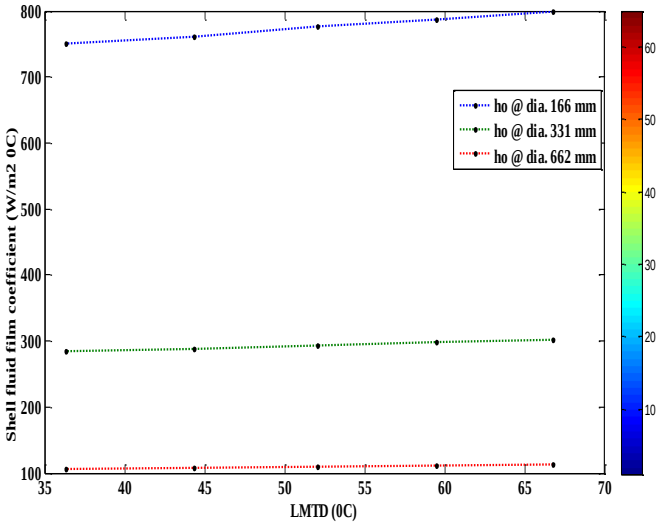


Fig. 11: Shell fluid film coefficient against LMTD

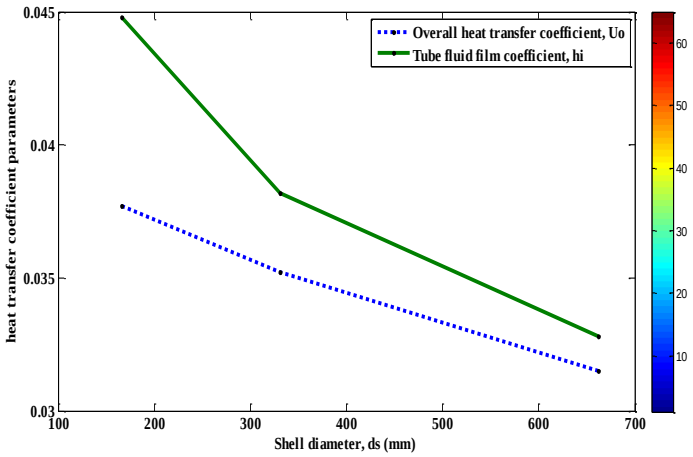


Fig. 12: Heat transfer coefficient parameters against Shell diameters

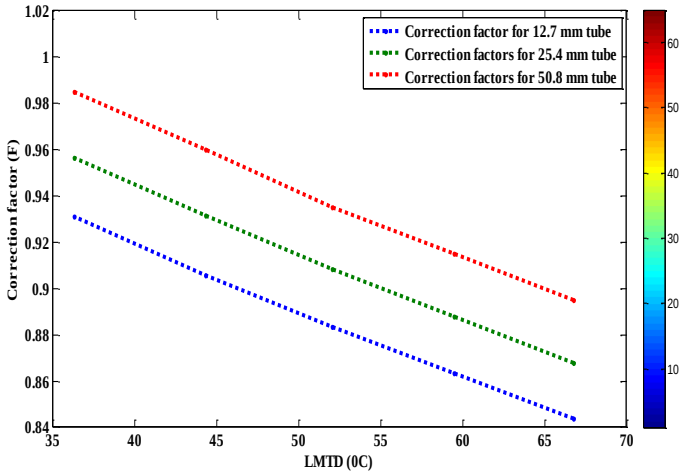


Fig. 13: Correction factor against LMTD

https://dx.doi.org/10.22161/ijaems.4.6.5 *ISSN: 2454-1311*

Education to Educate: A Case of Punjab Education Foundation

Sayeda Zeenat Maryam, Umm-e-Amen, Adeena Safdar, Anam Shehzadi, Sayyed Khawar Abbas

Hailey College of Commerce, University of the Punjab, Lahore, Pakistan

Abstract— *Mrs. Shehzad's doorbell rang, and she came out to open the door. She was sure about the arrival of her children Ali and Sana on the door as it was the time of school closing at 3'o clock. While serving the lunch, she thanked Allah and recalled the time a few years back. When Ali was in 4th grade, and Sana was in 5th grade, Mr. & Mrs. Shahzad thought to change the school of their children from private to government. This thought emerged because they were unable to afford the fee schedule of private schools. But they were aware of the drawbacks of Government Schools too. They never wanted to abolish their children's confidence level, productivity, and learning. It was not the dilemma of one home but the whole nation.*

Keywords— Punjab Education Foundation, Education, Government schools.

I. INTRODUCTION

Education is considered as the most important key driver to run an economy, and it encircles all aspects of life. We can't even imagine anything without this factor. Education is the necessity of life and key success factor of any nation. The education system of Pakistan is not much credible and strong as well as stable, so it categorizes Pakistan as developing country. Due to this big reason along with few constraints, Pakistan after 68 years of independence still considered as developing Nation. The education system overlooked throughout the decades.

History of Education in Pakistan

Under Article 25-A of Constitution of Pakistan, the ruling government will be liable to provide free quality education to students who are between the age group of 5 to 16 years. If we look towards traditional education system which is portrayed by Pakistan developed through Islamic Arabic culture which comes to us from the Indian subcontinent. We can figure out the effects of Muhammad Bin Qasim's Invasion in Sindh in 712 AD as well as Sir Syed Ahmed Khan's (1817-1898) tireless work of education of Muslims, on the traditional education system. Even after Independence, Quaid e Azam followed the crafted reforms and strategies of Sir Syed. After independence, Muhammad Ali Jinnah invited many teachers, Professors and consultants to Pakistan which came from India and England. Through combinedefforts, they designed the Curriculum and Teaching Strategies. With the passage of time, the quality of education disappeared. Although, many educational systems and reforms adopted which included the National and British educational Systems.[1]

Issue between private and Publics sector schooling

During 1970's after the nationalization of all private schools, severe restriction was made at growth of that sector and potential, fast forward twenty years and you will see private sector schools have re-emerged again. After that, private schools were more in demand than before due to massive problems in public school system. Nationally in Pakistan overall private school enrollment was 13% at that time but in 2002 it became 60%.[4]

According to the Human Development in South Asia's 1998 report following were lacking points of Public schools.

Sr. no.	Public school %	Lacking Necessity
1	70%	Toilet
2	68%	Water
3	92%	Play Grounds
4	60%	Boundary walls
5	16%	Building

Furthermore, a delegation of UK, while reporting the situation of Public schools in Pakistan described the lacking points such as shortage of furniture, electricity, windows, blackboards, etc. As well as, there were overcrowded classrooms and "ghost schools," schools getting government grants but doesn't exist.[4]

The need of Punjab Education Foundation

In prescribed context govt. Schools due to massive problems were not able to provide quality education whereas private schools feed expensively. So there was a need for an organization which might be able to serve the Nation with a quality education without any concept of monetary profit for the sake of the public. Punjab Education Foundation established in 1991.

https://dx.doi.org/10.22161/ijaems.4.6.5 *ISSN: 2454-1311*

Brief History of Punjab Education Foundation

The Punjab Education Foundation initiated under the Punjab Education Foundation act presented in 1991, as an autonomous statutory body to encourage education on no profit basis. Since going through the prescribed pattern, it seems difficult to arrange free and quality education for deserving students at their ease. PEF has been restructured under the Punjab Education Foundation Act-XII of 2004 for enhancement of education while encouraging the efforts of Private sector providing education to poor through Public-private Partnership.[2]

Punjab Education Foundation is promoting free quality education in Punjab under the umbrella of public-private partnership; its long-run objective is to promote educated society so that every child should have access to the basic right of education in Punjab. [3]

The Board formulated as strategy flexible approach. The salient features are:

- Provision of the low-income households for better quality education by the private sector
- The technical assistance of privately managed schools
- Support of the schools of less affluent areas
- Promote female education
- Financial assistance through new instruments on the basis of per child enrollment
- Vouchers for the slums/kachiabadis households.
- The monetary reward for well-reputed institutions

The tradeoff between private and public sector

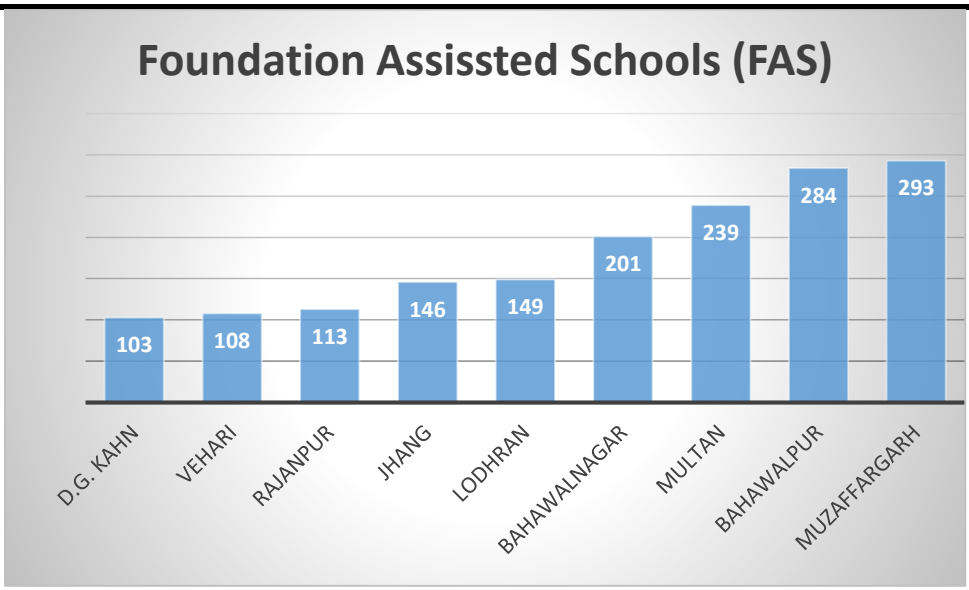
PEF is performing a pivotal role in trading off between private and public sector, helping to resolve the problems of both sectors and fulfilling the need of being educated to several sectors of societies. PEF having 15 boards of directors has a chairman who is selective head by private members. Foundation is innovatively intervening education to disenfranchised and less-privileged sections of society, through Public Private Partnership. It introduced economic, affordable and cost-effective models to educate the deserving ones.

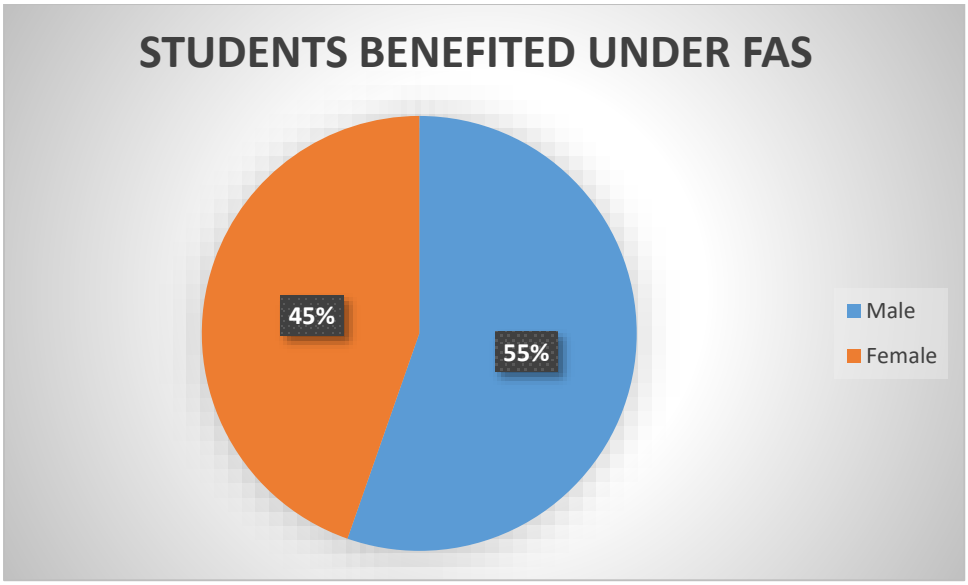
These have gained international and national appreciation. PEF utilizes four Strategies to bridge the gap between these sectors.

II. FOUNDATION ASSISTED SCHOOLS (FAS)

PEF initiated Foundation Assisted Schools (FAS), through PPP; it assisted the poor strata of society under the flagship of PEF in Punjab. Foundation Assisted schools were having background in 2005 when it was initiated with outreach in 6 districts, till now it is extended in36 districts in Punjab. The number of schools having Partnership with PEF under FAS reached around 3000 and their induction came through nine phases to cater the need of 1.3 million students. FAS targeted rural, Slum and Urban areas in Punjab to promote and encourage quality education while giving financial as well as technical support to its partners. Under FAS, PEF faced the problem to spread the flagship because here private sector was very efficiently earning heavy profits. PEF captured their intention to educate and while focusing that intention they tried to compile their intention of profit as well as, for that cause PEF offered them level wise fee to compensate them for the sake of their opportunity cost of profit in a way. PEF gave their partner schools per month fee Rs. 450 up to Primary Classes, Rs. 500 up to Elementary Classes, 600 up to secondary arts classes, Rs. 700 up to secondary level science students, Rs. 800 up to higher secondary Arts students and Rs. 1000 up to higher secondary science students, per head. This planning of FAS proved very successful. FAS are also running an android app which asks to help PEF to send children to school to promote their cause and objective. Moreover their Newsletters and E-Newsletters are also spreading their motives very efficiently. PEF publish their annual report every year and sent it to almost all stakeholders along with detail of expenditure on different programs for their information purpose. Audit report transparency also added value to trust of PEF for their stakeholders. PEF achieved more transparency and prudence every year along with three different audits, those includes governmental, external and internal audits, and these make PEF more credible. Through this credibility and trust PEF targeted the children at their best extent, renovating them with education. We can see the bar chart given below, these are the districts where 70.76% schools of FAS are geographically located and number of schools is mentioned. We can see most schools are in the district **Muzaffargarh which are 293 and in Bahawalpur 284** schools are under FAS. Whereas Multan, Bahawalnagar, Lodhran, Jhang, Rajanpur, Vehari and D.G. Kahn are further districts with high number of schools. These districts are more targeted till now. Total students till yet benefited though FAS are 1,326,047 which is really impressive statistic. We can see the breakup of these students in boys and girls in the pie chart below and could figure out the proportionate too.

https://dx.doi.org/10.22161/ijaems.4.6.5 *ISSN: 2454-1311*





PEF-FAS, first of all, select their partners with very effective criteria, new phase launched in national dailies and schools apply for the partnership with the PEF. Later, school passes the Quality Assurance Test by PEF upon prescribed criteria in the advertisement. Qualified school gets through physical inspection for infrastructure and is then selected and offereda partnership with PEF. After determining the authenticity of documents of school, the school gets ascertained before school becomes the partner of FAS.

III. CONTINUOUS PROFESSIONAL DEVELOPMENT PROGRAM (CPDP)

The second strategy utilized by PEF was CPDP, launched in 2005, its core function was to technically train and assist PEF partner school teachers and Heads during service. All these training were meant to enhance and ensure quality education. They use the following team.

Sr. No.	Number of members	Group
1	14	Personnel to manage administrative side
2	41	MFTs (Monitor/ Facilitator/ Trainer)
3	15	Subject Specialists(SS)

They also produced new training modules, materials and new resources to contribute their efforts in capacity building. Most importantly, they conducted Training need analysis (TNA) and they identified the weaker areas, when needed; they provide customized trainings to enhance efficiencies. Through this CPDP, 994 trainings were conducted in FY 13-14, 949 trainings in FY 14-15 and they approached 23,880 teachers and heads in FY 13-14, 19,500 teachers and heads in FY 14-15. One of the most effective things was that they standardized modules

https://dx.doi.org/10.22161/ijaems.4.6.5 *ISSN: 2454-1311*

with the collaboration and guidance of Training Module standardization Committee (TMSC) at the Financial Management and Quality Assurance Test. CPDP utilizes three programs to train all of them. Continuous Teachers Development program (CTDP) was specific for teacher's training, School Leadership Development Program (SLDP) was specified for the trainings of the heads and Subject Based Support Program (SBSP) both caters to subject specialist work as facilitators, trainers, Mentors and teachers for the tasks assigned.Along with these programs CPDP utilizes the three trainings model too, their characteristics are as under in the table. With the help of these models, trainings become more effective and up to date. Trainers for these trainings were different TOPs (training providing organizations) who having partnership with CPDP-PEF utilize different schools as training camps. Highly qualified trainers are being selected by this TPOs.Now there was a problem of selection of the TOPs. According to selection criteria, These TPOs were advised to submit their EOI, as per Punjab Procurement Regulatory Authority (PPRA) Rules, 2014. Through transparent selection, selected TPOs were asked to conduct Pilot trainings and after the valuation of those workshops, final recommendation for partnership was announced. And if any school teacher doesn't go for the trainings in that way the repute of the school would be affected. If training venues were 40 km apart from school then per day Rs. 1500 are paid to participants in trainings.

Sr. #	**Description**	**Cluster-basedTraining**		**PIVOT Training**		**Camp Based Training**
		CTDP	**SLDP**	**CTDP-Subject Based**	**SLDP-Need Based**	**All of the Teaching staff**
1	No of training days	6	3	2	2	6
2	Training time (incl. 30min Break)	5 ½ hrs/day	5 ½ hrs/day	8-hrs/day	8 hrs/day	6 Hrs/day
3	No of participants in a training	30 - 35	15 – 20	25 – 30	25 – 30	Actual/all staff including principals and owner
4	Target Audience	Primary Teachers	School Heads	Elementary and Secondary	School Heads/Teacher	Primary Level
5	Training Schedule	As approved				
6	Venue Selection	Maybe PEF partner school (within 15km)	TPO's own venue (above 15 km)		Distant Schools	

IV. EDUCATION VOUCHER SCHEME (EVS)

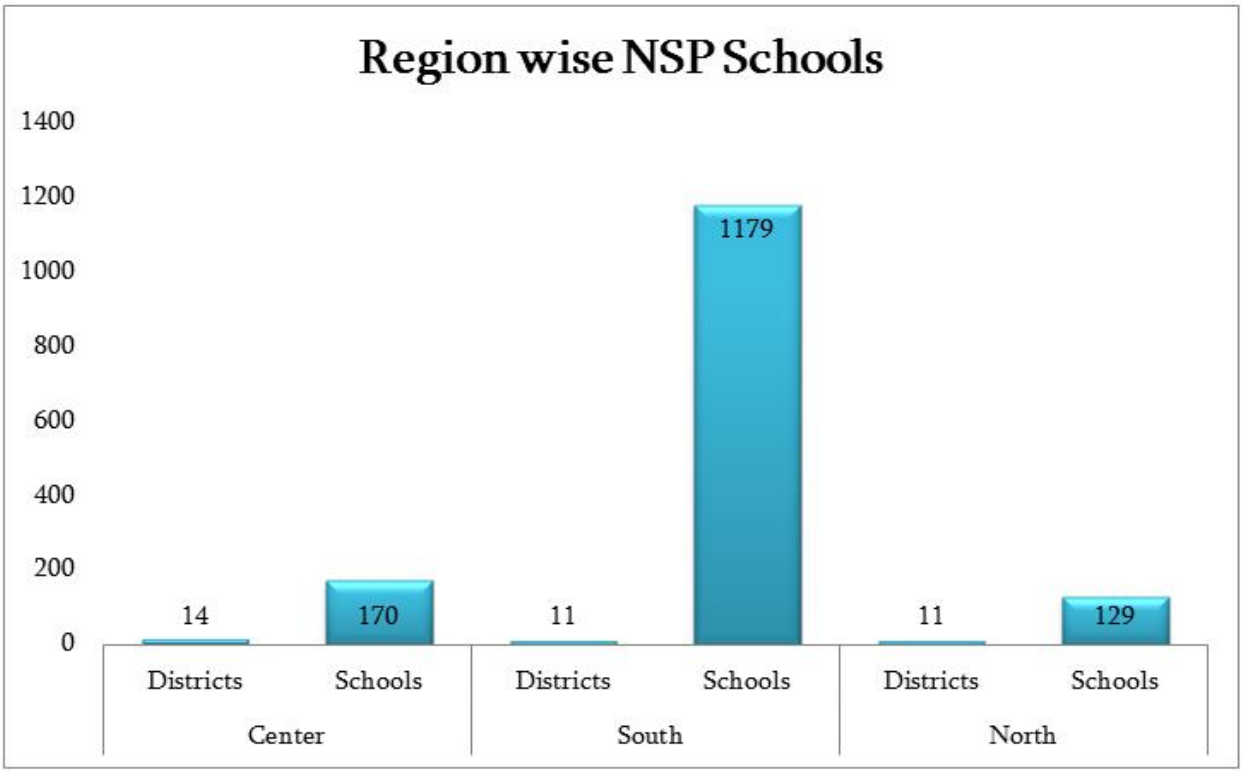
This strategy was introduced in 2006 to educate the children of underprivileged and less affluent areas who ignored due to social and financial constraints. To utilize the strong mechanism of education and to become able to get rid of the vicious circle of poverty and deprivation for next generation this program launched. Nine years, 14 phases, 36 districts, 3 lakh children, more than 1365 EVS partner schools, is the short story of this strategy. The age of beneficiaries, under EVS, are age group of 6 to 16 years.

In this program, schools selectedby single ownership, school rooms for primary must not less than 5 and for middle 8 and matric shouldn't be less than ten rooms. With few more things,the final selection basedon the physical verification. Under this program, in primary Rs. 450, in the middle, Rs. 500 and in metric Rs. 600 per student offered to partner schools.

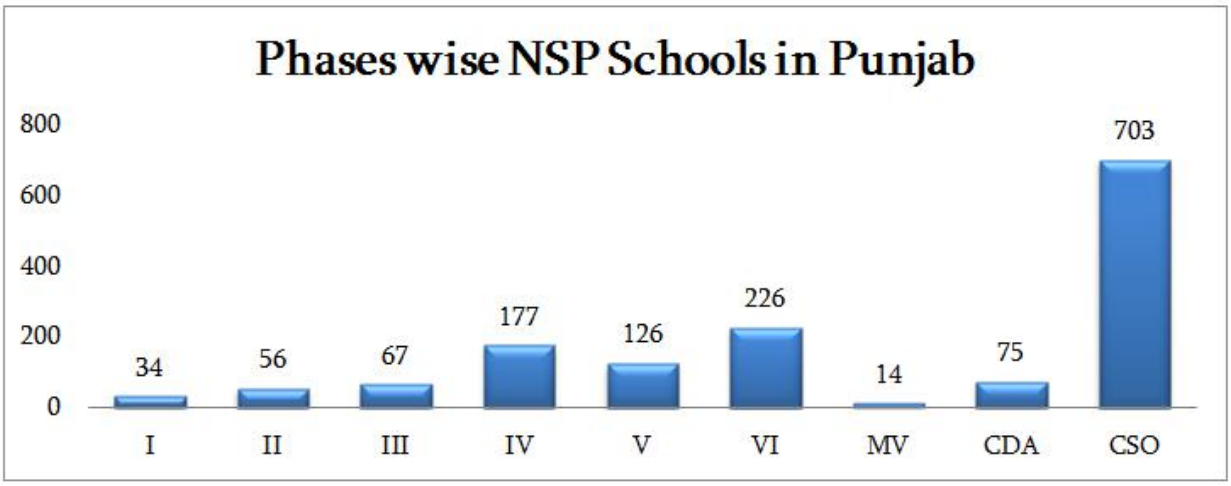
V. NEW SCHOOL PROGRAM (NSP)

This strategy comes in 2008 as a pilot project at initial stages. This engages private entrepreneurs in the shape of schools of distant, remote and under-served areas of the province. It targeted areas where govt. schools are scarce NSP now adhere 1478 schools in 36 districts.

https://dx.doi.org/10.22161/ijaems.4.6.5 *ISSN: 2454-1311*



New schools are opened in those areas where condition of at least 300 people in population is fulfilled and where within 1km radius no other school exists. Women education is preferred too, enhancement is encouraged. Grace period of 50 enrolments was given to partners as well as to have Student-teacher ratio 30 to 1, 1 toilet, 2 rooms and 2 teachers and water provision. New project with seven NGOs, to open new schools in allotted districts which were supposed to be verified by PEF.



NSP emphasizes at retention of children too. It provides the partners, minimum standards in stipulated time. QAT assesses the learning of the students. Internal and external monitoring and evaluation conducted. They target the specifically weaker areas. It provides orientation of whole process, as well as SIS provided to NSP. Financial Assistance is provided; continuity is dependent for the partnership at the performance as per QAT standards. After partnership, no consideration will be charged to students. In order to noncompliance penalties and even cancellation of agreement will considered to be charged. At initial till 50 students financial assistance will be settled and approved as per BODs rate approved. Later when partnership being existed at primary level Rs. 550 is given at per child rate, at elementary level Rs. 600 given at per child and for secondary level Rs. 700 is given for arts and Rs. 800 given for science par students.

https://dx.doi.org/10.22161/ijaems.4.6.5 *ISSN: 2454-1311*

VI. SHINING STARS OF PEF

To evaluate the performance and role of the PEF in above mention context in the reference we are can see the success stories of the PEF which are hereunder.

MisbahS haheen-Voice of Cholistan

She belongs to the Cholistan in Bahawalpur and studying in a remote school. Her school was under Cholistan Development Authority (CDA) and after the expiry of the project school taken by PEF along with other schools. She comes as the real hero of PEF and CDA partnership. She heard of culmination in CDA, one day she stopped the vehicle of DCO Bahawalpur and asked about the future of girls' education instead of paucity of resources for them. After the PEF-CDA saga, all 75 schools were enjoying free education. National Dailies and BBC declared her as "Malala-e-Cholistan."

Faryal Ali- A girl par excellence

Faryal belongs to Bhakkar, a remote and backward area. She is the daughter of a vegetable seller who uses the cart for that, along with three siblings from different schools. She is the first initiator as a girl from her family, who comes to school. She topped Sargodha board in 2013 by securing 970/1050 marks. Proveda great deal of motivation and encouragement to other girls to go to school. UK's international development department (DFID) highlighted her as a symbolof success.

Govt. Schools under PEF

The low-income level played a strong role to let Pakistan underdeveloped nation[5],andtill yet only private schools practiced for the partnership agreement of PEF, but while observing the difference between PEF oriented schools and pure government sector schools government announced to hand over the 274 schools from the pure government to semi-government sector. Now in future prospective and while keeping the limitation. We can see different things. [5]

1- Does PEF overcome the reason behind its initiative? If not what are the factors, could be considered important for it.
2- Privately owned institutes always perform better to keep moving forward in the direction of profit. Could itadhere to the same level of efficiency?
3- Govt. decision of privatization of public schools wouldn't affect the reputation of public school governance? If then how?
4- What can be the further strategies for the sustainability of PEF with effectiveness?

REFERENCES

[1] Educational-articles. (2012). *historical-background-of-education-in-Pakistan*. Retrieved from http://sekho.com.pk: http://sekho.com.pk/educational-articles/historical-background-of-education-in-pakistan/

[2] Foundation, P. E. (2016). *index.aspx*. Retrieved from http://pef.edu.pk.pefsis.edu.pk: http://pef.edu.pk.pefsis.edu.pk/index.aspx

[3] Mission&Vision. (2016). *About/about-pef-mission.aspx*. Retrieved from http://pef.edu.pk.pefsis.edu.pk: http://pef.edu.pk.pefsis.edu.pk/About/about-pef-mission.aspx

[4] Private_schools. (2002). *education/private_schools.asp*. Retrieved from http://www.yespakistan.com: http://www.yespakistan.com/education/private_schools.asp

[5] Abbas, S. K., Hassan, H. A., Asif, J., & Zainab, F. (2018). HOW INCOME LEVEL DISTRIBUTION RESPONDS TO POVERTY: EMPIRICAL EVIDENCE FROM PAKISTAN. *Global Scientific Journals*, 6(3), 131-142.

[6] Times, D. (16 december,2015). *decision-taken-to-hand-over-274-primary-schools-to-pef*. Retrieved from http://www.dailytimes.com.pk: http://www.dailytimes.com.pk/islamabad/16-Dec-2015/decision-taken-to-hand-over-274-primary-schools-to-pef

https://dx.doi.org/10.22161/ijaems.4.6.6 *ISSN: 2454-1311*

Performance Evaluation of Secure Key Distribution Based on the B92 Protocol

Brahim Ouchao[1], Abdeslam Jakimi[2]

[1]Department of Computer Science Faculty of Sciencs and Technics Errachidia, RO&I Team, Moualy Ismail University
ouchaob@gmail.com
[2]Department of Computer Science, GL&ISI Team, Faculty of Sciencs and Technics Errachidia, Moualy Ismail University
ajakimi@yahoo.fr

Abstract**—** *Quantum Cryptography (QKD) uses the laws of Quantum Mechanics to create new cryptographic primitives. Precisely, this technique is based on two laws of quantum mechanics, namely uncertainty principle and no-cloning theorem. The best known QKD is the BB84 protocol published by Bennett and Brassard in 1984. Since then, various QKD protocols have been developed for example a B92 protocol. This latter is similar to that of BB84but this time using only two non-orthogonal states of the four states of BB84. In this work, we develop the java simulation B92 protocol and we give some details of the implementation. Next, we show by an example how Alice (Initiator) can configure the protocol parameters before execution. Finally, we give the statistical results allowing to compare this protocol with that of BB84.*

Keywords— QKD, Qubit, BB84, B92.

I. INTRODUCTION

The basic idea of the security of quantum transmissions was the instability of the quantum elements during the measurement. The B92 protocol is a simpler version of BB84 [1,2]. It is a two-state protocol (it uses two non-orthogonal quantum states) invented by Charles Bennett in 1992. It is based on the fact that two non-orthogonal quantum states are sufficient to guarantee the detection of an eavesdropper. Since no measurement can distinguish two non-orthogonal quantum qubit [3], it is impossible to identify the qubit with certainty. In addition, any attempt to learn the qubit will alter the qubit in a notable way. The coding scheme B92 is sometimes easier to implement. The coding scheme B92 uses a one-to-one correspondence between the conventional qubits and the quantum states. To send the qubit b, Alice prepares a photon in the following quantum state: 0° Horizontal polarization codes 0 and +45° Diagonal polarization for coding 1.

The rest of the paper is organized as follows: Section 2 presents and introduces our approach. Section 3 gives a predict the ear of a spy. Section 4 illustrates and presents the comparison of BB84 and B92. Section 5 concludes the paper and provides an outlook into future work.

II. CONCEPTION

Fig.1 shows the interface of our application that provides an implementation explaining a quantum transmission simulation based on the B92 protocol. Although it provides only a secret key distribution, the architecture can exploit to ensure a more secure transmission. Our application consists of designing a protocol running on a single computer or on two computers (servers) connected remotely via a socket connection [6].

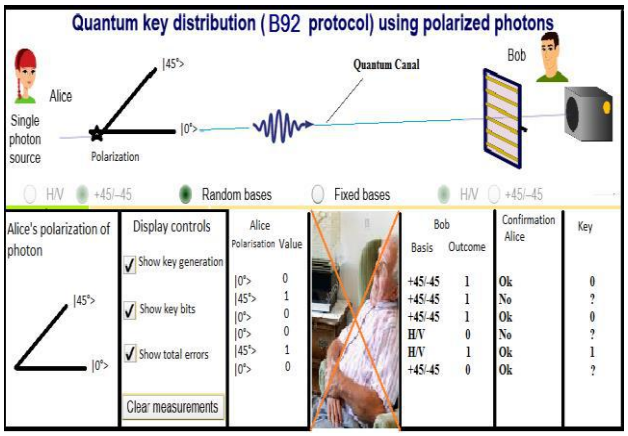


Fig. 1: Simulation of the B92 protocol without spy.

These servers can be used either to simulate a quantum channel, or to interact the two ends of a real quantum channel. The output generated by a protocol execution is a collection of HTML [7] files providing feedback for all relevant phases of the protocol. The software architecture consists of 4 main steps:

- Alice randomly prepares each photon with ether 0° Horizontal polarization assigned a qubit of value (|0>) or |+45> Diagonal polarization assigned a qubit of value (|1>) [4, 5].
- Alice sends the polarized photon to Bob. This one is equipped with a polarization analyzer that measures randomly along the two basis. that is to say according to the following four directions (0°, +45°, 90° or -45°)

https://dx.doi.org/10.22161/ijaems.4.6.6 *ISSN: 2454-1311*

- Bob informs Alice via an authenticated public channel the basis used, but not the polarization of the photon.
- Alice and Bob keep the polarizations of the photons (qubits) sent and received in directions 45° and 90° and reject those received in directions 0° and 45°.

1.1. Example

For example, if Bob detects a photon by measuring with a polarized filter on the 90° direction, he knows that Alice has sent a polarization photon 45° (it cannot be 0° polarization) and therefore it encodes this value by the bit 1. Bob can therefore assign the detections 90° the binary values 1, and the detections 45° the value 0. If Bob does not detect the photon, he cannot be certain which state Alice sent. Thus, Alice and Bob keep only those measurements where Bob detected a photon. This sequence of 0 and 1 bits values forms the key.

1.2. Algorithm of B92

The algorithm of the B92 protocol is:

Inputs n: size of the key.
b: Alice's bit sequence.
Variables
m: counter;
b': (sequence of 0, 1 and character?) generated by Bob.
Begin
Input(n);
m=0;
while(m ¡ n) do:
Alice chooses the bit randomly b_m in {0,1}.
Bob chooses the basis t'_m in {+, X}.
if $b_m = 1$ then Alice sends the qubit $|0\rangle'$ to Bob endif.
if $b_m = 0$ then Alice sends the qubit $|0\rangle$ to Bob endif.
Bob measures the incoming qubit in the base t'_m:
if Bob detecte 0 then b'_m =?, $m = m+1$, and inform Alice "detection' endif'.
if Bob d'etecte 1 then
if $t'_m = '' + ''$ then $b'_m = 1$ endif.
if $t'_m = '' \times ''$ then $b'_m = 0$ endif.
$m = m+1$, and inform Alice "detection".
endif.
If Bob does not detect anything, so inform Alice " no detection " finsi.
end while.
Sorties:
Alice's result $b = b_1 b_2 ... b_n$.
Bob's result $b' = b'_1 b'_2 ... b'_n$.
End.

III. PREDICT THE EAR OF A SPY

1.3. Case: without spy

Alice and Bob communicate in an authenticated public channel to determine which photons have been detected. To do this, they exchange a small number of their bit values which are then rejected (because they are no longer secure) to check for errors. Assuming no spy has intervened, Alice and Bob will have the same qubit sequences. Unlike the BB84 protocol which extracts a sample from the shared key, the B92 protocol even exploits the rejected qubits to calculate the probability of transmission error. It leaves the key intact. After publicly communicating, Alice and Bob find half of these qubits rejected common. Which shows the absence of espionage listening. This is the ideal case for negligence and errors due to the impurity of the transmission channel. Fig 2. illustrates the results obtained

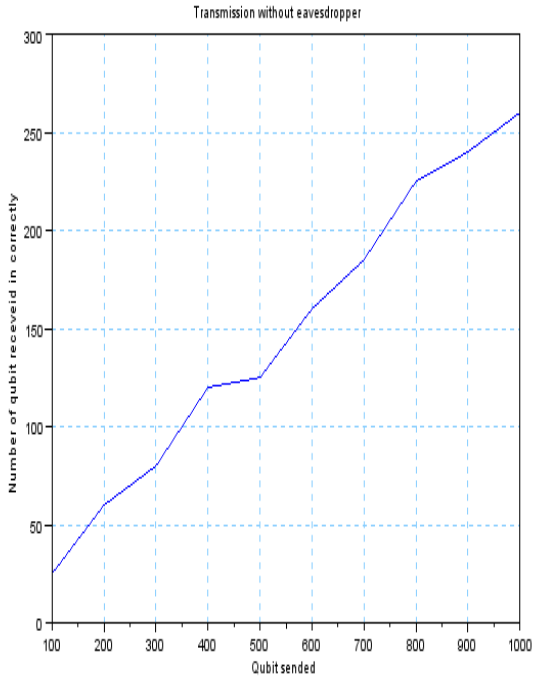


Fig. 2: Average number of qubits received correctly in the absence of the Spy.

1.4. Case: with spy

Figure3 illustrates the interface of the application in the presence of a spy. The analysis of the results obtained shows that the increase in the measurement rate of the spy disrupts the transmission. Indeed, if the probability of error is better than 0:25, then the transmission is no longer secure.

https://dx.doi.org/10.22161/ijaems.4.6.6 *ISSN: 2454-1311*

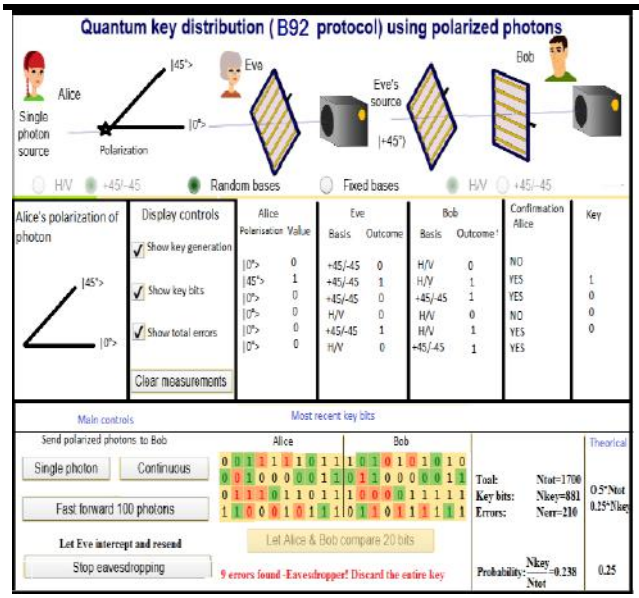


Fig. 3: Simulation of B92 protocol with spy.

1.5. Interpretation

Fig. 4 illustrates the results obtained. It can be seen that the average number of qubits measured between Alice and Bob decreases compared to the previous case (case without spy). Certainly, as long as the error rate is below a threshold (P_{error} < 0:25) [4] the spy remains deaf.

IV. COMPARISON OF BB84 AND B92

1.6. View on BB84 and B92

With some simple modifications in BB84, one can adopt it in model B92. In this last protocol Alice does not encode the qubit randomly. If the generated bit is zero then it sends the polarized photon 0° if the bit is equal to one then the polarized photon 45° is exchanged. With some modifications in the code of BB84, we can adopt it in model B92.

1.7. Attack "Intercept Resend"

In terms of indiscreet detection, B92 is better than BB84. This is well explained in figure5 and figure6.

1.8. Analysis and interpretation

The probability of detection of spy converges faster to 1 when the number of quits exchanged is large. Thus the number of correct measurements between Alice and Bob is reduced; this is due to the listening of the spy's indiscreet ear.

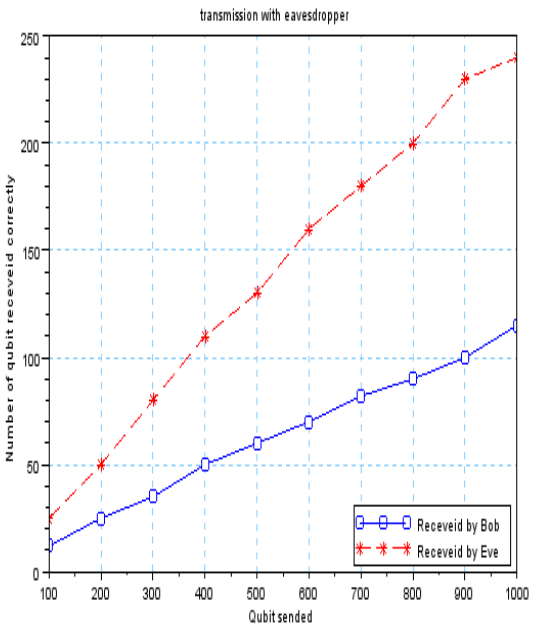


Fig. 4 :Average number of qubits received in the same databases in thepresence of a only spy.

In addition, the simplicity of implementing the B92 protocol and the Figure 5: BB84 and B92 comparison for Intercept Resend correct measurements by eavesdropper. Number of de-mined exchange bit makes this protocol more efficient compared to its BB84 ancestor.

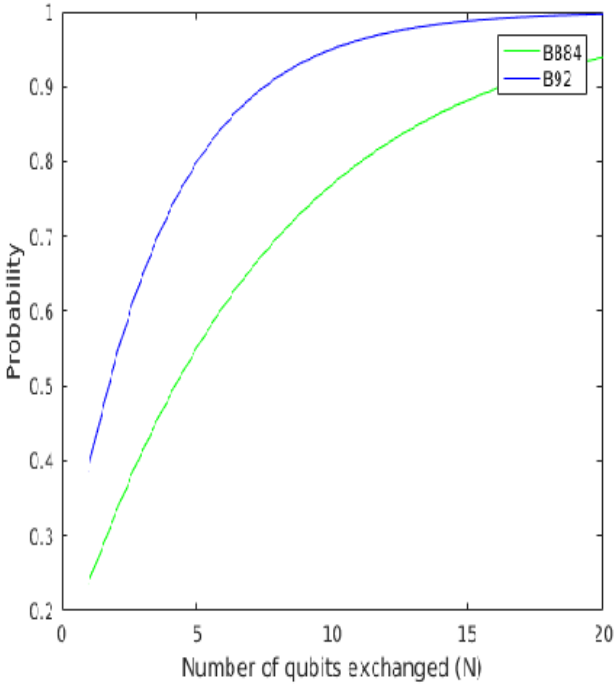


Fig. 5: BB84 and B92 Comparison for Intercept Resend eavesdropper detection.

https://dx.doi.org/10.22161/ijaems.4.6.6 *ISSN: 2454-1311*

V. CONCLUSION

In this work we have developed a java simulation of protocol B92 (BB84 version) for key quantum exchange. The analysis of the results obtained allowed us to define a security zone where the presence of the spy does not influence the transmission. This study also confirmed to us, after a statistical comparison, the importance of the B92 protocol in relation to its BB84 ancestor and this, even if their main steps are similar.

As future works, we will evaluate our approach on more complex systems as quantum teleportation. We will study the possibility of developing the java simulation, comparing and giving more details of the implementation.

REFERENCES

[1] Ch.H. Bennett, G. Brassard and A. Ekert, Quantum cryptography,Scienti_c Am. 267,pp. 26-33, 1992 (int. ed.).

[2] Ch.H. Bennett, G. Brassard, Quantum cryptography: Public key distribution and coin tossinh. In Proceedings of the IEEE International Conference on Computers, Systems, and Signal Processing, Bangalore, India, IEEE, New York, pp. 175-179, 1984.

[3] B. Ouchao and E. H. El Kinani, Statistical Analysis of Common Qubits between Alice and Bob in BB84 Protocol, Contemporary Engineering Sciences, 4, 8, 363-370, 2011.

[4] B. Ouchao and E. H. El Kinani, Analysis of the Inuence of the Rate of Spies'Measure on the Quantum Transmission, Science Journal of Mathematics and Statistics, 2012, 7

[5] B. Ouchao and E. H. El Kinani, Etude statistique de l'inuence de pr_esence des espions: Simulation du protocole BB84 en langage Java, African Journal of Mathematical Physics, 11, 41-46 2012.

[6] V. S. Bagad and I. A. Dhotre, Computer Networks (5th revised edition, 2010 ed.), Technical Publications Pune, p. 52, 2008.

[7] Matthew MacDonald, \HTML 5 - The Missing Manual", 2nd ed, OReilly. 2014.8

https://dx.doi.org/10.22161/ijaems.4.6.7 *ISSN: 2454-1311*

Benefits of industrial safety in productivity

Verónica Flores Sánchez[1], Angel Adolfo Rodriguez Calvo[2], Jesús Juárez Borbonio[3], Patricia Lyssett Bellato Gil[4]

[1]Department of IMI, Universidad Tecnológica del Centro de Veracruz, Veracurz, México
Email: calidad.utcv@gmail.com
[2] Department of IMI, Universidad Tecnológica del Centro de Veracruz, Veracruz, México
Email: 4928@utcv.edu.mx
[3]Department of ER, Universidad Tecnológica del Centro de Veracruz, Veracurz, México
Email: jesus.juarez@utcv.edu.mx
[4]Department of DNM, Universidad Tecnológica del Centro de Veracruz, Veracurz, México
Email: lyssett.bellato@utcv.edu.mx

Abstract— *The risk analysis was carried out in a company dedicated to construction. In the first phase of the project, a diagnosis of the risks was made in which it was found, 30.3% of the works are performed in height, 15.8% of the activities carried out have the risk of falling materials, in the same way there was a risk of not use personal protective equipment and some psycho-physical factors.*
The company must comply with the Mexican standards that apply and reduce the risks according to the degree of danger.
Keywords— Risk, efficiently, personal protective equipment.

I. INTRODUCTION

The relationship between health, illness and work is initially considered as a phenomenon with unique causes (physical risk factors, chemicals, etc.) and specific effects (work risks), reducing the problem to a single causal explanation where a danger can produce a disease, for which the identification and assessment of risk factors is taken as a starting point with the purpose of quantitatively estimating the magnitude of the problem in the face of exposure.

Therefore, the appropriate intervention to work in the prevention of occupational accidents and diseases should be carried out systematically.

Success in risk management is based on developing the culture of risk prevention in the organization, where prevention must be an inherent value of organizational management at all levels (Marín A., Félix P. 2006).

The foregoing indicates that the company that companies must manage their risks from a strategic, tactical and operational perspective.

Consequently, all those responsible for the organization must have risk prevention methods to apply them in their due level of responsibility. Managers should monitor strategic risks, managers and supervisors should reduce tactical risks, and process owners should ensure that operational risks are less and less (Cortez, J. 2007).

Labor productivity is the indicator of efficiency for the relationship between the product obtained and the amount of labor inputs invested during its production, this can be represented in the work hours necessary to obtain a product or service.

Therefore, any implication in the work hours in a negative way influences the same tendency on labor productivity, so a systematic work to eliminate factors generated by accidents and occupational diseases contributes significantly in productivity at the organizational level.

The case study company performs maintenance and repair of machinery and equipment, offers installation and modification of structures, repairs industrial machinery and electrical installations. Similarly remodels and paints work areas.

Due to the nature of the services, there are frequent levels of risk in heights, handling of toxic products, burns, among others.

Objectives

Develop procedures for the prevention of accidents or occupational diseases in order to preserve the life, health and physical integrity of workers in order to increase productivity levels.

Specific objectives

- Identify the risk factors that exist in the maintenance area of the company, case study.
- Analyze the impact of the application of safety standards in the area of maintenance on the productivity of the same area.

The implementation of safety programs in the workplace is important to prevent occupational hazards that may cause damage to the worker. The physical and mental integrity of the worker is more important than indices of production,

https://dx.doi.org/10.22161/ijaems.4.6.7 *ISSN: 2454-1311*

the foregoing indicates that the more dangerous a work activity is, the greater the care and precautions must be when carrying it out; consequently the prevention of accidents and efficient production go hand in hand.

It is important to emphasize that the implementation of security programs bring benefits to the employer and the employee.

Benefits for the employer:

1) Decrease in costs due to work accidents.
2) High production levels for incentives granted to the employee with zero accidents.
3) Better work environment
4) Benefits for the employee:
5) Reduction of accident risks within the work area.
6) Better quality of life for the employee and his family.
7) Increased life expectancy by reducing risks to the employee's health.

II. RESEARCH PROPOSAL

Firstly, the risks and unsafe conditions existing within the company must be determined and known.

The above taking as reference the official Mexican standards issued by the Ministry of Labor and Social Security and that determine the minimum conditions necessary for the prevention of work risks and are characterized by the fact that they are used to attend to risk factors, to which The workers can be exposed.

In Mexico, occupational safety and health is regulated by various precepts contained in the Political Constitution, the Organic Law of the Federal Public Administration, the Federal Labor Law, the Federal Law on Metrology and Normalization, the Federal Regulation of Safety and Health in the Workplace, as well as by the official Mexican standards of the subject, among other ordinances ("Normas Oficiales Mexicanas de Seguridad y Salud en el Trabajo", 2018).

Following are the 41 official Mexican standards on occupational safety and health. These standards are grouped into five categories: safety, health, organization, specific and product. Its application is mandatory throughout the national territory ("Normas Oficiales Mexicanas de Seguridad y Salud en el Trabajo", 2018).

Safety rules:

1. NOM-001-STPS-2008 Buildings, premises and facilities
2. NOM-002-STPS-2010 Prevention and protection against fire
3. NOM-004-STPS-1999 Systems and safety devices in machinery
4. NOM-005-STPS-1998 Handling, transport and storage of dangerous substances
5. NOM-006-STPS-2014 Handling and storage of materials
6. NOM-009-STPS-2011 Works at height
7. NOM-020-STPS-2011 Containers subject to pressure and boilers
8. NOM-022-STPS-2008 Static electricity
9. NOM-022-STPS-2015 Static electricity
10. NOM-027-STPS-2008 Welding and cutting
11. NOM-029-STPS-2011 Maintenance of electrical installations
12. NOM-033-STPS-2015 Works in confined spaces
13. NOM-034-STPS-2016 Access and development of activities for workers with disabilities.

Health Standards:

1. NOM-010-STPS-1999 Contaminants by chemical substances
2. NOM-011-STPS-2001 Noise
3. NOM-012-STPS-2012 Ionizing radiation
4. NOM-013-STPS-1993 Non-ionizing radiation
5. NOM-014-STPS-2000 Abnormal environmental pressures
6. NOM-015-STPS-2001 High or depleted thermal conditions
7. NOM-024-STPS-2001 Vibrations
8. NOM-025-STPS-2008 Lighting

Organization Rules:

1. NOM-017-STPS-2008 Personal protective equipment
2. NOM-018-STPS-2000 Identification of hazards and risks by chemical substances
3. NOM-019-STPS-2011 Safety and hygiene commissions
4. NOM-026-STPS-2008 Colors and safety signs
5. NOM-028-STPS-2012 Safety in processes and equipment with chemical substances
6. NOM-030-STPS-2009 Preventive health and safety services

Specific Rules:

1. NOM-003-STPS-1999 Pesticides and fertilizers
2. NOM-007-STPS-2000 Installations, machinery, equipment and agricultural tools
3. NOM-008-STPS-2001 Timber exploitation and sawmills
4. NOM-008-STPS-2013 Timber forest exploitation
5. NOM-016-STPS-2001 Operation and maintenance of railways
6. NOM-023-STPS-2012 Works in underground and open pit mines
7. NOM-031-STPS-2011 Construction

https://dx.doi.org/10.22161/ijaems.4.6.7 *ISSN: 2454-1311*

8. NOM-032-STPS-2008 Underground coal mines

The first three categories (safety, health and organization) are compulsory in the work centers that carry out production, commercialization, transport and storage activities or services, depending on the characteristics of the activities they develop and the raw materials, products and by-products that they are handled, transported, processed or stored. For the fourth category, its mandatory application is envisaged in the companies that belong to the specific sectors or activities to which these standards refer. Finally, the fifth category corresponds to the companies that manufacture, market or distribute fire protection and personal protection equipment ("Normas Oficiales Mexicanas de Seguridad y Salud en el Trabajo", 2018).

This document identifies and assesses the importance of existing risks for occupational safety and health in the case study.

In the first phase of the study, the characteristics of work activities and jobs are identified.

Subsequently, the potential risks are identified and evaluated. The criteria for assessing risk are described in figures 1 and 2.

Accident probability	P
VERY HIGH - It is very likely to occur immediately	5
HIGH - It is likely to occur in a short period of time	4
MODERATE - It is likely to occur in the medium term	3
LOW - It is possible that it will be produced	2
VERY LOW - It is unlikely that it will produce	1

Fig. 1: Probability of the accident occurring

Severity of the consequences	C
VERY HIGH - May cause death or severe disability	5
HIGH - May cause significant invalidating injuries	4
MODERATE - May cause non-disabling injuries	3
LOW - Can cause small injuries with low	2
VERY LOW - Can cause small injuries without loss	1

Fig. 2: Severity of the consequences

Finally, the degree of danger is calculated by multiplying the values shown in Figure 1 and 2.

III. RESULTS

During the tour of the company the following risks were found:

1. Risk of work at height
2. Risk of falling materials
3. Risk of installation of work equipment
4. Risk of handling tools and equipment
5. Risk related to the order and cleanliness
6. Psycho-occupational risks
7. Risks of non-use of personal protective equipment

The most frequent accidents were: fall of height

1. Cuts
2. Punctures
3. Bone fracture
4. Hit by falling objects

Due to the above, the rules that should be followed can be seen in the following list:

1. NOM-001-SEDE-2012 Electrical installations
2. NOM-001-STPS-2008 Buildings, premises and facilities
3. NOM-002-STPS-2010 Prevention and protection against fires
4. NOM-004-STPS-1999 Systems and safety devices in machinery
5. NOM-005-STPS-1998 Handling, transport and storage of dangerous substances
6. NOM-006-STPS-2014 Handling and storage of materials
7. NOM-009-STPS-2011 Work at height
8. NOM-020-STPS-1994 Medicines, healing materials and personnel providing first aid
9. NOM-022-STPS-2008 Static electricity
10. NOM-027-STPS-2008 Welding and cutting
11. NOM-029-STPS-2011 Maintenance of electrical installations
12. NOM-033-STPS-2015 Work in confined spaces
13. NOM-010-STPS-1999 Contaminants by chemical substances
14. NOM-011-STPS-2001 Noise
15. NOM-025-STPS-2008 Lighting
16. NOM-017-STPS-2008 Personal protective equipment
17. NOM-018-STPS-2000 Identification of hazards and risks by chemical substances
18. NOM-019-STPS-2011 Safety and hygiene commissions
19. NOM-026-STPS-2008 Colors and safety signs
20. NOM-030-STPS-2009 Preventive health and safety services

https://dx.doi.org/10.22161/ijaems.4.6.7 *ISSN: 2454-1311*

21. NOM-011-STPS-2001 Conditions of safety and hygiene in workplaces where noise is generated
22. NOM-015-STPS-1994 Personal protection for workers in workplaces

IV. CONCLUSION

Risk	P	C	GP
Risk of work at height	5	3	15
Risk of falling materials	4	4	16
Risk of installation of work equipment	5	5	25
Risk of handling tools and equipment	4	4	16
Risk related to the order and cleanliness	5	4	20
Psycho-occupational risks	3	3	9
Risks of non-use of personal protective equipment	5	4	20

Fig. 3: Degree of risk hazard (GP)

According to figure 3 it can be concluded that:

1) The risk of work at height is MODERATE. It needs to be corrected quickly (<1 week).
2) The risk of falling materials is HIGH. It needs to be corrected immediately (<1 day).
3) The risk of installation of work equipment is VERY HIGH. It is necessary to paralyze activity and jobs.
4) The risk of handling tools and equipment is HIGH. It needs to be corrected immediately (<1 day).
5) The risk related to the order and cleanliness VERY HIGH. It is necessary to paralyze activity and jobs.
6) The psycho-occupational risks LOW. It needs to be corrected as soon as possible (<1 month).
7) The risks of non-use of personal protective equipment, is VERY HIGH. It is necessary to paralyze activity and jobs.

REFERENCES

[1] Cortez, J. (2007). Seguridad e higiene del trabajo. España. Editorial Tebar.
[2] Díaz, A., Gallego, A., Márquez, A., Millán, A., Moreno, J., Fernández, R.,…Viñas, J. (2008). Manual para la formación en prevención de riesgos laborales. España: Editorial Lex Nova.
[3] Marín A., Félix P. (2006). Seguridad Industrial, Manual para la formación de ingenieros. España. Editorial Dykinson, S.L.
[4] Ramírez, C. (2005). Seguridad Industrial: Un enfoque integral. México: Editorial Limusa.
[5] Méndez, Alejandro; Roberto Juárez. (2002) Investigación de Operaciones. México. Mc Graw Hill.
[6] Normas Oficiales Mexicanas de Seguridad y Salud en el Trabajo. (2018). Retrieved from http://asinom.stps.gob.mx:8145/Centro/CentroMarcoNormativo.aspx
[7] Rodríguez, J. (2002). Cómo elaborar y utilizar los manuales administrativos. México. International Thomson Editores, S. A. de C. V.
[8] Vaughn, R. C. (1988). Introducción a la ingeniería industrial. España: Editorial Reverté, S. A.

https://dx.doi.org/10.22161/ijaems.4.6.8 *ISSN: 2454-1311*

Evaluation of Gastric Diseases Using Segmentation RGB Interface in Video Endoscopy Images

Sandra Luz Mendoza-Trejo[2], Víctor Manuel Ruiz-Martinez[1,2], José Ernesto Domínguez-Herrera[1,2]

[1] Group of Polymer Composite Materials and Interphases, Carlos III University of Madrid, Av. Universidad 30, 28911 Leganés, Spain
Email: 100367719@alumnos.uc3m.es
[2]Department of IMI, Universidad Tecnológica del Centro de Veracruz, . Av.Universidad 350, 94910 Veracruz, México
Email: sandra.mendoza@utcv.edu.mx, victor.ruiz@utcv.edu.mx

Abstract— *Video endoscopy is a prevention, diagnosis and prognosis technique usually used to detect gastric lesions due to its minimal invasion and low risk, however the critique of the medical personnel is the main actor to give a diagnosis, in this article, a novel algorithm of image processing using MATLAB software to separate video endoscopy in 6 tonalities implementing RGB filters and their combinations has been evaluated by medical personnel to determinate if the colorimetry helps in the detection of gastric diseases such as polyps, varicose veins and ulcers, the medical staff indicates that the color red, pink (Without green) and yellow (without blue) help in the detection of varicose veins due to enhanced of natural color and reduction the interference of fluids in cavity, gastric ulcers are detected easily by yellow (without blue) and pink colors.*

Keywords— RGB Segmentation, Video Endoscopy, Injury Identification.

I. INTRODUCTION

The human interest to explore the human body has transcended through time, since the eighteenth century the ability to observe and explore the cavities was reduced to the mouth, the oropharynx, the nostrils, the external auditory canal, the vagina and the rectum [1], later in 1806, Philipp Bozzini used a tube that he created, known as "Lichtleited" to study the urinary tract using the sun and a candle as a source of light to see further into the body's cavities [2]-[3], Antonín J. Desormeaux began the current endoscopy in 1965 with his study of the urinary tract and the bladder using an instrument called "endoscope"[4].

In 1868, Dr. Adolph Kussmaul, got to observe the inside of a stomach of a living human body for the first time. The test was performed with a swallow's swords that could swallow a long and straight metal tube [5]. In 1881, Johann Von Mikulicz and his associates created the first rigid gastroscopy [6], but it was until 1932 that Dr. Rudolph Schindler invented a flexible gastroscope that allowed the examination of the interior of a stomach through numerous lenses located throughout the tube with a miniature electric lamp [7].

The use of the technology has allowed endoscopy studies were less invasive every time [8], with simpler interfaces [9] and with a more precise analysis using color models [10], while the advancement of technology the characteristics are improved, however these improvements are offset by the high costs of these technologies.

Nowadays, there are video endoscopy systems that use techniques based on edges and clusters to classify and show the images that are in focus allowing to improve the conditions to the specialist to take better decisions [11]. Those can show images in different shades of color by using chromatic filters, giving to the endoscopy specialist doctors precious information to the detection of lesions and diseases in the inner cavities [12] In the technological advances of the endoscopy video equipment, the FICE system is one (FUJI Intelligent Chromo Endoscopy), it uses spectral images to get images that remark the characteristics of the mucosa allowing to identify tissue lesions [13],the NBI (Narrow band imaging) is a video endoscopy system based in the modification of the light bandwidth emitted, using a system of filters that stretches the light wave length highlighting the vascular patterns [14]

Currently, video endoscopy is an indispensable tool for the detection and treatment of different diseases, however, when performing endoscopic examinations, there are some lesions that are not seen with the naked eye, so when observed in certain shades of color using Color filters, the image provides valuable information to medical specialists

https://dx.doi.org/10.22161/ijaems.4.6.8 *ISSN: 2454-1311*

in endoscopy for the detection of lesions and diseases of the internal cavities with greater precision.

The current systems of endoscopy are excessively expensive, doubling or tripling in price of the traditional equipment, therefore, they are not easily acquired, due to the above, it is necessary to develop and evaluate a system for the spectral decomposition of video endoscopy, using filters in their color components to obtain images with tonalities that give information in the diagnosis of diseases.

II. METHOD

The MATLAB software was used in these studies, implementing filters in the space of color RGB in a sequence of endoscopy images.

The filter RGB works delimitating one or two components of color, in this investigation red, green, blue, without red (Blue-green), without green (pink), and without blue (yellow) colors were tested.

To use a specific configuration as red color, red color turn "1" while green and blue colors turn "0" as shows in table 1.

Table.1: RGB configuration

RGB configuration	Primary Colors		
	Red	Green	Blue
Red	1	0	0
Green	0	1	0
Blue	0	0	1
Without Red	0	1	1
Without Green	1	0	1
Without Blue	1	1	0

Figure 1 shows the block diagram of the image conversion, the original image is separated into its RGB components, then the filtering is done in the space domain, by the convolution, resulting in the spectral components R'G'B' in non-true color. Finally, the specters are joined to generate the resulting image.

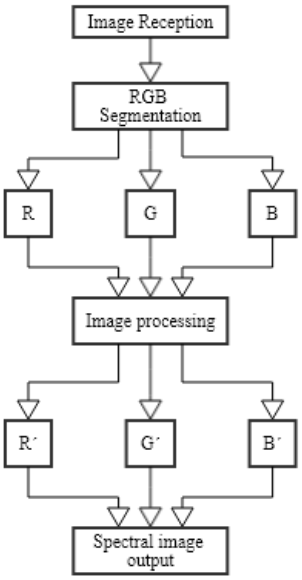


Fig.1: RGB segmentation block diagram

The endoscope-computer-user interface was programmed in MATLAB software to process video endoscopy; it shows the sequence of images red, green and blue, without red (blue-green), without green (pink), and without blue (yellow) colors following the code shows below.

```
Mov= aviread('prueba.avi');
T=size(mov);
f=T(2);

for i=1:5
       fram=mov(:,1);
       tim=size(fram.cdata);

mneg=uint8(zeros(tim(1),tim(2)));
       for j=1:f
            fram=mov(:,j);
            ImO=fram.cdata(:,:,:);
ImR(:,:,1)=fram.cdata(:,:,1);
ImR(:,:,2)=zeros; ImR(:,:,3)=zeros;
```

Figure 2 MATLAB code sample

Injuries such as ulcers, polyps and varicose veins, were evaluated by video endoscopy, those were provided by specialized doctors, the images were processed and filtered in the RGB spectra, an information analysis was performed using an instrument that evaluated colorimetry, injury identification, coupling to equipment, and customer satisfaction.

III. RESULTS

3.1 Man-Machine Interface

The interface in figure 3 shows the system for selecting the desired RGB regime, allowing with one click to select the channel to filter, 67.5% of endoscopy specialists indicated that the interface is efficient and easy to use.

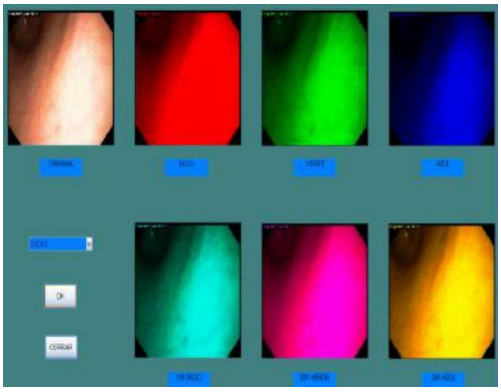


Fig.3: Graphic interface of the different components of the RGB system.

According to the injuries analyzed, it can be determined the injure to identify, because the 90% of specialists indicated by use of colorimetry allows better identification of this injury, followed by polyps and varicose veins with 58% and 53% respectively.

https://dx.doi.org/10.22161/ijaems.4.6.8 *ISSN: 2454-1311*

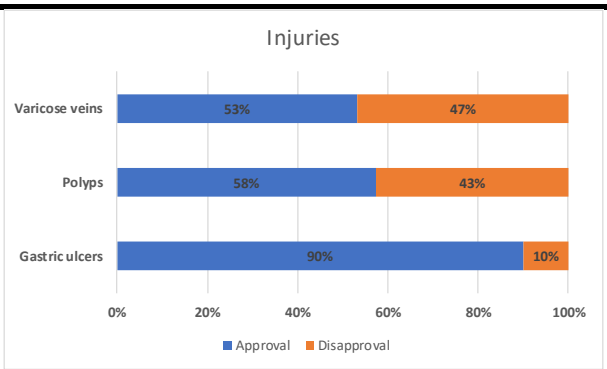


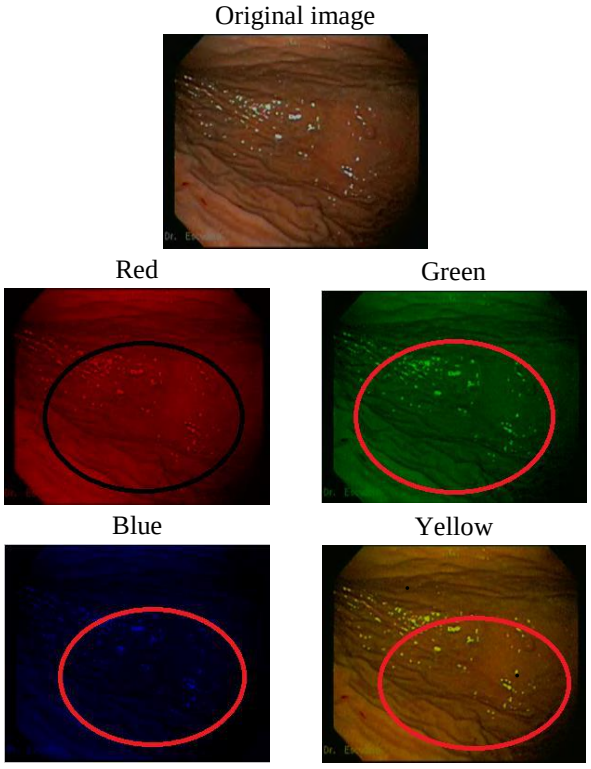
Fig.4: Approval for injury

The use of RGB colorimetry in the identification of varicose veins and polyps is effective, however, 42.5% of medical specialists say the color influences the analysis in these diseases, in the same way, only 20% medical specialist agree with colorimetry. It can affect on the analysis, emphasizing on green and blue colors.

3.2 VIDEO ENDOSCOPY ANALYSIS.

The use of different RGB tonalities were evaluated according to decomposition of original image in 6 combinations results in three conditions. This conditions are the original R, G and B segmentation and combinations R-G, G-B and R-B

3.2.1 Varicose veins



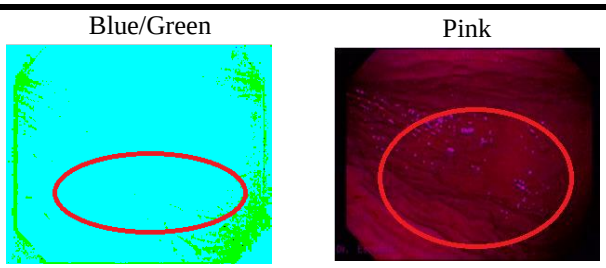


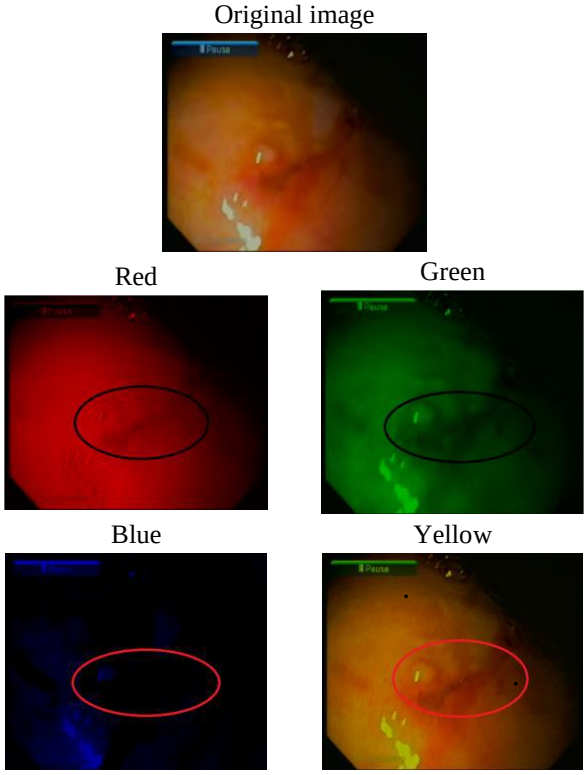
Fig.5: RGB Decomposition of Varicose veins

The detection of varicose veins is efficient using colors such as red, pink and yellow, because the tortuous or dilated vein is highlighted. The 50% of the specialists opted for the red tint to detect this lesion, followed by pink (without green) with 33% and color yellow (without blue) with 17%.

The shades Green, blue green and blue, (without red) do not highlight the varicose vein in the gastric cavity, because the blue and green color show a colorimetric saturation, while the green color does not show evidence of the lesion.

3.2.2 Gastric ulcer

The suffering lesion by medical specialists to be detected is the ulcer because the 90% agrees that it is quick and easy to detect with the decomposition of colors, although, they explain to use yellow and pink (without green) colors are the most useful colors for this detection with 67% and 33% of effectiveness respectively.



https://dx.doi.org/10.22161/ijaems.4.6.8 *ISSN: 2454-1311*

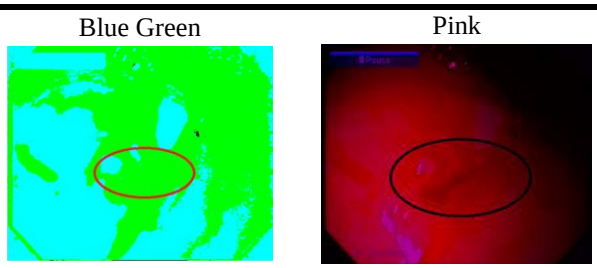


Fig.6: RGB Decomposition of Gastric ulcer

The primary colors and blue-green composition (without red) was descanted due the images saturated.

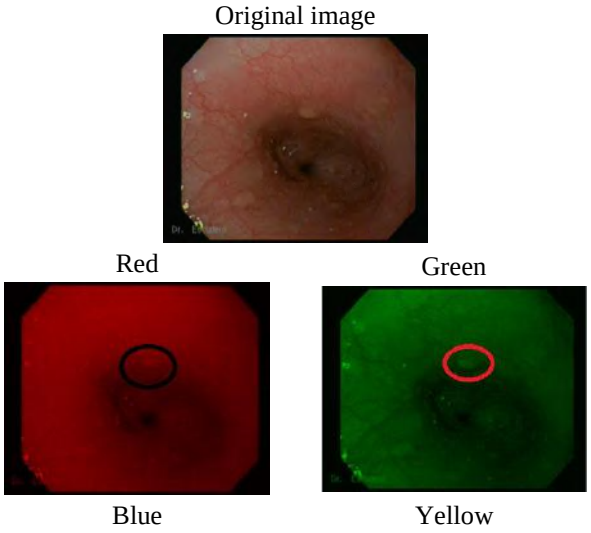
The medical specialists explain about filtration with yellow and pink colors (without green), allow to find small lesions in the upper small intestine, which early Zollinger Ellison syndrome.

The first paragraph under each heading or subheading should be flush left, and subsequent paragraphs should have a five-space indentation. A colon is inserted before an equation is presented, but there is no punctuation following the equation. All equations are numbered and referred to in the text solely by a number enclosed in a round bracket (i.e., (3) reads as "equation 3"). Ensure that any miscellaneous numbering system you use in your paper cannot be confused with a reference [4] or an equation (3) designation.

3.2.3 Polyp

The detection of polyps has accepted 58% by medical specialists, this can be given by the range of colors and used for this detection.

The 55% of the specialists believe that the pink (without green) has better detection, due to the color of polyp change and becomes white, yellow and green colors were selected 18% and the 9% were selected blue color by medical specialists.



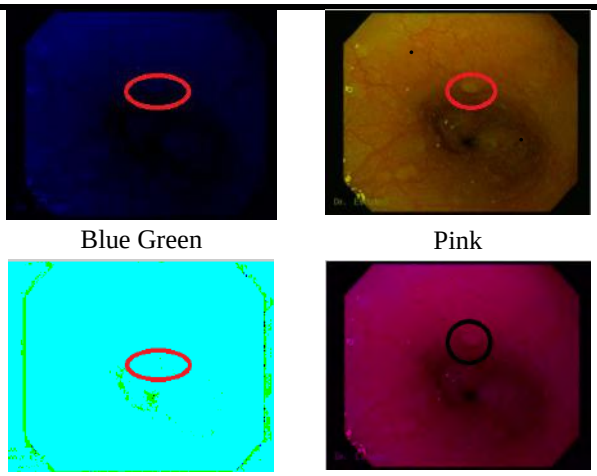


Fig.7: RGB Decomposition of Polyp

Red and green-blue (without red) colors were not succeeded in the detection of polyps, because these colors show colorimetry as walls cavity.

According to the analysis made to each injury, the following table was summarized:

Table.2: Colorimetry - Injury summary

COLOR	Varicose veins	Gastric ulcer	Polyp	TOTAL
RED	50%	0%	0%	15%
GREEN	0%	0%	18%	10%
BLUE	0%	0%	9%	5%
YELLOW	17%	67%	18%	25%
PINK	33%	33%	55%	45%
BLUE GREEN	0%	0%	0%	0%

The pink (without green) is the most accepted by the specialists for gastrointestinal injuries detection, due to it highlights the natural color skin, reducing interference caused by fluids on internal cavity.

The varicose veins have been denoted by the internal high turbulent flow using the red color.

IV. CONCLUSIONS

The decomposition RGB video endoscopy allows to specialist gives faster and trusty diagnosis with the use of the specific spectra for each lesion.

Use of colors such as red and pink (without green) will allow a better detection of gastrointestinal varicose veins.

Gastric ulcers are detected easily by yellow (without blue) and pink colors.

RGB decomposition is not affable to detect polyps because colorimetry doesn't show this condition.

Green-blue (without red) color is not suitable to detect gastrointestinal diseases because saturation of color given for inner fluids in the cavity.

The processing time of the system is directly linked to the characteristics of the computer, being the processor and the video card the main factors.

https://dx.doi.org/10.22161/ijaems.4.6.8 *ISSN: 2454-1311*

The RGB decomposition of red color for the varicose veins and yellow color for ulcers can start point through systems such as: artificial intelligence, neural networks and others, to generate systems for detecting injury of this type without the intervention of medical specialist.

REFERENCES

[1] Gross, S., & Kollenbrandt, M. (2009). Technical Evolution of Medical Endoscopy. Acta Polytechnica: Journal of Advanced Engineering, 49(2), 6–10.

[2] Reuter, M. (2006). Philipp Bozzini (1773-1809): The endoscopic idealist. Der Urologe. Ausg. A, 45(9), 1084–1088, 1090–1091. https://doi.org/10.1007/s00120-006-1165-9

[3] Doglietto, F., Prevedello, D. M., Jane, J. A., Han, J., & Laws, E. R. (2005). Brief history of endoscopic transsphenoidal surgery--from Philipp Bozzini to the First World Congress of Endoscopic Skull Base Surgery. Neurosurgical Focus, 19(6), E3. https://doi.org/10.3171/foc.2005.19.6.4

[4] Léger, P. (2004). [Antonin Jean Desormeaux]. Progrès En Urologie : Journal de l'Association Française d'urologie et de La Société Française d'urologie, 14(6), 1231–8.

[5] Matteson, E. L. (2012). History of vasculitis: The life and work of Adolf Kussmaul. Cleveland Clinic Journal of Medicine. https://doi.org/10.3949/ccjm.79.s3.12

[6] Zajaczkowski, T. (2008). Johann Anton von Mikulicz-Radecki (1850-1905)-a pioneer of gastroscopy and modern surgery: His credit to urology. World Journal of Urology. https://doi.org/10.1007/s00345-007-0227-y

[7] Linder, T. E., Simmen, D., & Stool, S. E. (1997). Revolutionary Inventions in the 20th Century: The History of Endoscopy. Arch Otolaryngol Head Neck Surg, 123(11), 1161–1163. https://doi.org/10.1001/archotol.1997.01900110011001

[8] Nabh, A., Sherid, M., & Spurr, C. (2013). Diagnostic Endoscopy. Endoscopy of GI Tract, 37–74. https://doi.org/10.1117/1.JBO.19.4.049902

[9] Wang, A., Banerjee, S., Barth, B. A., Bhat, Y. M., Chauhan, S., Gottlieb, K. T., … Rodriguez, S. A. (2013). Wireless capsule endoscopy. Gastrointestinal Endoscopy, 78(6), 805–815. https://doi.org/10.1016/j.gie.2013.06.026

[10] Charisis, V. S., Hadjileontiadis, L. J., Liatsos, C. N., Mavrogiannis, C. C., & Sergiadis, G. D. (2012). Capsule endoscopy image analysis using texture information from various colour models. Computer Methods and Programs in Biomedicine, 107(1), 61–74. https://doi.org/10.1016/j.cmpb.2011.10.004

[11] Oh, J., Hwang, S., Lee, J., Tavanapong, W., Wong, J., & de Groen, P. C. (2007). Informative frame classification for endoscopy video. Medical Image Analysis, 11(2), 110–127. https://doi.org/10.1016/j.media.2006.10.003

[12] Lai, K., Bo, L., Ren, X., & Fox, D. (2011). A large-scale hierarchical multi-view RGB-D object dataset. In Proceedings - IEEE International Conference on Robotics and Automation (pp. 1817–1824). https://doi.org/10.1109/ICRA.2011.5980382

[13] Owo Eko Cahyono, Agung Tjahjo Nugroho, Miftahul Rizkiyani(2017).Detection of Paddies Reflectance Values to classify their Ages using RGB Photograph Images. *International Journal of Advanced Engineering Research and Science (ISSN : 2349-6495(P) | 2456-1908(O))*,4(10), 046-050. http://dx.doi.org/10.22161/ijaers.4.10.7

[14] Liu, Y. X., Huang, L. Y., Bian, X. P., Cui, J., Xu, N., & Wu, C. R. (2008). Fuji Intelligent Chromo Endoscopy and staining technique for the diagnosis of colon tumor. Chinese Medical Journal, 121(11), 977–982.

[15] Gono, K., Obi, T., Yamaguchi, M., Ohyama, N., Machida, H., Sano, Y., … Endo, T. (2004). Appearance of enhanced tissue features in narrow-band endoscopic imaging. Journal of Biomedical Optics, 9(3), 568. https://doi.org/10.1117/1.1695563

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

Modelling Production Performance of Small Scale Production Plant

ManDjun Lee[1], Prashobh Karunakaran[1], RahmatAidil Djubair[2], Heng Jong Ngu[1]

[1]Lecturer, School of Engineering and Technology, University College of Technology Sarawak, Malaysia
[1]Senior Lecturer, School of Business and Management, University College of Technology Sarawak, Malaysia

Abstract— *This paper is about development of a model to evaluate capacity utilization (CU) of small scale production plants. The model employed short term production function with key independent variables of: plant operators, capital, R&D, energy and machinery maintenance expenditure. CU of small scale plant is the output and dependent variable for this study. The developed model is tested on a small scalewater production plant. The output results show that the average CU is 74% for six months of operations. The model test results revealed that all the inputs are positively correlated (R>0.893) to CU, with major inputs are significantly contributing to CU. About 80% (R^2=0.797) of the inputs are consumed to achieve CU of production process. The model estimated value was found to be close to actual recorded outputs (<2% difference). The model is found to be statistically significant at 95% confidence level with p-value less than 0.05. The developed model is useful for small scale plants in evaluating the production performance to achieve technical and economical sustainability. For further research in this topic, this study suggests building a model to optimize the contribution of inputs to CU of small scale production plants.*

Keywords— Capacity utilization, Operations research, Production performance, Small scale production.

I. INTRODUCTION

This study developed a model to evaluate capacity utilization of a small scale plant. This study is designed to apply the concept and knowledge of Operations Research in engineering into a small scale plant evaluating its capacity utilization. The developed model is tested in a small scale water production plant. The model will contribute to explore and identify bottlenecks, productivity gap and non-value added inputs. In the bigger picture, this model will contribute to achieve production sustainability in the aspect of economy and environment. Information to evaluate capacity utilization of a small scale plant is currently very limited in published material, whereas technically and economically feasible small scale plants are essential. Therefore, this work will contribute to the current knowledge stock of operations research. Essentially, the study will contribute to the foundation on capacity utilization of small scale plant domain. In this aspect, this study is new and novel.

1.1 Problem Statement

Nowadays, small scale production process is turning to the status of industry which implies that the involvement of man, machinery, materials, money and methods (5Ms) are key operating parameters to achieve low cost production. However, most small scale production plant lack of research and development capability to push them forward. To address all these issues, engineers and scientists need to pay attention to improve production performance as CU is one of the important keys in production performance measurement. Over the years, CU is also being improved for better measures and implemented in other industries such as automobile, electric generation, fishing, food processing and logistics [1]–[7]. To the best of our knowledge, there has not been any work on CU in the small scaleproduction. In this regard, the fundamental questions to get solution of the stated problems are:

1. What empirical model is required that includes all key operating inputs of small scale production plant to evaluate CU?
2. How does the developed model contribute to evaluate CU in an operating condition of a small scale production plant?

1.2 Research Objectives

This study has two specific objectives:

(i) To develop a CU model for small scale production plant
(ii) To test the CU model in an operating small scale production plant

1.3 Novelty of Study

Majority of the publications focused on production output, performance of machines related to output, production cost, pollutions and energy consumption. Publications on source

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

of operations management inefficiency of production plant is very limited. The output of small scale production plant depends on inputs such as labour, energy, maintenance, research and development (R&D) as well as capital. How these inputs quantitatively relate to output is also limited in the literature. This work developed a model with all major inputs (capital, labour, maintenance, energy, R&D), output (CU of small scale plant) and the contribution from each input to CU that can be measured quantitatively. The developed model will contribute to explore and identify bottlenecks, productivity gap and non-value-added inputs. In this aspect, necessary decisions could be taken to overcome the inefficiencies of the small scale production plant. Therefore, this work will definitely add new knowledge in the stock of present water production domain.

II. LITERATURE REVIEW

2.1 Concepts of Capacity Utilization

The most used definition of Capacity Utilization (CU) is the ratio of actual output to the potential output. Potential output has various definitions from the perspective of engineering and economy [8]–[13]. In the perspective of engineering economy, CU measures the amount of inputs that are utilized to produce outputs from a plant production cycle. CU is an indicator in whether a plant can accommodate future growth without extra investment. CU is also being used to explain some important factors in production economics such as productivity, profit, assessing growth, employment generation and production cost [14]–[16]. In engineering operations point of view, CU measures how much of the existing output of the production facility that is being utilized, and plans could be devised to improve the production efficiency to meet customer demand [17]. In macroeconomic perspective, CU of manufacturing industries decrease sharply during economic recession because of the decrease in aggregate demand for products. Industrial practice proves that when CU is decreasing, the industry is most likely operating with a negative output gap that contributes to increase the unit cost of production. It is because the negative output gap acts as non-value-added inputs. Likewise, if CU increases, then the industry is operating with a positive output gap which contributes to reduce the unit cost of a product [18]. This statement is supported by past literatures that increasing capacity utilization contributes to reduce overall cost such as setup, maintenance, inventory holding, shortage cost and cost incurred by low quality products [19]. Factors affecting CU in production process are such as machineries transforming capability, skill of machine operators, working environment, degree of maintenance in machineries and raw material quality [20].

CU is an important tool for production and operations management to evaluate production performance and formulate strategy to reduce non-value input that appears as productivity gap [5], [17], [21]. Past literatures demonstrated increase in CU contributes to reduce overall cost such as setup, maintenance, inventory holding, shortage cost and quality cost [19], [22]. Better CU, efficient capacity planning and management are the key to improve production performance [23]–[26]. Over the years, CU is also being improved for better measures and implemented in other industry such as automobile, electric generation, fishing, food processing, logistics, [1]–[3]. The preliminary literature survey report states that was done at the earlier stage of this study, there has not been much work of CU in water processing industry. In this regard, the outcome of this study would fill up this gap and contribute to assist manager of small scale water processing industry to evaluate CU for achieving sustainability.

2.2 Key Operating Parameters of Small Scale Production Plant

Personnel or labour workforce is one of the main input in production operations. Skill sets that owned by labourwillhave huge impact on the output quality. Skill sets are influenced by the level of education and experience and it is crucial factor for any production facility in to grow[27]. In addition, personnel cost is an important cost component in a production facility. Personnel cost of production consists of direct and indirect workforce cost, which means wage for machine operators and maintenance personnel at production plant is direct personnel cost while cost for management or supporting department is considered as indirect personnel cost [28]. Labourcost made up a significant portion of most production cost structure. There are methods to reduce labour costs. These include the adoption of new technology, efficient workforce management, promote labour training, and outsourcing [29]. Shahidul and Shazali (2011) found that favourable working environment, provide trainings to workforce will contribute to increase labour productivity. This concept is applicable to production plant as personnel cost constitutes about 1 to 6% of production cost [30].

Research and development (R&D) activities are essential effort contributes to success of production technology by making it more significant over the years [31]. Although present production technology is well developed, however, there are still rooms for improvements in efficiency, reliability, simplicity and cost reduction. In this regard, huge

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

amount of R&D efforts in production should be directed towards improving and optimizing the existing production technology. The topics of R&D that gaining attentions are such as [32]:

- Development of alternative energy sources
- Mitigation and control of scaling and fouling
- Alternate materials of construction
- Optimization of process design
- Improvements in components design
- Control systems to optimize consumables consumption.

In this aspect, the expenditure of R&D provides indication of engineering research capability. R&D efforts and production performance are connected mutually to improve competitiveness in the global market [23]. R&D expenditures are incurred in the midst of the existing production components and introduces new equipment aims to optimize the existing production performance. R&D is needed not only in large scale production plant process and also in small scale to support various applications of production processes. The strength of production machinery operations is positively associated with performance of maintenance activities [17]. Literature suggests that maintenance activities are responsible to restore plant machineries back to or close to original health condition [33]. Machinery capacity utilization is a powerful productivity indicator which measures how much installed productive capacity is being utilized with respect to actual production output. Generally, machinery productivity is positively associated with capacity utilization and capacity utilization depends on machineries condition; this creates linkage between maintenance and capacity utilization. Maintenance activities cannot be separated from production machineries as it is needed a manufacturing plant for utilizing its capacity to optimize production performance. Good implementation of maintenance strategy not only improves machinery efficiency and effectiveness but also brings significant improvements in plant capacity utilization. Consequently, the production system being benefited by becoming more productive. Indeed, quality maintenance work will contribute to increase CU and product quality [13]. Successful long term production depends on proper maintenance of production system. It is estimated that production maintenance is representing about 10% to 40% of total production operation cost [17]. In this category, the included costs of spare parts, and consumable for maintenance activities. Spare parts cost includes all the replacement parts for the machinery in the aspect of mechanical, electrical, and fluid systems [34]. Expenses relating to machinery hardware such gasket, bearing, lubricants, cooling agent, screw, bolts and nuts, O-rings and others are categorized as consumable cost [35]. Both facility and maintenance costs are important for a water production plant to achieve its economical sustainability [33]. The cost components should get higher priority from plant management in order to sustain. In other words, production system maintenance has to be optimized so that the water production plant is sustainable.

III. METHODOLOGY

This is an applied research in engineering domain consist of operations research, small scale production system hardware, production theories, capacity utilization theories, and production economics. Production and CU related theories have been applied to the water production process to develop the CU model. The methods and study process have concentrated on small scale water production process machinery to evaluate production performance.

3.1 Characteristics of Variables Used

Table.1: Explanatory Variables

Research Variables	
Dependent Variables	Definition of Variables
Capacity Utilization $(CU) = \sum_i^n \frac{Q_a}{Q_p}$ $CU = f(K,L,M,D,E)$	CU of production system depends on actual product output, Q_a and potential output Q_p. The output of the process is output desalinated water measured by product water volume Litre in one operating day (L/day). Product water output must conform with quality as per World Health Organization drinking water quality which is pH of water is recommended at range 7.0-8.5, total hardness is less than 100mg/L, turbidity (total suspended solids) is less than 5.0NTUs, and total dissolved solids to be less than 1000mg/L [36]. CU depends on inputs such as plant operators, maintenance activities, capital, energy, research and development investment to achieve higher production performance [13], [17], [37]. Inefficient part of water production process act as non-value inputs ultimately contributes to reduce capacity utilization of water production performance [38].

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

Research Variables	
Independent Variables (Descriptive Variables)	Definition of Variables
Inputs	
Capital (K)	The capital input of the process includes all expenditures associated with system implementation from the beginning of time of production project through engineering design, financing, construction, installation, commissioning and acceptance testing to start operating [39]. In this study, the major focus is on production system. In this aspect, the capital cost focus on production system cost and other operating cost associated with machinery such as insurance and amortization.
Plant Operators and Maintenance Staff (L)	Plant operators in charge of operating daily operations. Maintenance staff involve in all activities related to maintenance such as membrane cleaning, preventive maintenance schedule and breakdown maintenance. Both plant operators and maintenance staff have direct and significant impact on output productivity [40]. Operators with higher skills will increase production capacity. This signifies high degree of skill could be considered as high value adding to water production process and significantly correlated with productivity [20].
Maintenance Activities (M)	Maintenance activities are essential to reduce machinery breakdown and reduce membrane fouling. Membrane fouling factors are the determinants of water production performance. Fouling factors contribute to increase operating pressure across membranes and this reduces CU, product water production and lifespan of membranes [41]. Therefore, maintenance activities are crucial to remove membrane fouling. Good performance practices lead to higher product water quality, CU and reduce downtime [17]. The input of maintenance in the process is calculated by the membrane replacement cost, machineries breakdown and preventive maintenance cost. Typical expenditure for maintenance is about 5% to 8% of total operating cost.
Energy (E)	The energy is essential input resource for the plant machinery operations. Major concern with energy usage is environmental responsibility and low cost. Energy consumption contributes to major portion of water production cost and can reach up to 45% of total water production cost [42]. This is due to high pressure equipment in the process such as pump. Energy input is measured by cost of energy consumed by small scale water production plant. Average energy consumption range from 3.2kWh/m^3 to 12kWh/m^3[43]. Energy consumed in the production process are measured by kWh x cost per unit to get the total cost of electrical energy used in production process. The tariff is based on energy provider with the rate of 31.5Sen (MYR) for each kWh.
Research and Development (D)	R&D activities support the efforts to innovate or continuous improvement on the existing water production process for achieving higher productivity, more environmental friendly and reduce water production cost [20]. It is valued by the budget of R&D per year. Typical cost for R&D is about 5% of total production cost.

3.2 Description of Case Study

A small scale desalination plant was selected to conduct model testing. The small scale water production plant contributes to solve local water shortage problem. The characteristics of feed water is water with high turbidity (3100NTU), salt content of 35,000 mg/litre (ppm). These characteristics of feed water is classified as brackish and city polluted water (BWCP) [21]. The plant produce water at the rate of about 5000L/day. he basic components of the plant consist of water intake, bio-reactor, dual media filter, ultra-filtration membrane and production membrane pack. There are two (2) main stages of water treatment process: pre-treatment and filtration process.

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

3.3 Model Building and Testing Procedure

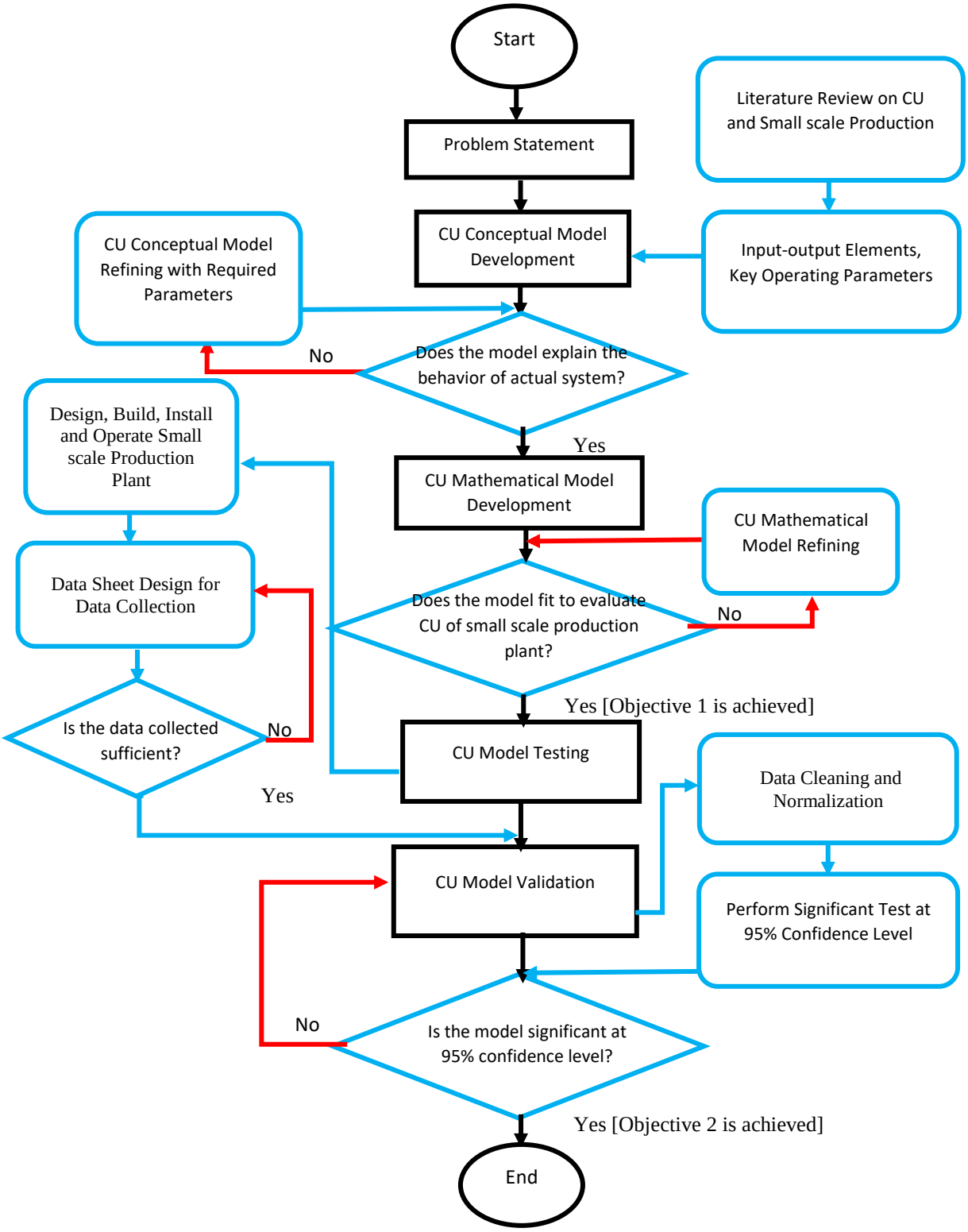


Fig.1: Methodology of Study

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

IV. RESULTS AND DISCUSSIONS

4.1 Model Building

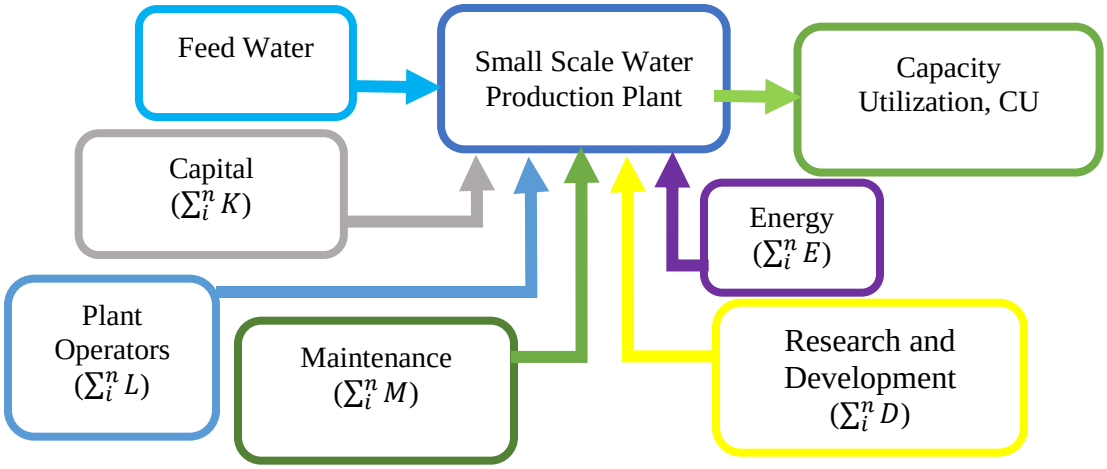


Fig.2: Combined Inputs with Mathematical Expressions

The CU model is built by combining all explanatory variables and is shown in Figure 2.

As [13], [37], [44], [45] suggested that input and output are not linearly correlated in any production process. Based on these references and mathematical expressions from the theory of production [44], theory of elasticity [45], the short-term production function of small scale production plant is shown in Equation 1 with CU as production output.

$$CU(t) = A.K^{\alpha 1} L^{\alpha 2} E^{\alpha 3} D^{\alpha 4} M^{\alpha 5} \quad (1)$$

From engineering perspective, since Equation 1 is nonlinear, the parameters are difficult to estimate. To simplify the parameters and make it linear, the Equation 1 is converted to logarithm linear form. The logarithm form of this production function is presented in Equation 2.

$$Log(CU) = \log(A) + \alpha 1 \log(K) + \alpha 2 \log(L) + \alpha 3 \log(E) + \alpha 4 \log(D) + \alpha 5 \log(M) \quad (2)$$

Here, CU(t) = Capacity utilization of small scale production plant output over time t. K= capital of small scale production plant. L = wages of plant operators, E = energy consumed in small scale production process, D =R&D expenditures used to improve small scale production plant CU, M =Maintenance expenses and A = transformation factor from inputs to CU.

Equation 1 and 2 are stochastic functions with output of CU and input variables affected by time, t. Input variables such as labour skill will grow with respect to time due to trainings received and contributes to improve CU of plant machinery. In this aspect, CU indeed depends on input variables and changes with respect to time.

Equation 2 could be used to estimate the CU of small scale production plant. The equation shows that the value of CU (t) depends on the elasticity of capital (α1), plant operators (α2), energy (α3), R&D (α4) and maintenance (α5).

4.2 Model Testing and Validation

This study uses six months operating data from the small scale production plant. Equations 1 and 2 are used to evaluate the contribution of inputs to CU. The findings are reported in Table 2.

Table.2: Model Estimate of Small Scale Production Plant CU

Parameters	Model Estimate
A	0.1660
α1	0.0350
α2	0.1750
α3	0.0320
α4	0.0700
α5	0.0030
R	0.8930
R^2	0.7970
DW	2.0970

The estimated Durbin-Watson (DW) value is 2.097 which is within acceptable limit (DW≈2). This indicates that the inputs are independent of each other without any significant autocorrelation among inputs. From Table 4.1, the value of R= 0.893 expressed that there is a high degree of positive relationship between the CU and independent variables,

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

capital, plant operators, energy, R&D, and maintenance. It indicates that if the above mentioned independent variables increase then CU also increase accordingly. The value of effect size R^2 =0.797 indicates that 79.7% of variance in CU model can be predicted from capital, plant operators, energy, R&D and maintenance. It means 79.7% of inputs are used achieve higher production CU in small scale production system operations. The information from Table 2 is being fitted into Equation 1 and 2 to generate the model to evaluate CU of small scale production plant and logarithm form of the equation is shown in Equation 3.

$$\text{LogCU} = -0.780 + 0.035\text{LogK} + 0.175\text{LogL} + 0.032\text{LogE} + 0.07\text{LogD} + 0.003\text{LogM} \quad (3)$$

The final form of CU model is shown in Equation 4

$$\text{CU(t)} = 0.166\ \text{K}^{0.035}\text{L}^{0.175}\ \text{E}^{0.032}\ \text{D}^{0.070}\text{M}^{\,0.003} \quad (4)$$

The model testing results are shown in Table 3.

Table.3: Differences Between Estimated Value and Actual Value of Small Scale Production Plant CU

Month	Estimated CU Value (V_E)	Actual CU Value (V_A)	Difference (D%)
1	0.7921	0.8068	1.822013
2	0.7728	0.7814	1.100589
3	0.7449	0.7553	1.376936
4	0.7112	0.7206	1.304469
5	0.6746	0.6851	1.532623
6	0.6483	0.6605	1.847086

Results from Table 3indicates that model estimate value is near to the actual value. The difference found is between 1.10 % to 1.85 %. This result demonstrates that the developed model is quite suitable for measuring CU of small scale production plant with production inputs of capital, plant operators, energy, R&D and maintenance.

4.3 Scenario Analysis of Findings

The findings indicate that the average CU of plant machinery for six months is about 73.5%. The model estimate indicates all the inputs are positively correlated (R>0.893) to CU. Overall, about 79.7% (R^2=0.797) of the inputs being consumed to achieve CU of production process. Table4 summarized the conversion efficiency (R^2) of the major inputs to CU of the small scale water production plant.

Table.4: Conversion Efficiency of Variables

Variables	Performance	p-value	Comment
Capacity Utilization (CU)	73.5% (>60%)	-	Achievement is significant
Plant and Maintenance Operators (L)	74.4% (>50%)	0.001**	Input is significant and efficiently contributed to output production
Capital (K)	12.7%	0.001**	Input is significant but not efficiently utilized
Plant Maintenance (M)	0.05%	0.45	Achievement is not significant and highly inefficient
Energy (E)	45.9%	0.001**	Input is significant but not efficiently utilized
Research and Development (R&D)	38.6%	0.001**	Input is significant but not efficiently utilized

**Variable significant (p-value <0.05) with one-tailed test at 95% confidence level

Major inputs are significant (p-value <0.05) except for plant maintenance (p-value > 0.05). In the aspect of contribution, only plant and maintenance operators (L) are significant (R^2=74.4%). Education and experience of plant and maintenance operators are the important factors for small scale production plant to sustain. Cobb-Douglas (1928) even demonstrated that without contribution of labour there would be no outputs. However, to optimize the performance of plant operators, it is suggested to improve working environment. Favourable working environment such as quality management, having friendly superior, liking the physical surrounding in the work place, job security, sustainable remuneration package, availability of food and drink in the workplace are the contributory factor for motivating plant workforce towards achieving higher productivity[46], [47]. Shahidul and Shahzali (2011) found a strong linkage between favourable working environment and productivity. In this aspect, improving the existing working environment would contribute to improve plant operators' performance.

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

The elasticity of energy for CU model of small scale production plant is 0.032. This implies a change of 10% units of energy at inputs will result in CU change of 0.32%. The findings indicated the energy is being overspent on auxiliary plant operations such as lighting system and surveillance camera security system. Moreover, the long feed water delivery line (200ft) from source water to pre-treatment process operations consumed more energy than to overcome osmotic pressure in the production membrane for salt separation process[48]. To improve the contribution of energy to CU of the small scale production plant, the use of energy recovery devices are suggested[49], [50]. The use of energy recovery devices such as Pelton turbine proven to reduce the consumption of energy in production plant and this lead to potential savings and higher CU[51].

The elasticity of maintenance for CU model of small scale production plant is 0.003. This implies a change of 10% units of energy at inputs will result in CU change of only 0.003%. This finding suggest maintenance in the testing plant contributes only to increase availability through break-down maintenance; preventive maintenance appears as non-value added input in six months of operations. The reason for such scenario might be due to the fact that the small scale production plant for this study has just operated for just about six month. In this aspect, the plant system is still considered new and no major maintenance activities are needed to remove scaling in the production membrane; pump servicing is not required; no leakage in the piping system that would reduce the availability of the plant For short-term production, the effect of maintenance effort is usually not noticeable and thus maintenance would be appeared as productivity gap that contributes to reduce the efficiency of any production plant[17], [52], [53].

Model validation is being done by using SPSS software statistical significance one-tailed test at 95% confidence level. The result indicates p-value obtained is about 0.01 ($p<0.05$) and this indicates the model is statistically significant. The actual and estimated values of CU have maximum difference about 1.85%. The findings demonstrate the developed CU model is indeed quite fit to evaluate CU of small scale production plant. In this aspect, the goal of this study has been achieved.

V. CONCLUSIONS AND RECOMMENDATIONS

The study of CU of small scale production plant is very limited. Very few solutions or experiences that could be found from scientific publications. On the other hand, technical approaches used by large production plants are available, but might not fully applicable to small scale production plant machinery. Practice from large scale plant shows that the contribution of capital, maintenance, plant operators, R&D and energy is positively associated with CU because CU plays vital role in production performance especially in production machinery. However, a model to evaluate CU of small scale production system is could not be found in the literature. In this aspect, this gap has raised logical questions of what model able to explain the CU conceptual behavior of small scale production system, what mathematical model could be used by small scale production plant managers to evaluate the process machinery, how the developed CU model contribute to evaluate production performance and contributions of inputs and is the developed model significant to evaluate CU. This study concludes by answering these questions. This study recommends a study program to optimize inputs for small scale production plant.

ACKNOWLEDGEMENT

The authors would like to thank University College of Technology Sarawak for funding the publication this research project.

REFERENCES

[1] D. A. Hashim, “Capacity Utilization in Indian Airlines,” Delhi, India, 2003.

[2] C. J. Morrison, “Productivity Measurement with Non-static Expectations and Varying Capacity Utilization: An Integrated Approach,” *J. Econom.*, vol. 33, no. 1, pp. 51–74, 1986.

[3] D. Zhang, “Studies in IT: Capacity Utilization and Option Market Information,” University of Calgary, 2013.

[4] C. I. Hsu and H. C. Li, “An integrated plant capacity and production planning model for high-tech manufacturing firms with economies of scale,” *Int. J. Prod. Econ.*, vol. 118, no. 2, pp. 486–500, 2009.

[5] S. Ray, “A Post-Liberalization Period Analysis of Industry Specific Economic Factors Affecting Capacity Utilization in Indian Aluminium Industry,” *Dev. Ctry. Stud.*, vol. 2, no. 1, pp. 9–16, 2012.

[6] L. R. Klein and R. S. Preston, “Some new results in the measurement of capacity utilization,” *Am. Econ. Rev.*, pp. 34–58, 1967.

[7] A. Jakubovskis, “Flexible production resources and capacity utilization rates: A robust optimization perspective,” *Int. J. Prod. Econ.*, vol. 189, no. March,

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

pp. 77–85, 2017.

[8] I. Johansen, "Production functions and the concept of capacity," *Collect. Econ. Math.*, vol. 2, pp. 46–72, 1968.

[9] L. Klein and V. Long, "Capacity utilization: concept, measurement, and recent estimates," *Brookings Pap. Econ. Act.*, vol. 73, pp. 743–756, 1973.

[10] E. Berndt and C. Morrison, "Capacity utilization measures: underlying theory and an alternative approach," *Am. Econ. Rev.*, vol. 71, no. 2, pp. 48–52, 1981.

[11] T. Coelli, E. Grifell-Tatje, and S. Perelman, "Capacity utilisation and profitability: a decomposition of short run profit efficiency," *Int. J. Prod. Econ.*, vol. 73, no. 3, pp. 261–278, 2002.

[12] Klein and R. Lawrence, "Some theoretical issues," *Econometrica*, vol. 2, pp. 272–286, 1960.

[13] M. I. Shahidul *et al.*, "Measuring Production Capacity Utilization and Its Impact on Manufacturing Performance and Environment," in *Energy and Environment*, 2013.

[14] F. R. James, "Measuring capacity utilization in manufacturing," *FRBNY Q. Rev. Winter 1976*, pp. 13–28, 1976.

[15] S. Hemanta, "Capacity utilization in small scale industries of India: some empirical evidence from under developed industrial structure," *J. Soc. Econ. Stat.*, vol. 1, no. 1, pp. 39–53, 2012.

[16] Z. Lai, "Capacity utilization and productivity analysis in the Canadian food manufacturing industry," The University of Guelph, 2015.

[17] C. H. Ting, M. I. Shahidul, S. T. S. Shazali, and Y. Abdullah, "Measuring Contextual Impact of Maintenance on Machinery Capacity Utilization and Environment," in *6th Engineering Conference*, 2013.

[18] B. Richard, J. A. Nicholas, and F. J. Robert, *Operations management for competitive advantage*, 9th Editio. The Mc Graw Hill Publication, 2002.

[19] K. Dhouib, A. M. N. Gharbi, and A. M. N. Ben, "Joint optimal production control/preventive maintenance policy for imperfect process manufacturing cell," *Int. J. Prod. Econ.*, vol. 137, no. 1, pp. 126–136, 2012.

[20] M. I. Shahidul and S. T. Syed Shazali, "Dynamics of manufacturing productivity: lesson learnt from labor intensive industries," *J. Manuf. Technol. Manag.*, vol. 22, no. 5, pp. 664–678, 2011.

[21] M. I. Shahidul *et al.*, "Determinants of desalination machinery capacity utilization: evaluate in the aspect of energy, environment and economic sustainability," in *Advances in Process Engineering & Green Energy*, 2014.

[22] A. Marucheck and M. McClelland, "Planning Capacity Utilization in an Assemble-to-Order\nEnvironment," *Int. J. Oper. Prod. Manag.*, vol. 12, no. 9, pp. 18–38, 1992.

[23] M. I. Shahidul, H. M. A. Elaswad, and M. D. Lee, "An empirical model to measure engineering management contribution to output growth of machinery manufacturing SMEs," *Int. J. Eng. Res. Manag.*, vol. 3, no. 3, pp. 106–116, 2016.

[24] M. A. Elaswad, M. I. Shahidul, S. T. S. Shazali, and Y. Abdullah, "Evaluate contributions of engineering management to output: a model building approach for manufacturing SMEs," *Int. J. Eng. Res. Manag.*, vol. 2, no. 8, pp. 28–37, 2015.

[25] Y. Qing and D. Izak, "Optimal capacity investment decisions with two-sided fixed-capacity adjustment costs," *J. Oper. Res.*, vol. 55, no. 2, pp. 272–283, 2007.

[26] B. Tamer and O. Ozalp, "Information acquisition for capacity planning via pricing and advance selling: when to stop and act?," *J. Oper. Res.*, vol. 58, no. 51, pp. 328–349, 2010.

[27] M. Mahmood, "Labour productivity and employment in Australian manufacturing SMEs," *Int. Entrep. Manag. J.*, vol. 4, pp. 51–62, 2008.

[28] S. K. Subramaniam, S. H. Husin, and Y. Yusop, "Machine efficiency and man power utilization on production lines," in *Proceedings of the 8th WSEAS Int. Conf. on ELECTRONICS, HARDWARE, WIRELESS and OPTICAL COMMUNICATIONS*, 2011, pp. 70–75.

[29] H. M. A. Elaswad, M. I. Shahidul, S. T. S. Shazali, and A. Yassin, "Modelling output growth measurement of machinery manufacturing SMEs," *Sci. Int.*, vol. 27, no. 5, pp. 4063–4070, 2015.

[30] R. Clayton, *Desalination for Water Supply*, Third Edit. Foundation for Water Research, 2015.

[31] G. V. Gude, N. Nirmalakhandan, and S. Deng, "Renewable and sustainable approaches for desalination," *Renew. Sustain. Energy Rev.*, vol. 14, no. 9, pp. 2641–2654, 2010.

[32] A. D. Khawaji, I. K. Kutubkhanah, and J. M. Wie, "Advances in seawater desalination technologies," *Desalination*, vol. 221, no. 1–3, pp. 47–69, 2008.

[33] J. P. Liyanage, "Operations and Maintenance Performance in Production and Manufacturing Assets: The Sustainability Perspective," *J. Manuf. Technol.*

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

Manag., vol. 18, no. 3, pp. 304–314, 2007.

[34] S. H. Huang *et al.*, "Manufacturing productivity improvement using effectiveness metrics and simulation analysis," *Int. J. Prod. Res.*, vol. 41, no. 3, pp. 513–527, 2003.

[35] S. a. Avlonitis, K. Kouroumbas, and N. Vlachakis, "Energy consumption and membrane replacement cost for seawater RO desalination plants," *Desalination*, vol. 157, pp. 151–158, 2003.

[36] I. Shahidul, C. H. Ting, M. D. Lee, and S. Begum, "Seawater Desalination for Environment and Economic Sustainability: A Case Study at Sadong Jaya Pilot Plant," *Int. J. Eng. Res. Manag.*, vol. 2, no. 8, pp. 69–74, 2015.

[37] I. Shahidul and S. T. S. Shazali, "Determinants of manufacturing productivity: pilot study on labor-intensive industries," *Int. J. Product. Perform. Manag.*, vol. 60, no. 6, pp. 567–582, 2011.

[38] J. G. Wacker, C. L. Yang, and C. Sheu, "Productivity of production labor, non-production labor, and capital: an international study," *Int. J. Prod. Econ.*, vol. 103, no. 2, pp. 863–872, 2006.

[39] N. Ghaffour, T. M. Missimer, and G. L. Amy, "Technical review and evaluation of the economics of water desalination: Current and future challenges for better water supply sustainability," *Desalination*, vol. 309, no. 2013, pp. 197–207, 2013.

[40] H. Elaswad, S. Islam, S. Tarmizi, A. Yassin, M. D. Lee, and C. H. Ting, "Benchmarking of growth manufacturing SMEs: a review," *Sci. Int.*, vol. 27, no. 3, pp. 2039–2048, 2015.

[41] D. M. Warsinger, J. Swaminathan, E. Guillen-Burrieza, H. A. Arafat, and J. H. Lienhard V, "Scaling and fouling in membrane distillation for desalination applications: A review," *Desalination*, vol. 356, pp. 294–313, 2014.

[42] A. Zhu, P. D. Christofides, and Y. Cohen, "Energy consumption optimization of RO membrane desalination subject to feed salinity fluctuation," *IFAC Proc. Vol.*, vol. 7, no. PART 1, pp. 255–260, 2009.

[43] C. Cabassud and D. Wirth, "Membrane distillation for water desalination: How to chose an appropriate membrane?," *Desalination*, vol. 157, no. 1–3, pp. 307–314, 2003.

[44] C. W. Cobb and P. H. Douglas, "A Theory of Production," vol. 18, no. 1, pp. 139–165, 1928.

[45] H. Elaswad, S. Islam, S. Tarmizi, A. Yassin, M. D. Lee, and C. H. Ting, "Australian Journal of Basic and Applied Sciences Revealing engineering management contribution (EMC) to outputs of manufacturing SMEs : a literature review," *Aust. J. Basic Appl. Sci.*, vol. 8, no. 15, pp. 97–106, 2014.

[46] A. Enshassi, S. Mohamed, P. Mayer, and K. Abed, "Benchmarking masonry labor productivity," *Int. J. Product. Perform. Manag.*, vol. 56, no. 4, pp. 358–368, 2007.

[47] A. M. Belay, F. M. Kasie, P. Helo, J. Takala, and D. J. Powell, "Adoption of quality management practices," *Benchmarking*, vol. 21, no. 1, pp. 77–100, 2014.

[48] M. A. Ismail, A. K. Othman, S. Islam, and H. Zen, "End Suction Centrifugal Pump Operating in Turbine Mode for Microhydro Applications," vol. 2014, 2014.

[49] A. Drak and M. Adato, "Energy recovery consideration in brackish water desalination," *Desalination*, vol. 339, no. 1, pp. 34–39, 2014.

[50] N. Voutchkov, "Energy use for membrane seawater desalination - current status and trends," *Desalination*, vol. 431, no. October 2017, pp. 2–14, 2017.

[51] P. S. Goh, W. J. Lau, M. H. D. Othman, and A. F. Ismail, "Membrane fouling in desalination and its mitigation strategies," *Desalination*, vol. 425, no. August 2017, pp. 130–155, 2018.

[52] M. Wilf and C. Bartels, "Optimization of seawater RO systems design," *Desalination*, vol. 173, no. 1, pp. 1–12, 2005.

[53] S. Atilhan, "A system-integration approach to the optimal design and operation of macroscopic water desalination and supply networks," Texas A&M University, 2011.

BIOGRAPHIES

ManDjun Lee obtained his PhD in Advanced Manufacturing Engineering from University Malaysia Sarawak, Malaysia. His expertise is in the field of operations research, manufacturing operations, modelling on waste reduction, manufacturing productivity and performance, and water treatment. He has published numerous technical papers in the area of water treatment, manufacturing engineering, operations management and operations research.

Prahshobh Karunakaranis a registered Professional Engineer (Ir.) in the field of Electrical Engineering. He obtained his PhD. In Manufacturing Engineering (Automation) from the University Malaysia Sarawak, Malaysia. He obtained his BSc and Msc at South Dakota State University, USA. His main interest is in electrical engineering and advanced manufacturing engineering.

https://dx.doi.org/10.22161/ijaems.4.6.9 *ISSN: 2454-1311*

RahmatAidil Djubair, currently a Senior Lecturer and Head of Program for Marketing in University College of Technology Sarawak. He received his bachelor degree both from the University of Malaya and Meio University, Naha City in Okinawa Japan before continuing to pursue his career in banking field at CIMB as a customer service officer taking charge of Japanese and Malaysian customers. 5 years later he pursued his MBA in Korea at Chonnam National University, Gwangju before continue pursuing his career by working in LG as a Product Manager for 5 years in Seoul, Korea. Equipped with language proficiency, he developed and improved his communication and public speaking ability and till now have performed countless of motivation and marketing talks both around the country and international.

Heng Jong Nguobtained his BEng from Monash University, Melbourne. He is a registered professional engineer (PE) from the Board of Engineers Malaysia (BEM). He is also a chartered engineer (CPEng) from the Institute of Engineers Australia (IEAUS). His main interest is in the field of manufacturing engineering.