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TABLE OF CONTENTS

TEMPERATURE CONTROL SYSTEM USING MOBILE APPLICATION INTERFACE	1
ANA CAROLINA MARIATH MAGALHÃES CORRÊA E CASTRO MÁRIO MESTRIA	
FRAGILITY OF BUILT URBAN OBJECTS TO VICIOUS ATTACKS: ASSESSMENT BY MEANS OF LIMITED DATA ON ABNORMAL VIOLENT ACTIONS.....	16
EGIDIJUS RYTAS VAIDOGAS	
OPTIMIZING PROJECT MANAGEMENT USING ARTIFICIAL INTELLIGENCE	29
VALMA PRIFTI	
IMPORTANT ROLES OF LOCAL POTENCY BASED SCIENCE LEARNING TO SUPPORT THE 21ST CENTURY LEARNING	38
JUMRIANI Z. K. PRASETYO	
ANALYSIS OF INDONESIA MARINE FISHERIES WITH ECONOMIC GROWTH, POPULATION AND EFFORT EFFECTIVENESS.....	52
MAIZUL RAHMIZAL	
INFORMATION TECHNOLOGY AND SYSTEMS IN TRANSPORT SUPPLY CHAINS	61
OUALID KHERBACH RAFIK KABOUL YASMINE DEGHIR	
PREDICTION OF DELAYS IN CONSTRUCTION PROJECTS IN ALGERIA.....	73
SALHI ROUMEISSA MESSAOUDI KARIMA SASSI BOUDEMAGH SOUAD	
THE STRUGGLE FOR INTEGRATION OF REFUGEES AND IMMIGRANTS: EXAMPLES OF INTEGRATION OF REFUGEES IN EUROPEAN CITIES AND THE CASE STUDY OF ATHENS	80
EFTHIMIOS BAKOGIANNIS CHARALAMPOS KYRIAKIDIS TATIANI MILIONI	
STUDENTS TRAINING THROUGH APPLIED ACTIVITIES AT DEPARTMENT OF AUTOMATION AND APPLIED INFORMATICS, UNIVERSITY POLITEHNICA TIMIȘOARA	90

IOAN SILEA
PAUL NEGÎRLA
ADRIAN KORODI
OCTAVIAN ȘTEFAN

**INFLUENCE OF NANO PHASE CHANGE MATERIALS ON THE DESALINATION PERFORMANCE OF
DOUBLE SLOPE SOLAR STILL..... 99**

SASILATHA T
ELAVARASI R
KARTHIKEYAN V

Temperature Control System Using Mobile Application Interface

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Abstract

Temperature control becomes increasingly necessary with each day, be it in industrial, commercial or residential environments. In a similar way, technology has become a common tool in everyday life. Thus, the technologies need to accompany advances in the controls of processes in many fields, creating applications that can be used in mobile devices alongside these processes. Therefore, this paper proposes temperature monitoring of an environment, via Bluetooth wireless communication and with interface display on a mobile application, developed in MIT App Inventor. While implementing commands via hardware and software a procedure to lower room temperature was applied through a ventilation system. The data are collected through a DHT11 temperature sensor, and the wireless communication is through a HC-05 Bluetooth module, both connected to the development board Arduino. It was possible to condition the cooler to work accordingly with a preset temperature range by using its IDE (Integrated Development Environment). Thereby, this project is a low-cost and advantageous alternative to temperature control and monitoring supported by technological advancements.

Keywords: temperature control, temperature sensor, innovation, mobile application, development boards, wireless communication.

Introduction

In residential or commercial environments, physical or chemical processes and logistic chains in industries, among other environments, temperature plays a great role in establishing quality of the means and the final product. In many areas of scientific research and the productive sector, temperature is an important physical quantity that needs to be measured and controlled (ENJING et al., 2014).

Temperature control has been vastly applied in the transportation of medical

products, live tissue storage and blood transfusion (LIU et al., 2016). Temperature control is important to optimize thermic conditions of greenhouse operations (CHOAB et al., 2019). In Subahi and Bouazza (2020)'s work it was developed a monitoring system applied to a greenhouse environment to control its internal temperature with the goal of reducing energy consumption while maintaining good conditions that would improve productivity.

The fundamentals to use temperature control systems range from applications in industrial sectors that need to improve productivity avoid instantaneous alerts by sensors and create transparency in its supply chains, to services that need to maintain quality and compliances.

The study of a case in the industrial sector of steel production presented the need for temperature control on the environment and with certain procedures. According to ArcelorMittal (2020), in labs where mechanical properties and chemical analyses are made, temperature control allows standardized results. In addition, it was reported by the company that in melting and solidification of steel, to manipulate temperature implies in the control of energy consumption and equipment deterioration. Procedures such as lamination and cold-mechanical transformation of steel need temperature control to regulate mechanical properties of steel, energy consumption and equipment damage (ARCELORMITTAL, 2020).

In contact with the industrial metallurgical sector described in the previous paragraph, it was informed that are used: mechanical, electrical and electronic systems to administer processes; are applied in this industry: sensors such as contact thermocouple, infrared thermometer, contact pyrometer and digital or analogical thermometers; the efficiency of these control methods can be compromised in cases of big product demands, or the specific handling of a process, for example: controlled temperature of a volume of 100 tons of liquid steel, or temperature control of a rod with speed of 200 m/s.

With technological development, the need to evolve and innovate the control of productive processes in many sectors made necessary the creation of mobile applications. Simply, a mobile application is a software created with the purpose of entertaining, facilitating and or connecting the user, through an intuitive and easily accessed platform. Being used in different kinds of devices, such as smartphones and tablets Android and IOS, and smart TVs, these softwares assist people. Aware of the advantages presented by wireless communication, the possibility of a mobile application for temperature control has become an alternative.

Data correspondence can be done in many ways, through radio, satellite, microwaves, infrared, 4G, 5G, Wi-Fi and bluetooth. The last one is a wireless communication that transmits the wanted data between devices, as long as the distance between them it is short, which means that it depends on the proximity of the devices. The use of apps in mobile devices with wireless bluetooth communication offers many opportunities

in commercial, industrial and medical areas, as well as in our daily routine. With that, developing applications with use in mobile devices becomes an opportunity to solve problems in industries, transportation, logistics, financial management, businesses and health related activities (PINEM et al., 2020). Literature point to the advancement in the control of environmental temperature and in the communication between devices (CHOAB et al., 2019), (LIU et al., 2016), (MON, 2015), (PINEM et al., 2020) and (SAWIDIN, PONGOH, RAMSCHIE, 2018). In these researches, temperature control is shown in order to hone specific processes, which were previously traditionally done, and today can be benefited by the automated development.

According to Choab et al. (2019)'s work home automated controlled systems are low cost and flexible, using a micro web server, IP (Internet Protocol) connectivity to access and control devices remotely using an Android smartphone. In Sawidin, Pongoh and Ramschie (2018)'s research, temperature and humidity control is done via a microcontroller controlled by an Android smartphone. Moreover, in Santos (2017)'s work temperature control is used inside a greenhouse using two control techniques along with a friendly interface to monitor and regulate temperature via smartphone.

Besides domestic environments, it was developed temperature control in medical areas, as indicated in Pinem (2020)'s work, which designed an application for medical teams of high mobility that supported the referral health system in Indonesia. Furthermore, temperature control systems are highly used in many fields, like the transportation of medical products and organs storages, and blood transfusions (LIU et al., 2016).

According to Ciriello, Richter and Schwabe (2018), digital technologies contribute to transforming society and economy, in a way that they are the result and the foundation to the development of digital innovations; therefore, the results of digital innovation are elaborated through distributed, combined and or other technological platforms of innovations. This way, combined innovation means that new technological solutions are made through a combination of elements with digital characteristics, or different technological modules with the same patterns; like this, many branches of digital innovative development can arise (CIRIELLO, RICHTER, SCHWABE, 2018).

This project has as innovative potential a wide solution and open to improvements, meaning that it is a project of combined innovation, as its goal is the development of technologies that have reached the stage of dominating solution, but through recombination, it can reach sectors such as industries, commerce or services. The goal of this work is to control temperature via a cooling system using a friendly interface that monitors in real time the room temperature. Also, its goal is to control temperature by implementing a simple cooling system that will be activated according to the sensed temperature. With this, a more complete system, where temperature is controlled through an easily accessible interface and monitored in real

time. To do so, wireless communication and a mobile application will be used, while it will be a low cost system.

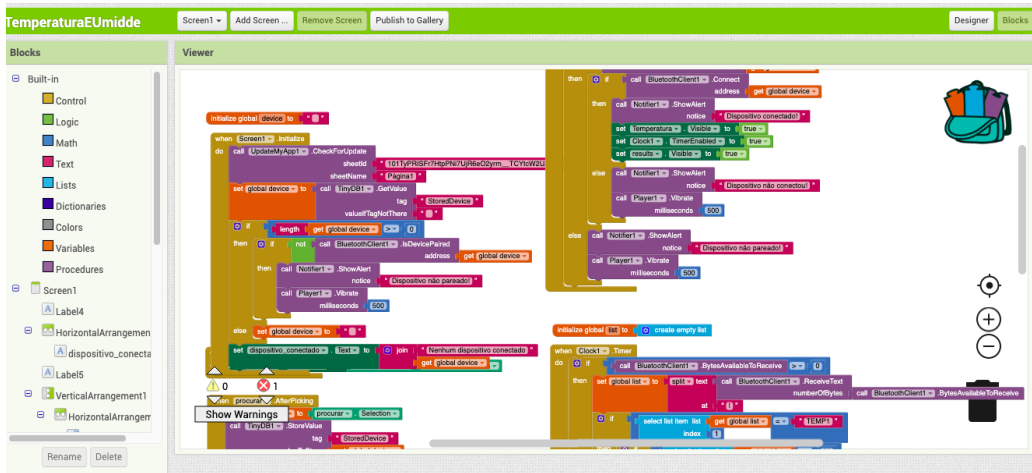
This article is organized as follows: section 2 describes the methodology of the proposed system. Section 3 presents the results and its discussion, and at the last section, the work is concluded with future improvements.

2. Materials and methodology

The research's proposition is to control temperature with a mobile application, using development boards and bluetooth communication (MON, 2015). The programming uses Arduino and its IDE (Integrated Development Environment), an open-source software (McROBERTS 2011).

Arduino allows for serial communication (PICORETI, 2020) and its code is based on C programming language (SCHILDT, 2001). The programming environment of MIT App Inventor will be used to develop the app's interface, Figure 1.

Figure 1 - App Inventor's Interface (Authors 2021).



2.1. Hardware

In order to elaborate a physical project, it was necessary to assemble the components, with its main elements as the temperature sensor DHT11, Arduino Uno and the Bluetooth module HC-05, with its specifications presented on Tables 1,2 and 3 respectively. Furthermore, other components were used to compose the circuit, such as a 10k resistor, a 1k resistor, a 1N4007 diode, a NPN TIP122 transistor, a heat sink, alligator clips and jumpers.

Tab. 1 - DHT11 Temperature and Humidity Sensor's specifications (Authors 2021).

Specifications	Values
Dimensions	23 mm X 12 mm X 5 mm
Power	3.0 to 5.0 VDC
Current	200 μ A to 500mA
Answering time	< 5 seconds
Humidity range measurement	20 to 90% UR
Temperature range measurement	0° to 50°C
Accuracy in Humidity measurement	\pm 5.0% UR
Accuracy in Temperature measurement	\pm 2.0°C

The DHT11 temperature and humidity sensor described on Table 1 has as its main characteristic measurement of temperature, but it can also be used to measure humidity in the same room. Below on Table 2, there is the description of the development board Arduino Uno SMD that used an ATmega328 module, and its port's structure allows for the use of jumpers to connect sensors, a characteristic that contributed to this component being chosen.

Tab. 2 - Development Board Arduino Uno SMD's specifications (Authors 2021).

Specifications	Values
Dimensions	68 mm x 53 mm x 10 mm
Microcontroller	ATmega328
Operating voltage	5 V
Input voltage	7 to 9 V
Voltage threshold	6 to 20 V
Digital Output I/O Pin	14

Analog Output 3.3 V Pin	6
DC Current at I/O Pin	40mA
DC Current at 3.3V Pin	50mA
Flash memory	32 kb
SRAM	2 kb
EEPROM	1 kb
Clock Speed	16 MHz

On the following Table are the specifications of the bluetooth module used on the project, as well as its range, meaning the minimum distance needed between devices for the bluetooth module to be able to transmit the collected data.

Tab. 3 - Bluetooth Module HC-05's specifications (Authors 2021).

Specifications	Values
Dimensions	26.9 mm x 13 mm x 2.2 mm
Bluetooth Protocol	v2.0+EDR
Firmware	Linvor 1.8
Frequency	2.4 GHz Band ISM
Modulation	GFSK
Sensibility	Greater than or equal to 84 dBm with 0.1% BER
Asynchronous Velocity	2.1 Mbps (Max)/160Kbps
Synchronous Velocity	1 Mbps/ 1 Mbps
Security	Authentication and encryption
Profile	Bluetooth Serial port
CSR chip	Bluetooth v2.0
Voltage	3.3 V (2.7 to 4.2 V)
Current	Paired: 35mA Connected: 8mA
Reach	10 m

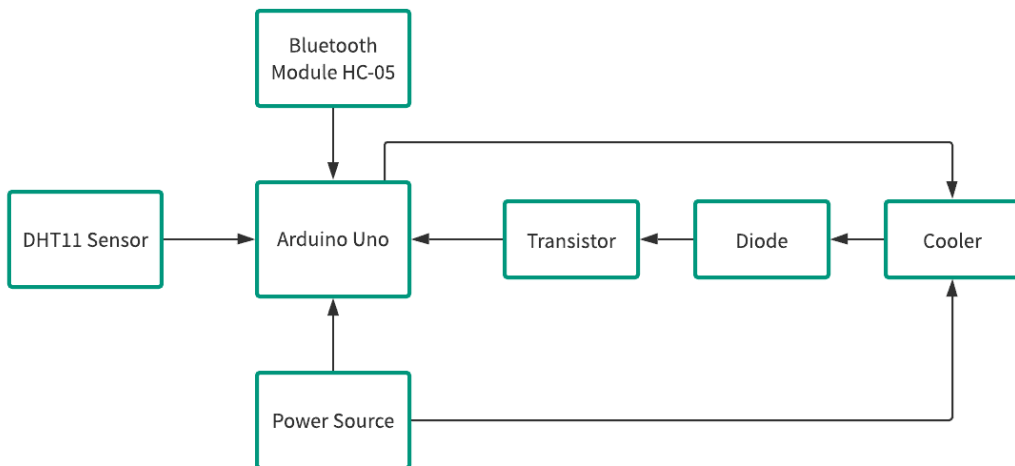
With the components defined, the project was assembled. Initially, the pins between the temperature sensor and the development board were connected through jumpers on the protoboard: Vcc pin from the sensor, connected to 5V pin on Arduino. Afterwards, the sensor was connected to Arduino through a 10k resistor, which was connected to the second pin on the sensor. Also, the Ground (GND) pin on the sensor was connected to the GND pin on Arduino. With these connections, a test code for the DHT11 sensor was used to verify the connections made.

Continuing the process, to connect the bluetooth module to Arduino, the protoboard was also used: the GND connection between both pins; Vcc module pin to 3.3V entrance on Arduino; TX port on the development board to RX entrance on the bluetooth module; and at last, RX port of Arduino to TXT output on the module.

In order to connect the cooler to Arduino, a diode, a transistor, heat sink and the 1k resistor were necessary. The diode was connected to an outside power source of 12V, so that it could be connected to the cooler, which was also connected to the transistor connected to pin 9 on Arduino through the resistor. The heat sink was used on the transistor, functioning as it should, as the heat emitted by the transistor was absorbed, protecting the equipment and increasing its efficiency.

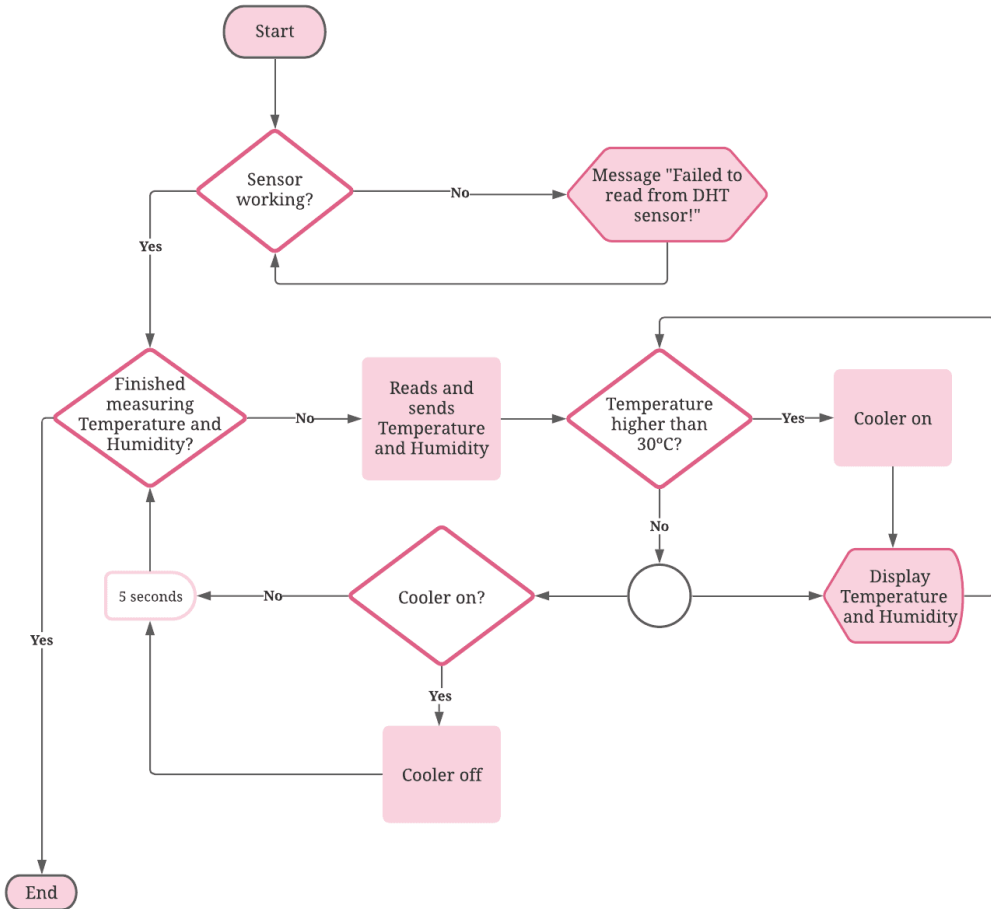
In Figure 2 below, the block diagram represents the connections made on the hardware described previously, making it possible to comprehend that the cooling system behaves as an output that depends on the data collected by the sensor:

Figure 2 - Block Diagram of Hardware architecture and its implementation (Authors 2021).



To finish the first part of the project, a code had to be built in Arduino's platform, which is indicated by the flowchart on Figure 3. To this end, it was necessary to add the DHT11 sensor's library to the code. Firstly, the code verifies if the sensor is working, and in case it is not a message "Failed to read from the DHT sensor" is presented. Then, when it is working correctly, the sensor reads, and then sends the temperature and humidity of the room, followed by the condition to turn on the cooling system. Finally, if the program is not closed, the code repeats.

Figure 3 - Flowchart indicating the relation between the code in Arduino's IDE and the sensors as physical components (Authors 2021).

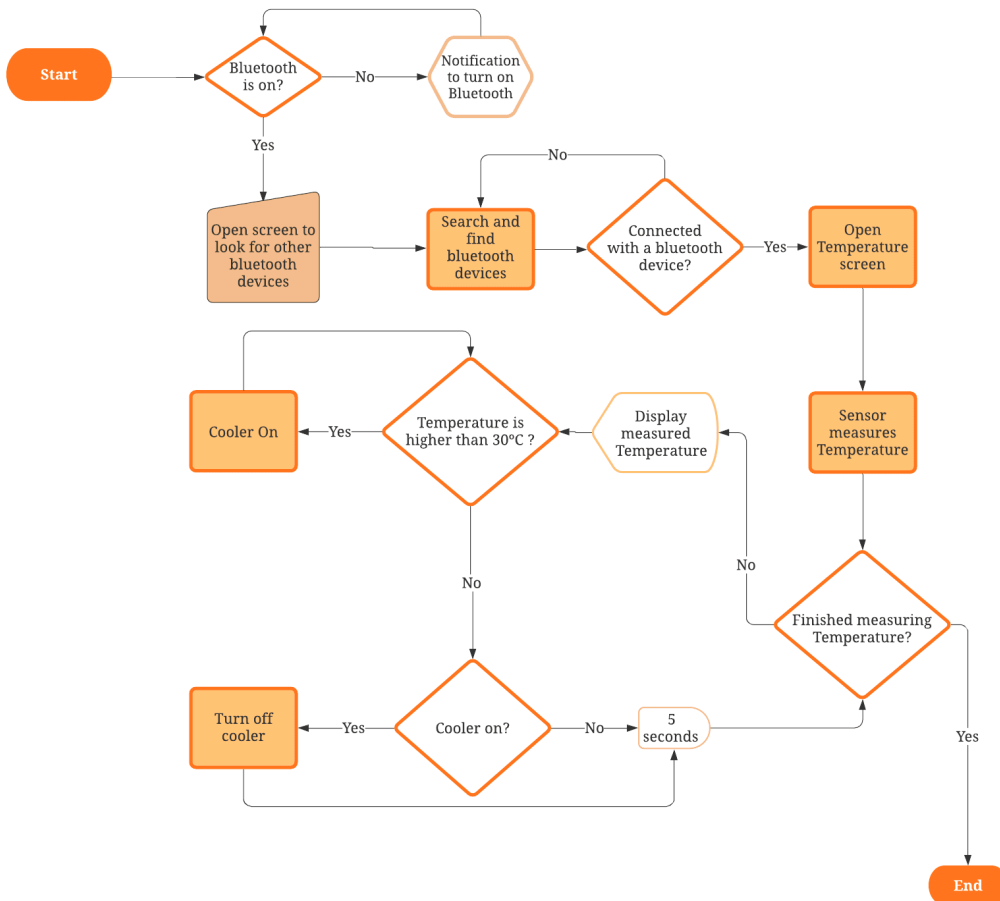


2.2 Interface

For the innovative development of the project described in the previous topic, an interface was created through the MIT App Inventor platform. Thus, the visual parts of the application were defined, establishing button locations, and answer boxes for the sensor. In this moment, for the purpose of aesthetics and organization, a new screen was created, which a button would activate and its purpose would be to select a bluetooth device to connect.

After the necessary elements for the app were defined, it was possible to build the code for the application and establish its relations with the components of the project, presented on the flowchart of Figure 4.

Figure 4 - Flowchart indicating the relation between the code and the Interface's physical components (Authors 2021).



In order to establish the flowchart from Figure 4, the Blocks area from MIT App Inventor platform was used, where the programming of the visual components can be made. Firstly, a variable "device" was initialized so that it could be related to the bluetooth. When the main screen of the app opens, if the bluetooth of the device is not turned on, a notification to do so would appear. This way, the button to search for other devices could be clicked and the screen to look for and select other devices could be seen. If no device connects, then the process repeats, else, it opens the temperature screen.

When opening this screen the image of a thermometer with the color, red if temperature is hot, blue if temperature is cold and black if it is room temperature, will show, and after the sensor measures the temperature it will show in digital format above the image, alongside the humidity. In addition, on the other side of the thermometer image the status of the cooler will appear, if it is on or if it is off. Finally, to continue seeing the temperatures of the room it is necessary only to stay on the

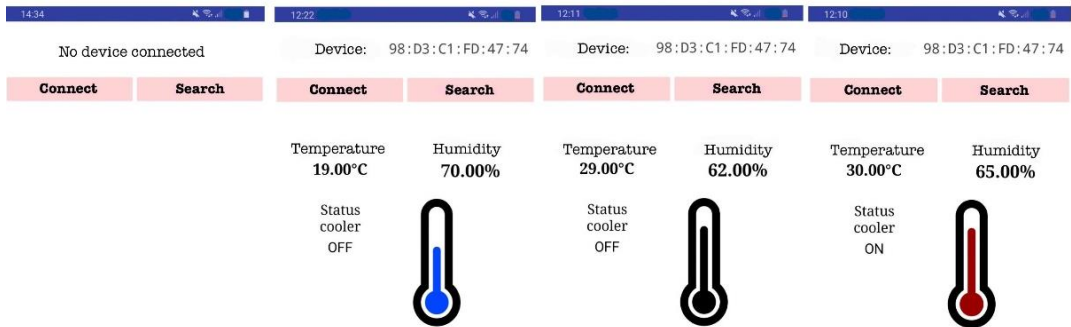
app, else, it should be closed.

To simplify the tests made of the program and define the venting system, temperature boundaries were established: above 30°C hot temperatures, below 20°C cold temperatures, and between those, room temperature. Nonetheless, the code can be adapted according to the finality of the application. For example, in greenhouses the best growing temperature is from 21-24°C, the minimum being 18.5°C and the maximum 26.5°C (JONES JR., 2002). Medications to be kept at room temperature must be in a well-vented place, between 15 and 25°C, or up to 30°C depending on the climate zone (HEWSON et al., 2013). Therefore, the temperature bounds of the code must be defined by the purpose of the application.

3. Results and Discussion

After the parameterization of the temperature values in three categories: hot, cold and room temperature, the project was tested as a whole, resulting in the visualization of the measured temperatures and humidity via the built mobile application and in real time. The results also included a working ventilation system defined by the developed codes, and behaving according to the measured temperatures. The visualization of data was presented on the app's interface, shown in Figure 5. The limitation of the developed project imposes the proximity between mobile device and the bluetooth module in the developed circuit, so that the data can be transmitted when measured by the sensor.

Figure 5 - App Interface views for temperature control (Authors 2021).



The assembled circuit is shown on Figure 6, with the hardware mentioned on Table 4, and the schematics for it are represented on Figure 7 with the project's pin out.

Figure 6 - System for Temperature Control and its Hardwares (Authors 2021).

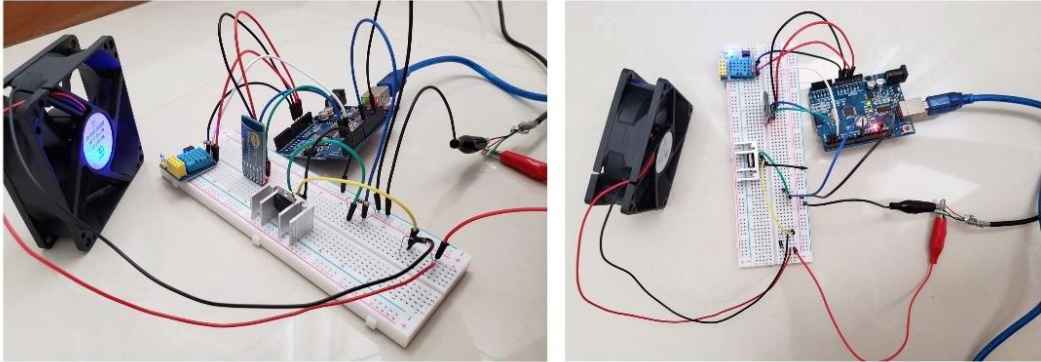
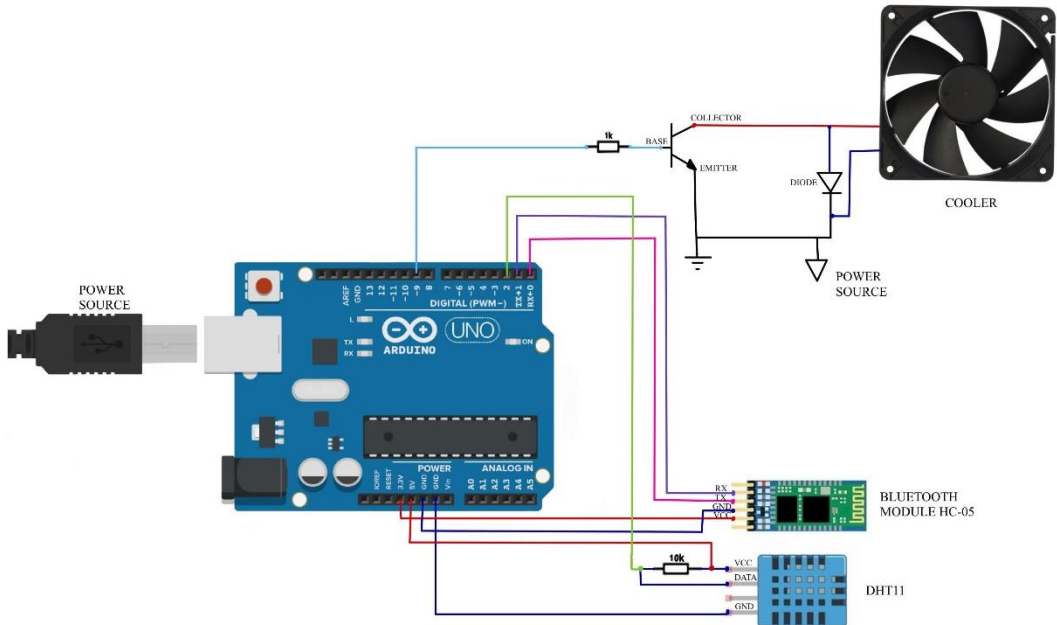


Figure 7 - Hardware schematics of the temperature control system (Authors 2021).



In this work, physical parts were acquired, consulted and the values of each of the devices and equipment established. On Table 4 the value of each physical component is defined, while on Table 5 some of the components currently used in industries, mentioned in the literature, are represented with its minimum and maximum values, as the price of the component varies according to its accuracy and the range of temperatures it can measure required by the industrial, commercial, medical or residential sector. It is important to notice, that such costs are represented on both Tables in Brazil's official coin, Real, and in Dollars with the conversion made on December 27th of 2021.

Tab. 4 - Components' values (Authors 2021).

Component	Cost (R\$)	Cost (\$)
Arduino Uno SMD and hardware's power cable	56.91	10.11
DHT11 Temperature and Humidity Sensor	21.76	3.87
Module Bluetooth HC-05	52.86	9.39
10 Resistors	1.43	0.25
Protoboard	19.80	3.52
65 jumpers	23.50	4.18
Smartphone	300.00*	53.30
Diode 1N4007	0.10	0.018
NPN Transistor - TIP 122	1.50	0.27
2 Alligator clips	1.24	0.22
Cooler	9.00	1.60
Heat Sink	3.12	0.55
Power Source	40.00*	7.11

*Approximate values.

Tab. 5 - Device Values in the Literature (Authors 2021).

Device	Minimum Cost (R\$)	Minimum Cost (\$)	Maximum Cost (R\$)	Maximum Cost (\$)
Thermocouple	13.50	2.40	2000.00	355.32
Infrared Thermometer	12.00	2.13	7000.00	1243.63

Besides the real time visualization benefit of the project, this application is advantageous in the matter of cost to assemble it. In production processes, in laboratories, industries, greenhouses and other areas with the need for temperature control, equipment such as thermocouple, digital or analog, infrared and contact thermometers are used. Table 5 shows the necessary hardware to control temperature in a professional environment, which requires quality equipment. When comparing the values on Table 5 with the ones on Table 4, it can be concluded that the use of the developed innovative temperature control system is advantageous.

Likewise, stands out the advantage and ease provided by the mobile application that

is monitored via digital values. It is not needed to depend on an analogical system, which in cases of precision, is subject to parallax errors. The control adjustments given by the app present more precision in temperature measurement and control.

4. Conclusion

This work developed a low cost system composed of a mobile application, electronic devices and development boards used for temperature control. As it is low cost, its application becomes viable in many commercial areas, logistic chains, and industrial processes, transportations of products and in laboratories.

Even though its combinatory innovative functionality, the project can still be improved so that it has greater usability, can cover broader areas and has more developed functions. The emphasized innovation is described in literature as stages that start to develop separate pieces quickly in order to create new products through already existing infrastructure. About the developed system, an application with Wi-Fi or Ethernet connection can be built, this way, the necessary proximity between devices presented by bluetooth connection, will no longer be necessary. Therefore, the project would benefit with a system based on an IoT (Internet of Things) structure to control electronic devices through a smart system.

Furthermore, the implementation of new commands to the app, such as increasing and decreasing temperature with the assistance of new buttons, via interface of IoT structure and ventilating tools, would enrich the current project. This way, it would become a different system, where temperature could be remotely controlled through an easy access interface, monitored and used in real time.

From the literature, in Gunarathne e Kalingamudali (2019), an app was developed to communicate with a smart system to reduce energy consumption. There is a need to review how electric energy is used in order to avoid its waste. The ABESCO (Brazilian Association of Energy Conservation Service Companies) points out that Brazil has over 1.7 billion Dollars in annual losses with the improper use of electric energy annually generated (BRESCIANI, 2019). The rational use of electric energy is one of the challenges to power electric systems with the purpose of lowering energy consumption and consequently lowering economic costs.

In this sense, the control system developed reduces energy waste, given that it avoids triggering the cooling system in a periodic way, and it cooperates with the improper losses of electric energy. The ventilating process will only be triggered when a certain temperature level is reached.

As future projects, suggests that research to measure energy consumption using the current application be developed, so that the measurements of reduced energy use is shown. Finally, in a future research it is proposed that other applications for irrigation control, housing associations access and residential automation be developed. Still, it is possible to evaluate through users of different areas in this research, if the mobile

application answers the requirements: usability, functionality and efficiency.

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Fragility of Built Urban Objects to Vicious Attacks: Assessment by Means of Limited Data on Abnormal Violent Actions

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Abstract

An assessment of fragility of objects built (constructed) in urban environment to deliberately imposed abnormal actions (loads) is considered. The actions under analysis are explosions, vehicular impacts and fires that can be imposed by acts of terrorism and sabotage as well as such highly random events as car crashes into structures due to unintentional roadway departures. The fragility is assessed by means of mathematical models known as fragility functions and developed for vulnerable building and transportation structures, protective barriers, and energy supply facilities. The result of fragility assessment is the probability of the damage that can be foreseen and modelled by means of mathematical models used for structural analysis. The case is studied where information on an abnormal action can be expressed in the form of a small-size statistical sample with components acquired in post-mortem investigations of attacks or unintentional accidents. The basic idea is an application of the statistical (bootstrap) resampling for the estimation the damage probability. The resampling procedure is applied to values of the fragility function that can be developed for the damage caused by the abnormal action in question. The values of the fragility function are estimated for components of the small-size sample of abnormal action values. The resampling of the fragility function values yields a conservative estimate of the damage probability expressed by the limit of a one-sided confidence interval. The estimate of the damage probability can be applied to making decisions concerning the level of resilience of vulnerable urban objects.

Keywords: abnormal action, damage, terrorism, small-size sample, inaccurate data, fragility, inverse analysis.

1. Introduction

Urban environment is a natural scene of such vicious attacks as acts of terrorism and sabotage as well as the primary site for taking counterterrorist measures (Fregonese & Laketa 2022). Terrorism is a phenomenon with many faces that are revealed by

classifications of violent incidents (Erickson, 1999; Purpura, 2019). For a long time, a variety of immovable objects built in urban environment has been the target of terrorist assaults called the physical incidents (Young, 2015). This study deals with physical terrorism threatening built urban objects. The acts of physical assaults on built objects are called the vicious attacks (VAs).

Built urban objects are sensitive to mechanical and thermal actions imposed in the course of VAs. Most structural objects built to date were conceptualized and detailed without taking into account the possibility of any VAs. The WTC twin towers completed in 1973 and destroyed in 2001 are a prime example of such objects. The decision concerning the protection of an existing or future structure against the hazard of AA contains at least four easily identifiable choices shown in Figure 1. Means of protection of previously unprotected structure are the same as or similar to ones that could be provided for a future potentially exposed object. However, independently of the status of exposed target, existing or future one, choice and detailing of protective structural elements will depend on prediction of foreseeable abnormal actions (AAs) imposed in the course of VAs.

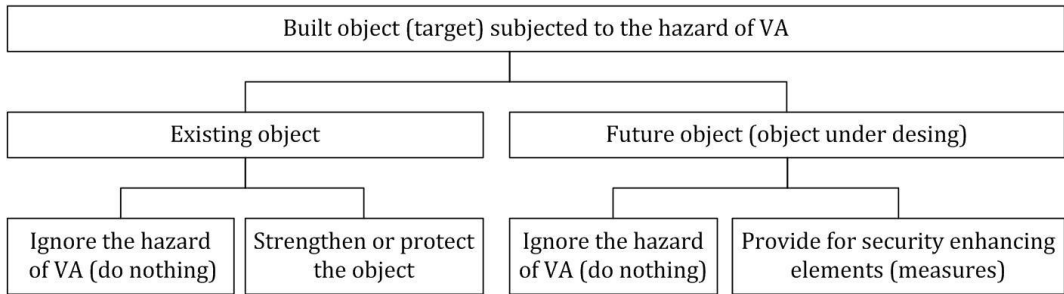


Figure 1. Four choices related to the decision concerning the protection of built objects against VAs

The present study is aimed at improving the prediction of damage to built urban objects by applying inaccurate data on AAs imposed during physical assaults. The main types of these assaults are malicious explosions and vehicle impacts. The gap of knowledge addressed in this study is how to estimate the likelihood of damage due AAs by means of inaccurate data on AAs generated in a relatively small number of VAs that happened in the past. The inaccurate data is modelled by subjective probability distributions that should be specified by the investigator of past incidents. A procedure that allows to propagate uncertainties expressed by inaccurate data to uncertainties related to the potential damage due to AAs is seen as the main added value of this study.

2. A Brief Review of Basic Equations Used for Assessing the Fragility of Built Objects Endangered by Vicious Attacks

From the standpoint of mathematical modelling, the damage to built urban objects (“targets” in what follows) caused by AAs imposed in the course VAs should be considered to be a random event. In what follows, this event will be denoted by the symbol Δ . The event Δ will be a consequence of a random event of AA imposition (event A) and the latter event in its turn will be triggered out by a random event of VA (event V). Thus we can write that the intersection probability of these three events is

$$\text{Prob}[\Delta \cap A \cap V] = \text{Prob}[\Delta/A] \text{Prob}[A/V] \text{Prob}[V] \quad (1)$$

An estimation of the probability $\text{Prob}[V]$ and circumstances of the event V are generally speaking a problem of security analysis (Osterburg & Ward, 2010). In other words it lies outside the traditional field of civil engineering and architecture. This probability depends on the type of the event V , history of occurrences of V , current political context. Thus the estimation of $\text{Prob}[V]$ will not be considered here. The product $\text{Prob}[\Delta/A] \text{Prob}[A]$ contains two factors. The first is related mainly to the structural engineering and the second should reflect knowledge on the physical phenomena occurring as the random event A (blast, impact by deformable body, temperature and thermal radiation resulting from an arsonist fire). In brief, the first probability $\text{Prob}[\Delta/A]$ lies on the structural side and the second probability $\text{Prob}[A]$ is related to predicting AAs.

Adding the additional factor $\text{Prob}[V]$ to the product $\text{Prob}[\Delta/A] \text{Prob}[A]$ supplements the engineering core of the problem with information related to security of potential targets (buildings, protective structures, energy lines, technological equipment of services used in urban environment). As we are interested in the engineering part of the problem, we can simplify it by assuming that the type of VA (event V) is known in advance and the event A will be triggered of by an occurrence of V . Then we have that

$$\text{Prob}[\Delta \cap A] = \text{Prob}[\Delta/A] \text{Prob}[A] \quad (2)$$

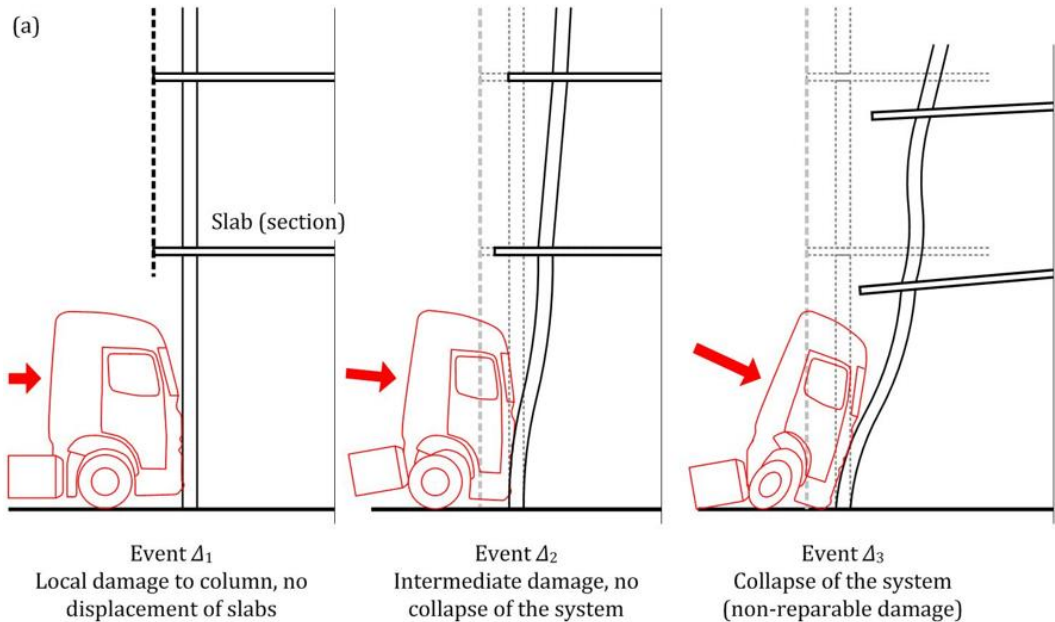
An assessment of fragility of the targets to a given AA presumes occurrence of the event A and exposure of a target to this event. In this context, the event A should be seen as a certain event with $\text{Prob}[A] = 1$. Then the problem reduces to an estimation of the conditional probability $\text{Prob}[\Delta/A]$. The above equation splits up the problem the fragility estimation into predicting vulnerability of a target to a given AA and assessing characteristics of this AA. These characteristics are usually expressed by a random vector $\mathbf{X} = (X_1, X_2, \dots, X_m)$, with a joint probability density function (pdf) $\psi(\mathbf{x})$

(Adam et al., 2018; Netherton & Stewart, 2009). With the vector \mathbf{X} , the probability $\text{Prob}[\Delta/A]$ is expressed as

$$\text{Prob}[\Delta/A] = \int_{\text{all } \mathbf{x}} \Phi(\mathbf{x})\psi(\mathbf{x}) d\mathbf{x} = E[\Phi(\mathbf{X})] \quad (3)$$

where $\Phi(\mathbf{x})$ is the fragility function developed for the damage event Δ and $E[\Phi(\mathbf{X})]$ is the expected value of the random function $\Phi(\mathbf{X})$. Eq. (3) arises from the field of seismic risk assessment and is now used in such fields as extreme wind risk analysis and nuclear power plant safety (Sundararajan, 1995).

In general, the event Δ present in Eqs. (1) to (3) can represent a very large number of damage states of target and AA in question. However, the estimation of the probability $\text{Prob}[\Delta/A]$ will be an affordable task if only a limited number of typical damage states, n_d , will be considered. Let these discrete damage states (random damage events) denote by Δ_d ($d = 1, 2, \dots, n_d$). An example of the events Δ_d that can be caused by a vehicular impact on a building is given in Figure 2a.



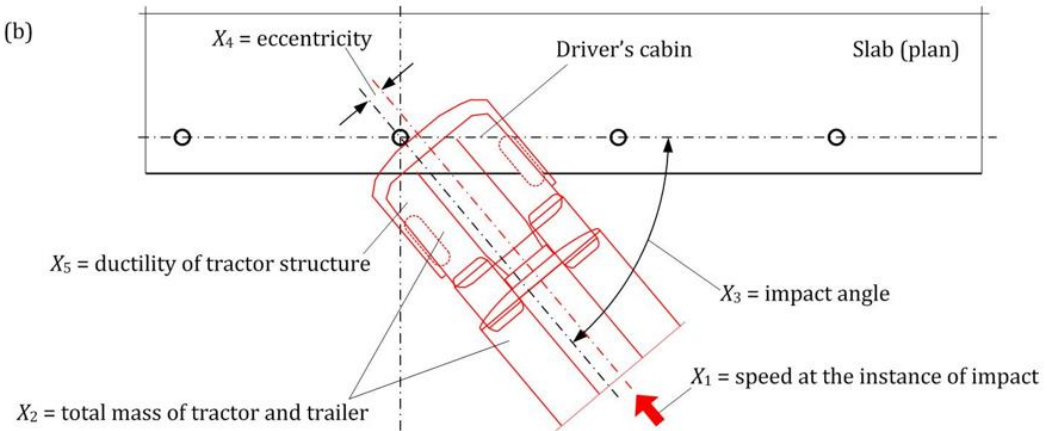


Figure 2. Illustration of the damage events Δ_t ($d = 1, 2, 3$) obtained by discretizing the continuous process of damage due to a vehicular impact (case (a)) and five characteristics X_j ($j = 1, 2, 5$) that describe AA caused by this impact (case (b))

The number of AA characteristics, m , is different for various situations of exposure of the target to AA. The number m will be equal to 1 in case of a simple reflection of a shock wave by dynamically insensitive structure (Bulson, 1997). The variable X_1 will represent the peak pressure in this case. If the target is a dynamically responding structure, information on blast loading will be represented by two characteristics: peak pressure X_1 and impulse (positive duration) X_2 . That is, m will be equal to 2. In more complex loading situations, the number m can be fairly high. An example of such situation is a vehicular impact on a ground floor column schematized in Figure 2b. One can easily identify at least five components of \mathbf{X} that can influence the interaction between impacting vehicle and structural system incorporating this column. The five characteristics of AA are illustrated in Figure 2b.

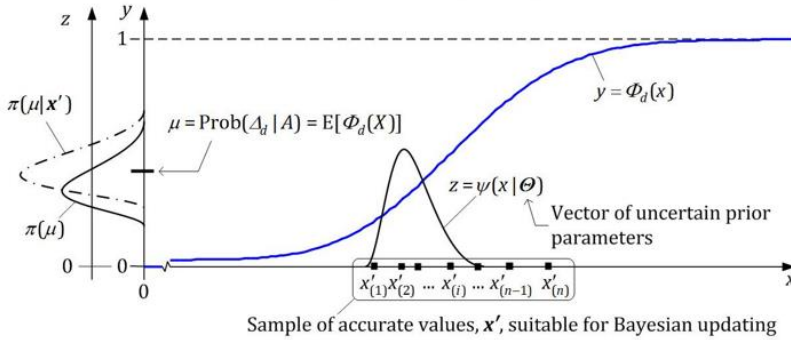
The interaction between AA and target can be highly complex. For instance, the spread of a shock wave in constrained environment may result in numerous reflections of the wave and complex process of loading. In addition, uncertainty related to AA as well as time-dependence of AA and response of the target to AA requires that this interaction should be viewed a short lasting random process. In this respect, the representation of AA by the random vector \mathbf{X} is a simplification used in many applications related to VAs without explicit justification. For the present, one can say that modeling AAs as short-lasting random processes is too complex to be attractive in practical sense.

For brevity and, as we hope, without loss generality, further consideration will be based on the assumption that AA under study can be characterized by a single random variable X with values x , that is, $m = 1$. In this case, Eq. (3) reduces to

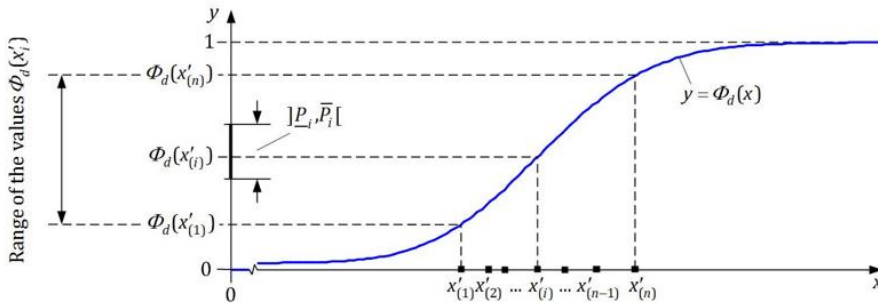
$$\text{Prob}(\Delta_d | A) = \int_{\text{all } x} \Phi_d(x) \psi(x) dx = E[\Phi_d(X)] \quad (4)$$

where $\Phi_d(x)$ is the fragility function developed for the discrete damage event Δ_d . This simplification allows to visualize the convolution of the functions $\Phi_d(x)$ and $\psi(x)$ that produces the probability $\text{Prob}(\Delta_d | A)$ (Figure 3a). Strictly speaking, the term “convolution” should be used only for a mathematical operation of two functions that produces a third function. This definition applies to the expression given by Eq. (4). However, this study uses this term in the broader sense to denote also a combination of the fragility function $\Phi_d(x)$ and information on values of AA that is not necessarily expressed by a single mathematical function.

(a) information on AA is expressed by a prior pdf $\pi(\mu)$ used for Bayesian updating with the sample x'



(b) information on AA is expressed by a small-size set of extracted from investigations of previous VAs



(c) information on AA is expressed by a small-size set of inaccurate data modelled by the pdfs $\psi_i(x)$

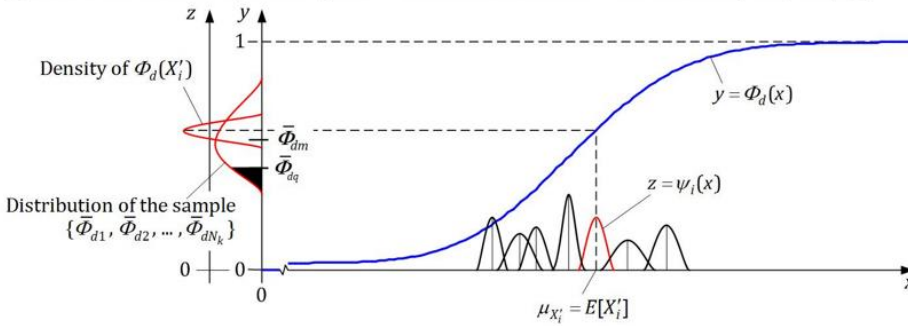


Figure 3. Illustration of the convolutions of the fragility function $\Phi_d(x)$ with three types of information on AA

3. Proposed Methodology for Prediction of Violent Actions With Limited and Inaccurate Information on their Occurrences

The present study considers the possibility to predict AA and the damage related to it by means of a small set of AA values extracted from investigations of previous VAs. The size of this set will be denoted by n and this number will be considered to be small in the sense of classical (Fisherian) statistics. Information that can be extracted from previous n incidents with AA under study can have three forms:

1. A set of values of the AA characteristic X expressed by $\mathbf{x}' = \{x'_1, x'_2, \dots, x'_n\}$. The ordered form of this set will be denoted by $\{x'_{(1)}, x'_{(2)}, \dots, x'_{(n)}\}$. The ordered set is illustrated in Figure 3ab. Elements of this set, x'_i , are fixed values, that is, there are no uncertainties in this data. In other words, values of X that took place in previous incidents are known accurately.
2. A set of probability distributions with the pdfs $\psi_i(x)$ (Figure 3c). The density $\psi_i(x)$ expresses uncertainty in applicability of an AA value related to the incident i . The value x'_i is not known accurately. Thus the information related to previous incidents is expressed by the set $\{X'_1, X'_2, \dots, X'_n\}$ and the corresponding set of pdfs $\psi = \{\psi_1(x), \psi_2(x), \dots, \psi_n(x)\}$. As VAs of given type are usually not related to each other, components of this set, X'_i , can be independent random variables. The expectation of X'_i is denoted by $\mu_{X'_i}$ and shown in Figure 3c. In the field of the quantitative risk analysis (QRA), the data expressed by the probability distributions $\psi_i(x)$ is called the imprecise data (Kelly & Smith, 2009, 2011).
3. Mixture of the accurate values x'_i and inaccurate data modelled by the pdfs $\psi_i(x)$.

Information expressed by the set x' can have different nature and can be used for the estimation of the damage probability $\text{Prob}(\Delta_d | A)$ in several ways. In the ideal case, the set x' can be viewed as a representative statistical sample of an imaginary population of the past and future incidents in which the AA in question is generated. Then the damage probability can be estimated by two-sided or one-sided confidence intervals $]\bar{p}_i, \underline{p}_i[$ or $]0, \bar{p}_i[$ computed by means of a statistical (bootstrap) resampling of the values $\Phi(x'_1), \Phi(x'_2), \dots, \Phi(x'_n)$ (Vaidogas, 2005). Both $]\bar{p}_i, \underline{p}_i[$ and $\Phi(x'_{(i)})$ are illustrated in Figure 3b. Furthermore, the set x' as a representative sample can be applied to Bayesian updating of the prior distribution specified to express epistemic uncertainty in the probability $\text{Prob}(\Delta_d | A)$ (Vaidogas & Juocevicius, 2009). In this case, the probability $\text{Prob}(\Delta_d | A)$ is interpreted as a population mean $\mu = \Phi_d(X)$, the prior distribution $\pi(\mu)$ is specified subjectively and the posterior distribution $\pi(\mu|x')$ is estimated by a procedure of statistical resampling (Figure 3a).

The above approaches to the estimation of the damage probability $\text{Prob}(\Delta_d | A)$ with the data set x' presume representativeness of x' . In case of VAs, a formal proof of this data property is a problem that has not been addressed to date, to the best of our knowledge. We think that the accurate values x'_i can be obtained and a certain degree of representativeness achieved in an experimental investigation of AAs. However, this issue is beyond the scope of the present study.

Information on an AA of the type in question is inevitably accumulated with time. This process is highly sporadic due to an intermittent nature VAs. In addition, VAs are rare events even on the global scale, especially if a particular kind of AA is considered. The quality of knowledge on AAs is also influenced by varying sophistication of investigations into previous incidents. Not every investigation of physical incident results in an assessment of AA characteristics that can be expressed by the values x_i (or x in the one-dimensional case). Unfortunately, some guides for an investigation VAs and non-intentional incidents similar to VAs are official, nontechnical documents that do not explicitly require a backward estimation of an AA that caused damage at the scene of VA (DOJ, 2000; HSE, 2022). These documents regulate mainly the forensic investigation of incidents. On the other hand, forensic evidence can be useful for the backward engineering analysis (Sudoyo et al., 2008).

A general theoretical framework for determining values of AAs generated in past incidents is the methodology of inverse problems (Gallet et al., 2022; Spranghers et al., 2014; Yu et al., 2021; Zhou et al., 2021). However, values of x_i can be retrieved also by means of engineering methods rather than a rigorous scientific inverse analysis. For instance, peak pressure and impulse of a distant explosion can be estimated by looking at damage caused not only to the main target on the incident scene but also to such neighboring objects as lighting poles or façade glazing (Bulson, 1997). A comprehensive analysis of engineering (not forensic) methods developed

for retrieving values of AAs during investigations of incident scenes does not seem to be available. However, it can be said with confidence that estimates of AA characteristics retrieved during post-mortem investigations of VAs will hardly be accurate data expressed, for instance, by the fixed values x_i . Inevitable uncertainties in values of AAs will require to express these estimates as uncertain data and to use subjective probability distributions for modelling this uncertainty. Examples of modelling inaccurate data in QRA applications are provided by Siu and Kelly (1998) and Kelly and Smith (2009). In the format of the present study, results of investigation of n previous incidents are expressed by the set $\psi = \{\psi_1(x), \psi_2(x), \dots, \psi_n(x)\}$. Elements of this set, $\psi_i(x)$, quantify subjective uncertainty that is modeled by the random variables X'_i . A simple scheme for constructing the probability distribution of X'_i is shown in Figure 4. This scheme is based on the assumption that an investigation of the incident i will allow to obtain an approximate estimate (fixed likely value) of AA characteristic in question, x'_{iL} . Uncertainty in this value can be expressed by a subjective random variable ξ_i that will model the investigator's (analyst's) believe in the actual, albeit unknown value of the characteristic. The distribution of the imprecise value X'_i can be obtained by means of multiplicative scheme $X'_i = x'_{iL}\xi_i$ or additive scheme $X'_i = x'_{iL} + \xi_i$ depending on the investigator's preference. The type of the probability distribution of ξ_i will determine the distribution of X'_i and the pdf $\psi_i(x)$.

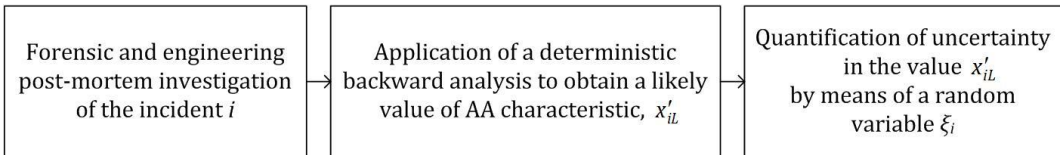


Figure 4. A scheme for specifying the subjective probability distributions of the inaccurate data X'_i on the basis of incident investigation results

The statistical quality the information expressed by the set $\psi = \{\psi_1(x), \psi_2(x), \dots, \psi_n(x)\}$ and its suitability for a rigorous estimation of the population mean $E[\Phi_d(X)]$ (damage probability $\text{Prob}(\Delta_d | A)$) is difficult to assess. The set ψ simply expresses information on the previous n incidents and this information can be a combination of objective and subjective knowledge on the AA under investigation. Processing uncertainties expressed by components of the set $\{X'_1, X'_2, \dots, X'_n\}$ through the fragility function $\Phi_d(X)$ will yield another set of random variables with the elements $\Phi_d(X'_i)$ (Figure 3c). The variables $\Phi_d(X'_i)$ can be used to compute a measure of the likelihood of the damage Δ_d , say, $L(\Delta_d | A)$. The term likelihood is used as a synonym of chance or possibility and not in the rigorous sense of the Bayesian updating. The likelihood $L(\Delta_d | A)$ will not necessarily coincide with the population mean $E[\Phi_d(X)]$. However,

this value can be used for making decisions concerning the vulnerability of targets under analysis to VAs. The value of the likelihood $L(\Delta_d | A)$ can be computed by means of the following algorithm of the stochastic simulation:

1. Generated the value $\{x'_{1k}, x'_{2k}, \dots, x'_{nk}\}$ of $\{X'_1, X'_2, \dots, X'_n\}$ from the probability distributions expressed by $\{\psi_1(x), \psi_2(x), \dots, \psi_n(x)\}$.
2. Compute the set of values of the fragility function, $\{\Phi_d(x'_{1k}), \Phi_d(x'_{2k}), \dots, \Phi_d(x'_{nk})\}$.
3. Compute the average $\bar{\Phi}_{dk} = n^{-1} \sum_{i=1}^n \Phi_d(x'_{ik})$.
4. Store the average $\bar{\Phi}_{dk}$.

A repetition of the above procedure N_k times will yield a simulated sample of averages of fragility function values, $\bar{\Phi}_d = \{\bar{\Phi}_{d1}, \bar{\Phi}_{d2}, \dots, \bar{\Phi}_{dN_k}\}$. A hypothetical distribution of this sample is shown in Figure 3c. The value of the likelihood $L(\Delta_d | A)$ suitable for decision making can be either the mean value $\bar{\Phi}_{dm}$ of the set $\bar{\Phi}_d$ or a conservative q -quantile $\bar{\Phi}_{dq}$ (with $q = 0.1$, say) of $\bar{\Phi}_d$. Both the mean value of $\bar{\Phi}_d$ denoted by $\bar{\Phi}_{dm}$ and the quantile are illustrated in Figure 3c. The values $\bar{\Phi}_{dm}$ and $\bar{\Phi}_{dq}$ are nothing more than a result of uncertainty propagation. The uncertainty expressed by the variables $\{X'_1, X'_2, \dots, X'_n\}$ is propagated to the likelihood measures $\bar{\Phi}_{dm}$ and $\bar{\Phi}_{dq}$. They must be compared to some tolerable values. This will require to answer the well-known question “how safe is safe enough”. It will be the task posed on urban community, what level of hazard posed by VAs can be tolerated.

4. Discussion

In line with the probabilistic procedure presented in this study, the assessment of fragility of built objects to AAs can be decomposed into two simpler sub-problems. The first sub-problem is a development of a fragility function for a damage event in question. The second sub-problem consists in collection and processing of information on the AA that can cause this damage and were encountered in past incidents. A solution of these two sub-problems for the case of VAs can be far from trivial.

A development of fragility functions is a problem of the structural reliability analysis (SRA). In a prevailing number of SRA applications, fragility functions have only one argument (earthquake loading, say) or two arguments (e.g., combined snow and earthquake loading) (Sundararajan, 1995; Lee & Rosowsky, 2006). However, an AA imposed on a built object can be characterized by three or more arguments (demand variables). An illustration of this case is the vehicle-ramming attack schematized in Figure 2b. A development of fragility functions having explicit form and more than two arguments can be an intricate task. To date, the only fragility function developed

for VAs seems to be a single-argument function of façade glass strength calculated for impulse of terrorists' explosions with a triangular time-pressure history (Stewart & Netherton, 2008).

The collection of the set of imprecise data on an AA under analysis can be another intricate task. It will require to group incidents with similar AAs and to extract information on characteristics of these AAs from incident investigation reports. This task cannot be solved by security specialists alone. Expertise in physical processes of AAs and special skills in modelling uncertainties related to possible values of these actions will be necessary. At the present time, methods for extracting information in the form of the aforementioned inaccurate data are still to be developed or improved in some special cases.

5. Conclusions

In this study, a procedure has been proposed for estimating the fragility of built urban objects to vicious physical attacks. The fragility is expressed as likelihood of the damage that can be caused by abnormal actions imposed in the course of such attacks. The procedure consists in propagating uncertainties related to abnormal actions generated in past incidents and expressing results of this propagation in terms of the damage likelihood. The propagation can be carried out by means of stochastic simulation and mathematical model of an endangered object known as the fragility function.

The main finding is that the damage likelihood can be assessed by generating values of inaccurate data and transforming these values into corresponding values of the fragility function. The measure of the likelihood can be average or conservative quantile of the transformed fragility function values. The inaccurate data can be retrieved from investigations of incidents that generated the abnormal action under analysis. The amount of this data will inevitably be limited because the number of incidents that generated a specific abnormal action is small event on the global scale. Inaccurate data should be considered as a prevailing type of information on abnormal actions, because a retrieval of precise, accurate data on such actions is hardly possible in case of an investigation of incidents that happened in the past. Estimates of the damage likelihood can be used for making decisions concerning protection of urban objects against vicious attacks.

An application of the proposed fragility estimation procedure will require further studies into development of multivariate fragility functions for characteristics of abnormal actions. Further work will be required for improving and refining extraction of processing of data on occurrences of abnormal actions in the past incidents.

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Optimizing Project Management using Artificial Intelligence

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Abstract

This study focuses on identifying the weakest points of project management and the possibility of where artificial intelligence can help precisely in their optimization. The results were taken from a survey where project managers of various categories were asked about the main challenges facing management today and the points where artificial intelligence can be seen as a optimization tool. In this decade, artificial intelligence (AI) has undoubtedly been one of the most influential technologies. AI has changed the way people live and work, and project management is no exception. There is always controversy about the use of AI technology. In this paper first is explained the need for companies to use AI technology and after considering the advantages and risks of AI. Also using project management based on machine learning is the optimal option. Some proposals for the implementation of AI in project management are presented. The study describes how AI systems can support project managers to become more efficient in their work.

Keywords: Optimization, Technology, Management, Project Management, Artificial Intelligence.

1. Introduction

This paper studies the role of artificial intelligence in project management including its application in project management while listing the benefits of AI integration in project management. In addition, this paper examines how AI facilitates excellence in project management. Various industries are using technology with a view to improve efficiency and effectiveness, while enabling management to be reliable, secure, and accepting. The integration of human skills and technical systems has resulted in increased performance and motivated culture thus ensuring continuous improvement. AI has various tools including Chatbots, Strategos, ZiveBox, Rescoper, ClickUp, Clarizen and PolyOne which help project managers in handling various tasks. For example, they assist the manager in the composition of the project team, as well as in assigning roles and responsibilities to individual team members. AI tools are also

useful to ensure that project managers manage effectively and adhere to deadlines. There are many benefits that project managers get from using artificial intelligence. First, AI provides support for project managers. This is because it eases the burden and pressure of project management through the application of machinery. AI is also useful in providing project managers with the accuracy of results as the tasks performed using AI have no errors. Furthermore, the use of AI helps project managers with insight and strategy. For example, an AI tool can suggest alternative or additional steps for project managers who are handling very difficult projects. In addition to assisting project managers in performing the above tasks, it also increases effectiveness and efficiency, thus increasing the product manager's productivity by increasing their creativity while increasing their emotional intelligence.

2. Project Management And Elements Of Project Management Phases

A formal definition of project management, based on the Institute of Project Management, defines the term as: "the application of knowledge, skills, tools and techniques to project activities to meet project requirements." A more tangible description is that project management is all you need to realize a project on time and within budget to provide the necessary scope and quality. Project management involves making decisions about the planning, organization, coordination, monitoring and control of a number of related activities in a timely manner. A project manager must make an exchange between cost, time and scope while ensuring the required quality. The Project Manager, therefore, often depends on tools and techniques that are quite effective not only in designing the best possible initial plan, but also capable of instantly projecting the impact of deviations to initiate the necessary corrective measures. The table presents the project management phases.

Table. 1. Elements of project management phases

Start	Planning	Organization	Control	Completion
1. Definition of the problem 2. Identification of project goals 3. Specification of goals 4. Determination of	1. Identification of project activities 2. Evaluation of time and expenses 3. Flow of project activities 4. Identification	1. Determining staffing needs 2. Recruitment of the project manager 3. Recruitment of the project team	1. Define management style 2. Organization of control 3. Preparation of the status report 4. Review of the project plan	1. Acceptance of the project by the customer 2. Distribution of the project 3. Distribution of documentation 4. Preparation of the final report

preliminary resources 5. Identify opportunities and risks	of critical activities 5. Compilation of the project proposal	4. Organizing the project team 5. Assignment of tasks	5.Changes	5.Implementati on audit
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3. Artificial Intelligence And Project Management

Artificial intelligence (AI), the ability of a computer or computer-controlled robot to perform tasks typically associated with intelligent beings. The term is often applied to the project of developing systems endowed with intellectual processes characteristic of humans, such as the ability to think, discover meaning, generalize, or learn from past experience. Since the development of the computer in the 1940s, it has been demonstrated that computers can be programmed to perform quite complex tasks, such as discovering evidence for mathematical theorems or playing chess, with great skill. Still, despite continuous advances in computer processing speed and memory capacity, there are still no programs that can meet human flexibility over broader fields or tasks that require much daily knowledge. On the other hand, some programs have reached the performance levels of human experts and professionals in performing certain specific tasks, so that artificial intelligence in this limited sense is found in various applications such as medical diagnostics, computer search engines and voice recognition. or handwriting. The term "artificial intelligence" has been misused and misunderstood. While for many the term AI means a conscious robot, which wants to destroy humanity; experts refer to this specific instance of AI as general artificial intelligence which is a long way to go in the future. However, there are other cases of AI used for better or worse in areas such as medicine, war, finance, espionage, etc. In relation to the field of project management, machines can copy cognitive functions related to the mind of the project manager such as decision making and problem solving. Various search engines and word recognition systems including Google and Siri among others use AI principles in performing their functions (Lahmann, Keizer, et al., 2018). However, the overall goal of AI is to develop computers and machines that are able to work in the best possible way (Vesma, 2009). This includes the use of optimization strategies, automation intelligence, and mathematical methodologies. Based on (Munir, 2019), programming AI strategies requires technological interpretation in addition to interpretation of psychology, neuroscience, and linguistics. Regarding AI implementation, being able to accurately determine the minds of project managers in a way that allows simulation using the techniques mentioned above remains controversial. This will be possible over time and the opportunity is increasing due to the development and use of microcomputers, the advancement of machine learning technology and the use of cloud computing

(Duchessi et al., 1993). The current study analyzes how AI is beneficial to project managers.

Technological field is dynamic and there is a lot of development in the field of project management. Given the importance of the tasks performed by project managers, it is important that such tasks are performed efficiently and effectively (Vesma, 2009). With technological advancement, several technological innovations have been developed to assist project managers in this regard based on (Anastasi et al., 2011). As such, this study aims to analyze how AI helps managers.

3.1 Assistance to project managers

There have been several AI applications that have been developed with a view to facilitating the work of project managers. This has resulted in new competitive constraints, which when combined with contemporary constraints complicate the exchange analysis process. Hiring various AI tools by project managers is expected to make project management easier. According to (McCarthy, 2007), the limitations and assumptions given to the project team at the beginning of the project do not change within the project life cycle is always taken for granted. This has been proven wrong ever since and all limitations and traces of assumptions should occur throughout the project life cycle, and this is where AI finds added use (Abduh & Soemardi, 2002). For example, managers are not always aware of when they may interfere with project implementation. Some of the AI tools used by most organizations include crisis panels. By observing the computer crisis panel, managers are able to identify projects that face various issues and which of the project constraints are not within the required level and projects that can be considered to be at the critical level (Tonchia, 2018).

Using AI, managers are able to identify projects that need immediate action and the specific actions that project managers need to take. This is essential in significantly reducing response time to project issues identified to be outside acceptable limits. It can be difficult for managers to determine the amount of work to be done or planned without having work restrictions. Extra work is usually done overtime regardless of technological requirements, skill requirements, and resource constraints without AI (Andrea Edkins, 2017). AI helps assist in project portfolio development that increases project probability of increasing value for the organization in addition to identifying effective resource management practices. It is worth noting that several software algorithms have been developed for this purpose (Salini et al., 2015). However, project scheduling and optimization practices remain manual and use trial and error strategies. Based on (Magaña Martínez & Fernandez-Rodriguez, 2015), the use of AI in project management helps to improve the effectiveness of schedule optimization by identifying all current and future projects of the organization in progress, compared to consideration only of a few specific projects. This assumes that everything is generally wrong or true in making assumptions. With the use of more information, some assumptions will be made.

AI utilizes sufficient database related to specific information and thus enhances problem solving and reasoning based on partial information (Butt, 2018). AI enables forecasts for the future, while offering opportunities that increase the value of decisions made. Using different AI tools with more information results in better decision results according to (Schreck et al., 2018). This requires consolidating the intellectual property of project management and obtaining information about AI tools as a starting point. Such tools include hatbots, Strategos, ZiveBox, Rescoper, ClickUp, Clarizen and PolyOne. The United States Patent and Trademark Office (USPTO) has issued a growing number of patents for AI inventions, proving that AI's innovative capabilities will revolutionize our industries and impact the global economy.

4. Risks and limitations of AI in Project Management.

Technologies are increasingly improving productivity, profitability, and business results, but there are also certain barriers and limitations to be taken care of. The main dimensions of risks according to studies are:

Table. 2. Risks and limitations of AI in Project Management

Risk dimension	Description	Impact on MP
Safety	AI technology may not follow the company's security standards.	Depending on the desired output of the project, AI may endanger the safety of human beings.
Privacy	AI cannot properly distinguish between approved and restricted data and violates the right to privacy	This can encourage the collection of personal data, unauthorized registrations and unethical decisions.
Autonomy	As AI dominates the environment, it can make people feel like "slaves" of the car.	AI at some point becomes independent, which makes Project Managers lose track of how and when to stop AI.
Data quality/availability	Incomplete and missing data reflect the statistical power of a forecast and produce estimates that lead to invalid conclusions.	Managing a group of stakeholders and various unpredictable events, AI-led projects will generally not respond appropriately to these challenges.

Employment	Repetitive and low-skilled jobs may no longer be available.	AI may not be competent to assign a task to the right person as it lacks people and social skills
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A major obstacle to AI adoption is the skills shortage and availability of experienced technical staff and training to deploy and operate AI solutions.

1. Data mismatch: exists where data sources conflict with each other at the data value level because the same data exists in different formats in multiple tables. Well-designed and well-controlled project management environment, missing or incomplete data occurs in almost all areas. Incomplete data can reduce the statistical power of a forecast and produce estimates that lead to invalid conclusions.

2. Creativity: Machines simply do not have the ability to be creative. People can think and feel, so decision making is creative and will benefit from the result. AI can help in terms of helping to determine the type of images with the style and the possible price of the client preference. But a machine can not yet compete with the human brain when it comes to originality. AI can be trained in some creativity parameters which can develop their sense of creativity

3. Hiring and retaining: Since the field is quite new in the field of project management, companies may need to invest in raising the level of their employees to meet the demands and challenges of this new way of project management.

5. Case study of project management and artificial intelligence

The first step in this research process was done using a survey which was distributed online to project managers. In this survey, the questions were divided into two categories:

1. Project Management

2. Artificial Intelligence

The survey was conducted among project managers in various enterprises mainly in various IT and telecommunication companies belonging to the most evolutionary industry of the moment to thus understand a broader perspective. The nature of the questions in the survey was defined in a wide range for project managers, some asking them to answer Yes / No, some enabling multiple choice options. The survey results were then used to identify trends in this industry. This section presents the survey results. The survey was answered by a total of 34 respondents with experience in project management in various fields from different businesses. One of the first questions (with Yes / No answer) was about defining AI systems awareness among project managers and the answer is illustrated below:

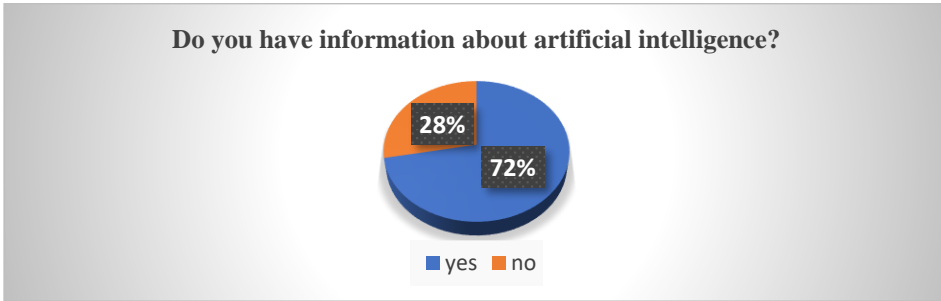


Figure. 1. Information about artificial intelligence

This statistical breakdown got an interesting change as shown in the figure below when project managers were asked if they use any AI system:

Examining the data from the answers to the two questions from the graphs it was found that out of 72% of respondents who have knowledge of AI, 12% use AI systems while 61% of project managers do not use any.

Further respondents who do not use any AI system were asked if they would like to use any AI system in the future and their answer is illustrated in the graph below:

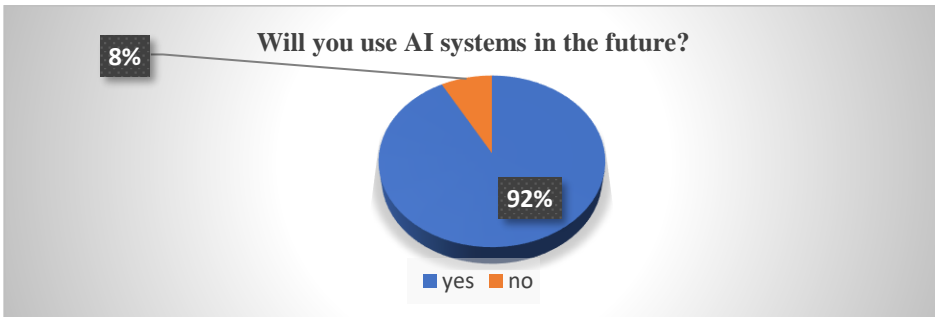


Figure. 2. Preferences to use AI in the future

In this section managers were asked about their experience in the field of project management and their answers are presented in the graph below.

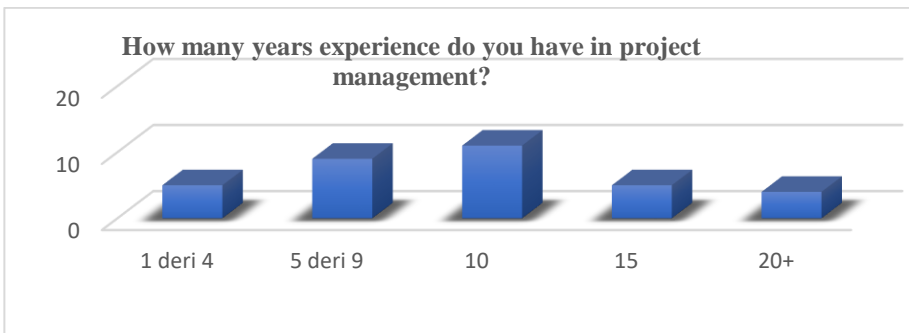


Figure. 3. Experience in Project Management

It turns out that 5 managers have less experience in the field of project management, 9 others have an average experience of 5-9 years. Most result that they have a relatively large experience of 10 years, while 4 had 15 years and 20 years had only 3 of them. 70% of respondents were IT project managers, without question this is justified by the fact that it is the most revolutionary industry of the moment. The remaining 18% and 12% respectively dealt with industrial projects and services. Based on the results it is concluded that the main challenges for project managers are risk management, project planning, budget and quality management. It usually happens that these are the weakest points in management because many factors influence. I would emphasize the fact that exactly at the weakest points of management, AI would intervene in their optimization. They are exactly the budget, project planning, risk management, quality management where Artificial Intelligence would provide support.

6. Conclusions and discussions

This paper concludes that this is the era of technological progress. Technological advancement has led to the development of big data science that uses AI as its backbone. AI is defined as a device that helps to realize different perceptions about the environment, while helping to take actions that increase the probability of achieving goals. Various fields are now applying AI.

However, the field of project management is particularly experiencing an increased AI adoption. In this regard, AI is helping to manage different projects at the same time using the limited resources available. As such, it can be concluded that AI helps project managers in many ways using different tools to perform tasks. different. Thus, AI means increasing project manager support, increasing accuracy, strategy and insight. The use of AI in project management has increased the productivity of project managers. AI has also increased the emotional intelligence and creativity of project managers by eliminating individual biases in decision making. Centrally, there are various risks that have resulted from the adoption of AI in project management. AI in project management does not replace people. Project managers are very important. However, it can be a powerful tool for a project manager who can increase productivity.

The computer analyzes all the data and finds patterns which help it to make a more accurate prediction. The analysis of the survey results reveals some more problematic aspects in project management and for which artificial intelligence systems would help in their optimization. In the future the attention should be focused on these challenges and how to solve them.

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Important Roles of Local Potency Based Science Learning to Support the 21st Century Learning

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Abstract

The development of scientific knowledge and technology, including education have reached the 21st century. In this century, education is not only functioned to develop technology-based learning but also environment-based learning. To meet the challenge, some researchers concentrating on scientific education have developed and implemented local potency based science learning. The researchers systematically reviewed several literatures of relevant research and concluded that local potency based science learning has important roles in the 21st century learning. The learning is able to improve students' abilities obligated by the 21st century learning that are: learning and innovation skills, digital literacy skills, and career and life skills.

Keywords: science learning, local potency, 21st century learning, 21st century skills

Introduction

The 21st Century Learning

Education is widely perceived as a solution to solve social problems. Education cannot be separated from learning systems given by schools. A correct learning is a strong base to create qualified human resources. Education is one aspect influenced by the era development. The influence gives direct impacts on the society. In this era, learning has reached the 21st century learning. It is notified that there are important roles of education in the 21st century. Trilling & Fadel (2009) argue that the roles are to give contribution in both working world and society, to facilitate students to

enhance their skills, to fulfill societal responsibility, and to preserve social cultures and values.

Picture 1 The framework of 21st Learning



The 21st century learning is not merely about teachers transforming knowledge to students but also guiding them to optimize their knowledge and skills. This optimization is expected to make them become globally competitive and able to solve any social problems. In his book titled 21st Century Skills, Kay (2010) conveys the framework of 21st century learning that is:

Based on the framework, there are main subjects and themes of 21st century learning that are art, economics, science, geography, history, government and civics, mathematics, art, world language, English, reading and language arts. There are three skills becoming the focus of 21st century learning: information, media, and technology skills, learning and innovation skills, and life and career skills (Alismail & Mcguire, 2015) Furthermore, Saavedra & Opfer (2015) explain that students have to master seven skills in order to be able to survive and compete with others in the 21st century. Those seven skills are:

- Critical thinking and problem solving
- Collaboration and leadership
- Flexibility and adaptability
- Entrepreneur and initiation
- Written or oral communication
- Information accessibility
- High curiosity and imagination

Science Learning

Learning is an interaction process between students and teachers as well as an interaction process between students and all supportive learning sources to achieve desirable results (Abdullah, 2012). A scientific investigation occurs during a

learning process. Hempel (2004) divides the branches of this scientific investigation into two big groups: empirical and non-empirical science. One of key learning or theme of 21st century learning is science, a branch of scientific knowledge whose role is to advance both scientific knowledge itself and technology.

Mohan (2007) explains that there are three essences of science learning: a body of knowledge, a way of investigation, and a way of thinking in pursuit of an understanding of nature. Yager & McCormack (1992) regard five domains of science as an expansion, development, and deepening of three domains of Bloom's taxonomy. Those five domains are knowledge/concept domain, process of science domain, creativity domain, attitude domain, and application and connection domain.

Local Potency Based Science Learning

To improve the qualities of education and human resources, education in Indonesia should maintain social contacts and kinship and encourage cooperation and awareness of social, cultural, ethic, and moral values. Hence, employing technology in education has to be in accordance with educational necessities of Indonesia. One learning method suitable to be implemented in scientific learning is local-potency-based science learning.

Parmin, Sajidan, Ashadi, & Sutikno (2015) argue that local potencies are uniqueness owned by a certain area. Physical environment such as variations of floras and faunas as well as sociocultural aspects such as utilization of simple technology are two examples of local potencies. National Education Standardization Energy (2006) defines local-and-global-potency-based education as an education utilizing local potencies and demands of global competitiveness in aspects of economy, culture, language, information-technology, communication, ecology, etc.

(Alismail & Mcguire, 2015) explain that local-potency-based learning is one approach of science learning. Science enables students to study natural phenomena without losing any faith to God so that students are aware of obligation to maintain a good relationship with God, human, and environment (Dewi, Kristiantari, Negara, & Oka, 2014). local potency based science learning can improve students' scientific skills because the learning is implemented through processes of observation, discussion, presentation, and practices (Atmojo, 2015).

Important Roles of Local Potency Based Science Learning

To observe significant roles of local potency based science learning to support the 21st century learning, the researchers systematically reviewed literatures of

various journals related to local potency based or local wisdom based science learning. The results are presented in Table 1.

No	Researcher and Research Title	Research Purposes	Research Variable		Research Method	Result of Research
			Dependent	Independent		
1.	Suastra (2010) "Local Wisdom Based Science Learning Model to Develop Science Basic Competence and Local Wisdom Value in Junior High School"	The aim of this research is doing need assesment or student in the science learning at junior high school student and will be reference to design local wisdom based science learning model to develop science basic competence and local wisdom value in junior high school.	science basic competence Local wisdom value in junior high school	local wisdom based science learning model	Research and Development (R&D)	In the class VII and VIII there are 11 standard competence can develop in the local wisdom based science learning model The suitable method is used for local culture-based science learning is an investigation / experiment, field observation, and discussion. A suitable learning resource to support science learning is the natural environment and socio-cultural, textbooks, audio-visual, and internet Design Appropriate learning developed includes steps: initial activity, investigation from various perspectives (exploration), elaboration, confirmation, end activities.
2.	Mungmachon (2012) "Knowledge and Local Wisdom: Community Treasure"	The aim of this research is identification environmental problem and social community and to known the role of knowledge and local wisdom to overcome this problem	Knowledge Local wisdom	Social and environmental problems	Study case	Globalization era gives negative effect in community. The findings show many environmental and social problems. In an effort to overcome this problem, various communities began to restore local wisdom and traditional knowledge remaining, and integrate it with new knowledge

No	Researcher and Research Title	Research Purposes	Research Variable		Research Method	Result of Research
			Dependent	Independent		
.	Santoso, Sajidan & Sudarisman, (2013) "Implementa- tion Science Technology Society Model Through Field Experiments and Laboratories Methods Reviewed By Attitude of Environmental Care and Student's Verbal Creativity"	The aim of this research is determining the effect of Science Technology Society learning model through field experiments and laboratories methods, between students who have an attitude of environmental care and verbal creativity in high and low categories of students' biology learning achievements, and their interactions	Environmen- tal care attitude Student's verbal creativity	Science technology society models	True experiment	There are influence field experiments and laboratories methods toward cognitive learning achievement, affective and psychomotor student There are influence attitude of environmental care toward cognitive learning achievement, affective and psychomotor student There are influence verbal creativity toward cognitive learning achievement, affective and psychomotor student There are interaction between method and attitude of environmental care toward cognitive learning achievement, affective and psychomotor student There is no interaction between method and creativity toward cognitive learning achievement, affective and psychomotor student There are interaction between attitude of enviroenmetal care and verbal creativity toward cognitive learning achievement, affective and psychomotor There is no interaction between method, attitude of enviroenmetal care and verbal creativity toward cognitive learning achievement, affective and psychomotor student
4.	Khusniati, (2014)	The aim of this research is	conservation character of	science learning model	Literature Review	science-based learning model local wisdom can

No	Researcher and Research Title	Research Purposes	Research Variable		Research Method	Result of Research
			Dependent	Independent		
	"Science Learning Model Based on Local Wisdom In Growing Character of Conservation"	identification role of science learning model based on local wisdom in growing conservation character of student	student	based on local wisdom		be utilized to deepen the concept of science so as to foster the conservation character of student
5.	Atmojo (2015) "Learning Which Oriented On Local Wisdom To Grow a Positive Appreciation of Batik Jumputan (Ikat Celup Method)"	The aim of this research is to identify science materials in the batik jumputan process as a local culture. With knowing By knowing the existence of element of science in batik jumputan, expected to grow positive appreciation to batik jumputan as local cultural heritage	Science process skills Appreciation	Learning which oriented on local wisdom of batik jumputan (ikat celup method)	Experiment	There are enhancement appreciation after and before learning of making batik jumputan process with the criteria 0,70 g (High criterion) Average score of science process skills in the making batik jumputan process is 60% KPS 80% (High category).
6.	Setiawan & Wilujeng (2016) "The Development of Scientific-Approach-Based Learning Instruments Integrated With Red Onion Farming Potency In Brebes Indonesia"	The aim of this research is development of scientific- approach-based learning tool integrated with red onion farming potency feasible to improve science process skills and cognitive learning outcomes students	Science process skills Cognitive learning outcomes	Scientific-approach- based learning tool integrated with red onion farming potency	Research and Development (R&D)	Realization of scientific-approach-based learning tool integrated with red onion farming potency feasible to improve science process skills and cognitive learning outcomes students This learning tool effective to improve science process skills with gained scores is 0,54 (medium category) This learning tool effective to improve cognitive learning outcomes students with gained scores is 0,50 (medium category)
7.	Sya'ban & Wilujeng (2016) "Developing of Essence and Energy SSP Based on Local Wisdom to Improve Literacy Science and	The aim of this research is developing of SSP based on local wisdom to improve literacy science and environmental care of students	Science literacy Environmental care	Science specific pedagogy (SSP) based on local wisdom	Research and Development (R&D)	Realization of SSP based on local wisdom to Improve literacy science and environmental care Of students of MTs" with category "very good" Based on Hotelling's T2 test concluded SSP

No	Researcher and Research Title	Research Purposes	Research Variable		Research Method	Result of Research
			Dependent	Independent		
	Environmental Care Of Students of MTs"	of MTs"				based on local wisdom effective to improve literacy science and environmental care of students of MTs" with the significance value is $0,000 < 0,05$.
8.	Setiawan, Innatesari, Sabtiawan & Sudarmin (2017) "The Development of Local Wisdom-Based Natural Science Module To Improve Science Literation of Students"	The aim of this research is development natural science module based local wisdom with the theme is "kelud eruption" to improve science literacy student	Science literacy	Local wisdom-based natural science module	Research and Development (R&D)	Natural science module based local wisdom effective to improve science literacy student with the validation result are: components of material feasibility is 87, 5% (very good) components of presentation feasibility is 91,7% (very good) components of language is 88, 9% (very good) components of local wisdom is 87, 5% (very good) components of science literacy feasibility is 88,9% (very good)
9.	Dwiyanto, Wilujeng, Prasetyo & Suryadarma (2017) "Development of Science Domain Based Learning Tool Which Integrated with Local Wisdom to Improve Science Process Skill and Scientific Attitude"	The aim of this research is: Developing of Learning tool based science domain integrated with local wisdom especially for science learning material "Object Change Around Us" for students grade VII of Junior High School Measuring the effectiveness learning tool based science domain integrated with local wisdom to improve science process skill and scientific attitude	Science process skill Scientific attitude	Learning tool based science domain integrated with local wisdom	Research and Development (R&D)	Realization of learning tool based science domain integrated with local wisdom feasible for science learning material "Object Change Around Us" for students grade VII of Junior High School Learning tool based science domain integrated with local wisdom effective to improve science process skill and scientific attitude of students grade VII of Junior High School.

No	Researcher and Research Title	Research Purposes	Research Variable		Research Method	Result of Research
			Dependent	Independent		
		of students grade VII of Junior High School.				
10.	Kumiati, Wilujeng, Prasetyo & Suryadarma (2017) "The Effectiveness of Science Domain-based Science Learning Integrated With Local Potency"	The aim of this research is to know the influence of science domain-based science learning integrated with local potency to improve science process skills student	Science process skills	science domain-based science learning integrated with local potential	Quasi Experiment	Science domain-based science learning integrated with local potency effective to improve science process skills student with the gain score is 0,67 (medium category)
11.	Dewi, Suryadarma, Wilujeng & Wahyuningsih (2017) "The Effect of Science Learning Integrated With Local Potential of Wood Carving and Pottery Towards The Junior High School Students' Critical Thinking Skills"	The aim of this research is to know effectiveness science learning integrated with local potential of wood carving and pottery to improve the junior high school students' critical thinking skills"	Critical thinking skills	Science learning integrated with local potential of wood carving and pottery	Quasi Experiment	Science learning integrated with local potential of wood carving and pottery effective to improve critical thinking skills of junior high school students with the significance value is 0.008 (significance <0.05)
12.	Rahardini, Suryadarma, Wilujeng (2017) The Effect of Science Learning Integrated With Local Potential To Improve Science Process Skills	The aim of this research is knowing the effectiveness of science learning integrated with local potential to improve science process skills	Science process skills	Science learning integrated with local potential	Quasi Experiment	Science learning integrated with local potential effective to improve science process skills with the gain score is 0,63 (medium category).
13.	Cahyaningtyas, Wilujeng & Suryadarma (2017) "The Effect of Science Learning Based Scientific Approach"	The aim of this research is knowing the effectiveness of science learning based scientific approach	Science process skill	Science learning based on scientific approach integrated to local potential	Quasi experiment	Science learning based scientific approach integrated local potential effective to improve science process skill with the significance

No	Researcher and Research Title	Research Purposes	Research Variable		Research Method	Result of Research
			Dependent	Independent		
	On An Integrated Scientific Approach To Local Potential On The Science Process Skill Of The Student"	integrated local potential to improve science process skill of the student"				value 0,001 (significance < 0,05)
14.	Susanti, Prasetyo & Wilujeng (2017) "Comparative Effectiveness of Science Integrated Learning Local Potential Essential Oil Clove Leaves in Improving Science Generic Skills"	The aim of this research is measuring effectiveness of science integrated learning local potential of essential oil clove leaves in improving science generic skills	Science generic skills	science integrated learning local potential of essential oil clove leaves	Quasi experiment	Science integrated learning local potential of essential oil clove leaves effective to improve science generic skills with the significant value is 0,000 Science integrated learning local potential of essential oil clove leaves more effective to improve science generic skills students of junior high school 3 ngaglik than students of junior high school piri ngaglik with the significant value is 0,000
15.	Wilujeng, Prasetyo & Suryadarma (2017) "Science Learning Based on Local Potential: Overview of The Nature of Science (NoS) Achieved"	The aim of this research is to know effectiveness of science learning based on local potential: overview of the nature of science (NoS) achieved"	Nature of science (NOS) achievement	Science learning based on local potential	Experiment	Science learning based on local potential effective to improve Nature of Science (NOS) viewed by science process skill and scientific attitude junior high school student especially class of VII and VIII

Learning based on local potential is one of approach that utilizes various potentials that exist in certain areas as a source of science learning. These local potentials include: economics, culture, language, information and communication technology, ecology, diversity of flora and fauna, products with the use of simple technology and others.

Based on the findings of several studies, it appears that this learning can improve the various abilities of student. Not only improve knowledge but be able to improve skills even give effect to the attitude of student. Increasing knowledge related to the concept of science is the obligation of a teacher to the students. This is because identical knowledge with the teacher managed to direct students to think and understand the concept. Based on the results of the literature review indicates that local potential based science learning is effective for improving students' knowledge.

In addition to knowledge, one of the other aspects that can be improved from this learning is students' science process skills. The enhanced skills of the science process include: observing, classifying, interpreting data, communicating, measuring, describing, conducting the experiment correctly, controlling variables, defining, formulating hypotheses, interpreting data, conducting investigations, selecting experiments, formulating models and the others.

Through learning based on local potential of course to train students to observe directly, make observations, find various problems and finally through communication students can give each other solutions related problems that exist. This step then gives a positive aspect to the changing attitude of students because students are invited to be logical, critical and reasonable to the various problems that exist.

One of the students' attitudes that have been improved from local potential-based science learning is environmental care. This attitude is certainly required by all students so that students better understand the various local potentials in their area and jointly maintain, preserve and appreciate various local potential as a natural heritage. Because this learning can increase knowledge, attitude, and skill it can be said that this learning can increase science literacy and the achievement of nature of science (NOS).

Kay (2010) describe skills involved in those big three skills focused in the 21st learning that are: *Learning and innovation skills; Information, media, and technology skills; and Life and career skills*. Components from this skills, namely:

Learning and innovation skills Critical thinking and problem solving
Communications and collaboration
Creativity and innovation

Information, media, and technology skills

Information literacy

Life and career skills

Initiative and self-direction

Social and cross-cultural interaction
Leadership and responsibility

Observed from the perspective of those focused skills and compared to achievements of local-potency-based science learning including scientific

processing skills, scientific generic skill, scientific literacy, knowledge, scientific attitude, cognitive learning outcomes, and creativity skill; it can be concluded that science learning integrated by local potencies holds important roles in the 21st century learning.

Beside to teach skills obliged by the 21st century learning, local-potency-based science learning is also expected to solve problems of science learning itself. Recent realities related to science learning can be observed on the report of OECD (2017) reporting that the study result of Program International for Student Assessment (PISA) in 2015 displayed Indonesian students' mastery in science reached the score of 403 only. It indicates that the mastery of science of junior high school students in Indonesia is still categorized as low. Such category illustrates the reality that students' scientific knowledge is still basic; whereas the expectation demands students to be able to reach the high order thinking ability.

Beside PISA, similar results are also shown by the result of survey conducted by Trends in Mathematics and Science Study (TIMSS) in 2015 that measured both scientific and mathematical skills of fourth and eighth graders. Indonesia was able to reach the average score of 397 and ranked as the 45th of 48 countries participating in TIMSS with the category of Low International Benchmark (IEA, 2017).

Based on the result of the report, it is expected that local-potency-based science learning can improve students' international achievements. Observed from the perspective of research result, local-potency-based science learning is effective to improve various skills obliged by the 21st century learning.

Conclusion

Based on studies on relevant research discussing local-potency-based science learning, it can be concluded this approach can approve scientific processing skills, scientific generic skill, scientific literacy, knowledge, scientific attitude, **cognitive learning outcomes, and creativity skill**. From this data show that this learning is effective and able to meet the 21st century skills demands that have to be fulfilled by the students in the 21st century learning.

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Analysis of Indonesia Marine Fisheries with Economic Growth, Population and Effort Effectiveness

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Abstract

Fisheries, as part of the human food chain, have an environment that affects fisheries resources. The view of slowing the number of fish catches in the sea due to factors that drive such as economic growth, population and effort effectiveness will decrease the power of fish in the sea. This study carried out the circumstance of fisheries in sea Indonesia and analyzed empirically the relationship between economic factors, population, and effort effectiveness on the catch volume. We apply the random effect (RE) estimator method which is reviewed for 33 provinces for the period 2000-2015. We use catch as a proxy for marine ecosystems. Our results confirmed that the growth of fish catchment in the sea Indonesia experienced a positive trend and the relationship between economic factors, population and effort effectiveness positive and significant on the volume of catch thus we conclude that catch fisheries in Indonesia is sustainable

Keywords: Indonesia marine catch, Fish stock, Fisheries

Introduction

The oceans provide a vast amount of vital resources not only to provide the basic human needs, but also to support human wealth. However, the ocean abilities to provide sustainable benefits for human well-being is limited by its regeneration capacity, which is currently deteriorating due to over-exploitation, pollution and coastal development (Halpern et al., 2012). Pontecorvo and Schrank (2012) utilization of global fisheries resources by humans experienced a fluctuation growth trend during the period 1950 to 1989 with a linear trend of 1.67 million metric tons per year. It rose from 16.8 million metric tons in 1950 to 81.9 million metric tons in 1989. However, the annual catch rate growth slowed in the early 1990s. In the early 1990s seen a slowdown in world catches. This slowdown occurs with considerable

variation from year to year. Annual catch decreased by more than 9% from 1996 to 2009.

The impact of an ongoing marine exploitation has been found by experts will affect the sustainability of sustainable fisheries, thereby reducing sea harvest. Olson (2009) states that the interactions between fish, climate and fishery populations deserve a thorough investigation. There is a growing sense that we have no objective to utilize fishery resources in a sustainable way. Olson provides a review of the scientific uncertainty about the complexity of the marine environment and its impact on fish stocks. Meanwhile, Beverton (1990) states that the rate of reproduction adjusts as a very deep stock measure so that stock collapse is not possible.

The reduction of fish resources in this case for the catch rate will be influenced by some of the key market demand factors for fish that respond to the increasing demand for fish products that mainly arise from the steadily rising incomes of the world and the human population, both of which have risen dramatically since the middle centuries ago and is expected to continue in the medium and long term (Westlund, 2005; Godfray et al., 2010), increasing the effectiveness of fishing effort due to increased capital and labor used. In the world's fisheries, as well as the continuing advantages in labor and capital productivity over the years, for instance, better vessels and equipment, and the use of expanded electronic equipment (Jin et al., 2002; Hannesson, 2007).

Indonesia is the largest archipelagic country in the world with 17,504 islands and a coastline of 104,000 km (Bakosurtanal, 2006). The total sea area of Indonesia is about 3.544 million km² or about 70% of the Indonesian territory. Based on FAO Year Book 2009 report, Indonesia's fishery production up to 2007 is holding 3rd ranked in the world. So research about how the condition of fish stock at sea in Indonesia is very interesting which in this case will be proxy with the catch volume. This is interesting because some of the most important issues in Indonesia's marine fisheries are the degradation and pollution of the Indonesian sea in some areas resulting in decreased fish productivity. Economic pressures in some coastal areas often trigger myopic (short-thinking) catching fish in destructive ways such as bombs and toxins, so these methods will damage ecosystems such as coral reef which has a direct impact on fish production process.

The study aims to learn about fishery conditions at the sea of Indonesia and analyze the relationship between fish stocks at sea by using proxy the number of catches affected by economic growth, population and effort effectiveness in fishing in Indonesian seas.

This paper will be arranged as follows: part 2 literature review. Section 3 discusses about the use of research methodology and estimates. Section 4 results and analysis. Section 5 presents the study's conclusions and policy implications.

Literature Review

Experts differ on the state of global marine fisheries in the last two decades. Some scientists believe that marine fisheries are not tend to be sustainable and the fish stocks at sea are threatened by depletion. This is marked by a decrease in catch rate. Pontecorvo and Schrank (2012) The Changes in fishing rate are borne out by revenue growth, population and fishing technology and increasing fishing efforts resulting in overall catches of fish decreasing indicating that marine ecosystems are declining.

Zeller and Pauly (2005) find that the global catch of fishes is declining faster than before, this is due to waste and garbage, thus indicating a decrease in the total availability of marine fish.

Myers and Worm (2003) states that the ecological effect of fishing on the ocean by using industry deception lowers biomass by 80% within 15 years of exploitation. In this study saw rapid growing potential species as well as large predatory fish species. Globally Myers and Worm (2003) concluded that the decline in the number of large predators in coastal areas has spread across the global ocean and has serious consequences for existing ecosystems at sea.

Pauly et al. (1998) suggest that unsustainable exploitation patterns are characterized by stagnant or declining fish catches. In a study conducted in 1950-1994. The trophic level of the species reflects a gradual transition in landings from long-lived, high trophic levels, piscivorous bottom fish toward short-lived, low trophic levels of invertebrates and planktivorous pelagic fish. This effect, also found to be occurring in inland fisheries, is the most pronounced in the Northern Hemisphere. Fishing down food webs (leads at first to increase catches), then to a phase transition associated with stagnating or declining catches. Pauly and Palomares (2005) use indicators The mean trophic level (TL) fisheries catch explains the finding that global trends towards catches are increasingly dominated by low-TL species. This illustrates no sustainability in the fishing process at the sea.

Merino (2012) in his research states that the expansion of human population and world economic development will increase demand for fish production in the future. Because fish productions are limited by productivity. The productivity of ecosystem management is endangering future aquaculture production and availability of fish products. On the other side, the argument concerns of the global oceanic collapse are a bit exaggerated and misleading. At this point, they argue that current catching practices are sustainable (Hilborn, 2007; Murawski et al., 2007).

Sugiawan et al. (2017) in his research explores global marine fisheries analyzing it with economic factors. Using the average group estimator for 70 countries in the period 1961-2010 using catch data and stock estimates as a proxy for marine ecosystems. The results show that the initial stage of economic growth, the level of income that leads to a decrease in the rate. Population growth puts continuous pressure on the catch level, further economic growth causes a decrease in catch. At the stage of

economic development, the composition of the economic effects resulted in the creation of new environmental regulations and clean industry that preserve the environment and cancel the damage of the previous stage of development.

Methodology Data

This research will use panel data with some annual series from provinces in Indonesia from 2000 to 2015. The volume of fish harvest is measured in a ton matrix. Economic growth measured from the GDP per capita per share is expressed in thousands of rupiah at constant prices in 2010. Population density is measured in people per square kilometer of land area and the effectiveness of the effort is seen from total boats or ships for marine fisheries in units. The data of fish production volume panels, real GDP per capita, population density data and total boats or ships are obtained from Indonesian Central Bureau of Statistics.

Estimation

This paper will look at the relationship between economic growth marked by per capita income, population, and fishing effort on Indonesian marine resource catches based on the parametric model:

$$\ln C_{it} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln P_{it} + \beta_3 \ln E_{it} + \varepsilon_{it}$$

Where C_{it} is the volume of fish catch region i , for period t ; Y_{it} is gross regional domestic product per capita region i , for period t ; $P_{i,t}$ is population density region i , for period t ; $E_{i,t}$ is total boat or ship region i , for period t ; ε_{it} is error term.

The data analysis used in this research is a form of regression analysis of data panel. The data panel is a combination of cross section and time series data. Using a data panel means doing an analysis on an observation on some units with a certain time range. According to Klevmarken (1989) and Hsiao (2003) in (Baltagi, 2005) using panel data provides several advantages: controlling individual heterogeneity, providing more informative data, more variability, reduced collinearity between variables, degrees of freedom and better efficiency. According to (Widarjono, 2013), when using the data panel, a combination of estimations such as intercepts and slopes of different coefficients will be produced. The approach used in panel data model in this research is Fixed Effect and Random Effects.

Approach that can be used in data panel model that is Fixed Effect and Random Effects, hence more according to (Widarjono, 2013), about model panel data can be explained as follows.

Fixed Effect Model

The characteristics of each cross section in the common effect model can not be captured by the model because it assumes the same intercept and slope across the entire cross section. In the fixed effect model, the differences between individuals can be accommodated by different intercept. To estimate Fixed Effects model panel data,

a dummy variable technique is used to capture the differences between intercept companies, different intercepts can occur due to differences in work, managerial, and incentive cultures. Nevertheless, the parts are same between companies. This estimation model is also called the technique of Least Squares Dummy Variable (LSDV).

Random Effect Model

In the fixed effect model, the addition of variables with dummy variables will give consequences in degrees of freedom (degree of freedom). it will reduce the efficiency of parameters. This random effect model will estimate panel data where interference variables may be interconnected between time and individuals. In the random effect model, the intercept difference is accommodated by the error terms of each cross section.

The model specification test on the data panel is required to obtain the best model that represented the condition of the data. In the model panel, the model specification test data is done through Hausman Test. According to (Widarjono, 2013), in the Hausman test, there are two things into consideration. Firstly, whether or not correlation available between error term and independent variables, if it is assumed that there is a correlation between error term and independent variable then random effect model is more appropriate. Secondly, with the number of samples in the study. If the taken sample is only a small part of the population, then it will get random error conditions. So that the random effect model is more appropriate.

Result and Discussion

Analysis of the development of Indonesian marine fishery, in this case fish stock at sea can be represented by Proxy of catch this thing can be seen in figure 1.

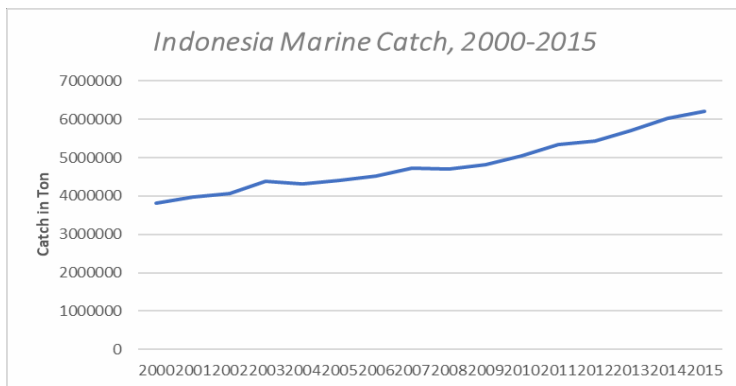


Figure 1. Indonesia Marine catch 2000-2015

As shown in Figure 1, the development of Indonesian fisheries production has experienced an increasing trend. The fisheries production rate in the period 2000-2015 having an average production increase of 1.03 percent. This supports the view

(Hilborn, 2007 and Murawski et al., 2007) stating that fishing practices are sustainable, so concerns over the collapse of fish stocks at sea are marked by a decrease in the number of harvests at sea as feared by (Pontecorvo and Schrank, 2012; Zeller and Pauly, 2005) are not proven in Indonesian marine waters. More specifically, it can be seen from all provinces in Indonesia, some provinces such as Maluku, North Sumatra, South Sulawesi accounted for 26.6 percent of the national harvest in 2000 as percentage decreased to national catch percentage in 2015 amounting to 23.06 percent of the total national catch. Some areas having an increased in fish harvests by 2 percent from 2000 to supply total national income in 2015 such as North Maluku and DKI Jakarta.

The second section looks at the relationship of catch volume influenced by economic growth, population growth and effort effectiveness. Empirically to provide evidence of the role of economic growth, population growth and effort effectiveness on the volume of fish catch in estimation using RE (Random Effects) and FE (Fixed Effects). The data panel is used to overcome the problems that exist in the estimation model as there are constant variables across time that are in the error so that will affect the value of coefficients in the model. Fixed effects and random effects model are two methods to overcome the condition.

The estimation results from the main model are shown in the output in table 1 below. The output shows the variation of results based on model and variation when the regression is done. In addition for displaying regression results, the model test is seen from Hausman Test. Hausman Test is to provide limits so it can be concluded which model is the best model. After getting the best model based on model specification test then the next step is to analyze the coefficient value in the model so that can be interpreted result obtained by regression analysis of panel data.

The first step taken in analyzing the results of regression output on the panel data model is by testing the model specification.

Based on the results of Hausman test is used to test between Random Effects and Fixed Effects, in the test obtained p-value value of 0.6603 on the model so it can be concluded that the random effects model is the selected model.

The Random Effect method obtained the result as follows: Table 1. Regression Estimation Results

Variable	Coefficient	Std. Error	P> Z
lnY	.175734	.0868948	0.043
lnP	.2329193	.0745119	0.002
lnE	.4911982	.1055401	0.000

Source: processed data, 2017

The output analysis result of random effect for model is analyzed in relation between variable. Table 1 shows that economic growth is statistically significant and significant at the 0.05 level, which means that economic growth contributes to the harvests of fish in the sea. The value of economic growth coefficient is 0.175734 which means that if there is an increase of 1 percent economic growth it will increase the harvesting of fish at 0.175 percent. The study of economic growth as a result of the catch as Sugiawan (2017) In the economic development stage of the composition of the economic effect resulted in the creation of new environmental regulations and clean industry that preserve the environment and cancel the damage of the previous stage of development of fish stock.

Another influence is also indicated by population growth, the effect of population growth is indicated by a positive and significant value at the level of 0.01 with a coefficient of 0.2329193 which means that if there is an increase of 1 percent population density, it will increase the fish catch in the sea of Indonesia of 0.232 percent. The influence of population on positive catch volume is in line with Sugiawan's (2017) study at global level which states that the population has positive effect on catchment. The higher population, the catch will increase. So, we can conclude that the stock of sea fish is still in sufficient supply.

Another effect for sea catch is shown by the effectiveness of the effort. Effect of effort effectiveness undertaken is indicated by the positive and significant value at the 0.01 level with the coefficient value 0.4911982 which means that if there is an increase of effort effectivity done by 1 percent, it will increase the catch in the sea of Indonesia by 0,491 percent. This is in accordance with the research conducted by (Jin et al., 2002) and (Hannesson, 2007) stating that better ships and equipment that used will increase the number of fish catches.

From the regression estimation it can be concluded that during the period 2000-2015 the number of fish catches at the sea in Indonesia increased. This indicates that the decreasing stock inventory that effect on the catch will decrease as feared by previous research (Pontecorvo and Schrank, 2012; Zeller and Pauly, 2005; Myers and Worm, 2003; Pauly et al., 1998; Merino, 2012) have not been proven in Indonesian seas.

Conclusion and policy Implementation

The purpose of this study is to examine the state of Indonesia's marine fisheries and to study its relation to economic factors, population growth and effort effectiveness. For this purpose, we use capture as a proxy for the abundance of marine resources. Our model uses panel datasets in 33 provinces in Indonesia in 2000-2015. We found no evidence of a reduction in Indonesian fishery catches that are affected by economic and population growth as much as experts fear.

Each important country like Indonesia is an important political entity that cares about the interests of the state, in relation to fisheries interest in policies focusing more on policy-specific for the improvement of national economy such as employment field in fishery industry, export value, utility satisfaction and so on. So the attention to the secondary issues tends to be lower, in this case the base of marine resources for the long term.

This is important considering that economic growth, population growth, and effort effectiveness in the form of ship quantities, environmentally friendly technologies will continue to increase it and keep the resource base maintained for the utilization of the sea as a basic human need and keep humans' wealth remain sustainable.

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Information Technology and Systems in Transport Supply Chains

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Abstract

Transportation and movement of goods is one of the most important human needs, the operation of transportation determines the efficiency of moving products. The progress in techniques and information technology (IT) and management principles improves the moving load, delivery speed, service quality, operation costs, the usage of facilities and energy saving. This study deals with the logistics processes in supply chain management, information technology in management and prospects for the use of information technology in the transportation logistics segment, with particular attention paid to the key factors in information technology that affects the efficiency of transport, allows information to be collected on such as traffic volume, flow, average traffic speed, and actual journey time. Such innovative means of gathering data on automobile traffic open up new perspectives for assessing transport accessibility in terms of automobile traffic by providing high-quality data that meet the requirements for use in company. The main purpose of this study is to give a comprehensive review of information technology (IT) and relationship with transport leading to increased competition and improvement of the level of Algerian companies.

Keywords: Transportation, information technology (IT), supply chain management.

Introduction

Globalization is fundamentally changing the environment of business decisions. Corporate decisions have to be increasingly taken in the new context where business operations are subject to worldwide forces of fierce competition. Firms have to respond strategically in order to stay competitive in this arena. Firms have typically two sources for gaining a strategy driven competitive edge: a) the continuous creation of new products and incorporation of new technologies, and b) the firm's decisions on the rationalization of existing operations. (Vesna Aleksić Marić 2012).

Companies today have to deal with new economic parameters. Political and economical moves occur faster than before. Trading zones are built up all over the world. Globalization became a generalized phenomenon that has more or less abolished some borders. Thanks to technical improvements the distances have also shrunk, and the world can be seen as a village. In such an environment, logistics activities can no more be seen as traditional transportation activities. The logistics task has to support economic growth of companies as well as the marketing and manufacturing activities as a result of increased international competition and international corporate mergers (Yung-y.T. and Wen L. Y. 2005). For industries, logistics helps to optimise the existing production and distribution processes based on the same resources through management techniques for promoting the efficiency and competitiveness of enterprises. The key element in a logistics chain is transportation system, which joints the separated activities.(Krumwiede, D.W et al 2002).

Transportation occupies one-third of the amount in the logistics costs and transportation systems influence the performance of logistics system hugely. There are innovative ways in which firms are combining transportation and distribution systems to increase their efficiencies in the globally competitive environment. Though the transportation logistics systems vary with type of product and geographical scope of the market for raw materials, components and finished products, there is a common objective underlying the various strategies. The common objective is to get the right product to the right place at the right time so the cost of holding inventory is minimized (Santash.G.K and Shirich. P. (2014)).

Logistics continues to grow and become a strategic resource that has already requires a certain level of staff and a variety of in-depth knowledge. For the existence of a market economy, transport companies should focus on getting the single most effective economic results in the supply chain. This may contribute to a number of factors, namely formed market of transport services, competition between enterprises and various modes of transport, and others. Thus, due to transportation, logistics of goods movement process is transformed into a single technological chain, and transportation is becoming an integral part of an integrated transport and production process.(Olga . Z. 2013).

Information technology (IT) has transformed many industries, from education to health care to government, and is now in the early stages of transforming transportation systems. While many think improving a country's transportation system solely means building new roads or repairing aging infrastructures, the future of transportation lies not only in concrete and steel, but also increasingly in using IT. IT enables elements within the transportation system—vehicles, roads, traffic lights, message signs, etc.—to become intelligent by embedding them with microchips and sensors and empowering them to communicate with each other through wireless

technologies. IT facilitates effective communication that is critical to the maintenance of value enhancing relationships.

According to Samson. K. N (2014).and Lai et al (2010) it is difficult to have effective communication in today's business world without the use of modern IT. IT enables an organisation and its suppliers to communicate and share information openly and frequently and hence expand knowledge-sharing and understanding of complex competitive issues through greater discovery and disclosure of information. Through the use of IT, firms can share information related to forward and reverse logistics with their suppliers (Samson. K. N.2014). Thus, high levels of IT use between a firm and its supplies are likely to lead to high levels of connectivity, which fosters the integration of logistics activities.

This study focus on the adoption and implication of information technology (IT) in the transport and logistics services. This study shows how companies in the sector use (IT) for managin their transport processes, internally and in exchange with suppliers and customers.

The objective of this study is to provide a broad view on the strategic impact of information technology (IT) usage and supply chain management amplication in the transport sector

Information technology as an enabler of supply chain management

Supply-chain management is a process responsible for development and management of the total supply system of a firm, both the internal and the external components. Prior to 1980s, the transportation and industry has witnessed the evolution of one of the most important trends in the history of logistics, the increasingly sophisticated use of computers. Although these devices and electronic commerce have found applications in transport and industry, the business sector is a major beneficiary (M. Kia, E. Shayan and F. Ghotb 2000). However. During the past two decades, the information flow between functional areas within an organization and between supply chain member partners were paper-based. The paper-based transaction and communication is slow. During this period, information was often overlooked as a critical competitiv resource because its value to supply chain members was not clearly understood. IT infrastructure capabilities provide a competitive positioning of business initiatives like cycle time reduction, implementation, implementing redesigned cross- functional processes.

Information sharing between partners in the supply chain is also crucial and these integration attempts are accompanied by IT initiatives. Such IT initiatives include:

- Use of bar-coding in logistics systems
- Use of EDI to communicate between branches
- Use of Material Requirements Planning

- Enterprise Solutions like ERP
- Internet and Web Services for communication between partners.

Given the complexity of the supply chain, with multiple participants, there is ample opportunity to increase efficiency and reduce costs by companies, which enables integration of the increasingly tighter links in the supply chain. The efficient usage of impecation (IT) in transportation and logistics distribution could provide:

- transportation management, including optimising the choice of carriers based on service requirements and freight rates;
- logistics management, including the tracking of containers from the port of origin to the port of unloading in Algeria, on the rail track and between origin and the final destination and flexible routeing, storage and distribution as necessary;
- trade and transportation documentation, including the electronic development and transfer of shipping documents, customs clearance and other regulatory requirements;
- international trade finance;
- insurance.(Nitty. H. K. . AND Nolila. M. N. (2009))

Fedar Brookman and Jakobus Smit and A.j. Gillert Silvius.(2012) reported an extensive literature review from articles published since 2004 and proposed a classification scheme for the rol of IT in SCM. in this scheme the researcher identified six major categories that focus on developing an IT. The model consiste of the six defined categories strategic planning, Virtual Enterprise, Infrastructure, Knowledge and IT Management, Implementation of IT.

J. harharia and Shanker (2004) elaborated on this study and specified the domains into enablers. In their study they identified ten enablers and measured the what extent and enablers is a driver for IT enabled SCM.

This results in shown in table 1

Rank	Enabler	Mean	STDV
1	Supply chain wide IT strategy	3.64	1.03
2	Profit sharing due tail enablement	3.29	1.16
3	High level of supply chain integration	3.05	1.32
4	Top management commitment	2.91	1.18
5	Security of online information	2.81	1.27
6	Trust in supply chain linkages	2.73	1.19
7	Collaborative planning	2.71	1.26
8	Reliable for IT enablement	2.63	1.14

9	Funds for IT enablement	2.53	1.37
10	Awareness about use of IT in supply chain	2.47	1.27

Table 1. identified enablers of an IT-enabled supply chain (Jharkharia and Shankar 2004)

Transportation and logistics processes in the supply chain management

Organization of transport and logistics processes within the supply chain management, based on consideration of the entire logical chain, which includes all businesses, combined with information technology tools. Advance the concept of market trends, a significant potential can be increased. The driving force is the rate of change in a certain area of the economy, including transport. Several flows should be managed to accomplish the transportation operations (Lumsden, 2007). One flow is the resource flow, including internal resources such as forklifts, pallets or other load units and external resources such as vehicles, containers, etc

The union of all businesses in the logical chain contains information on all activities that occur within this chain, from forecasting customer needs, distribution of orders and ending with shipment. This facilitates the interaction of all the major logistical problems, namely the supply-production distribution transportation.

The Fig. 1 below shows how the chain is using logistic information

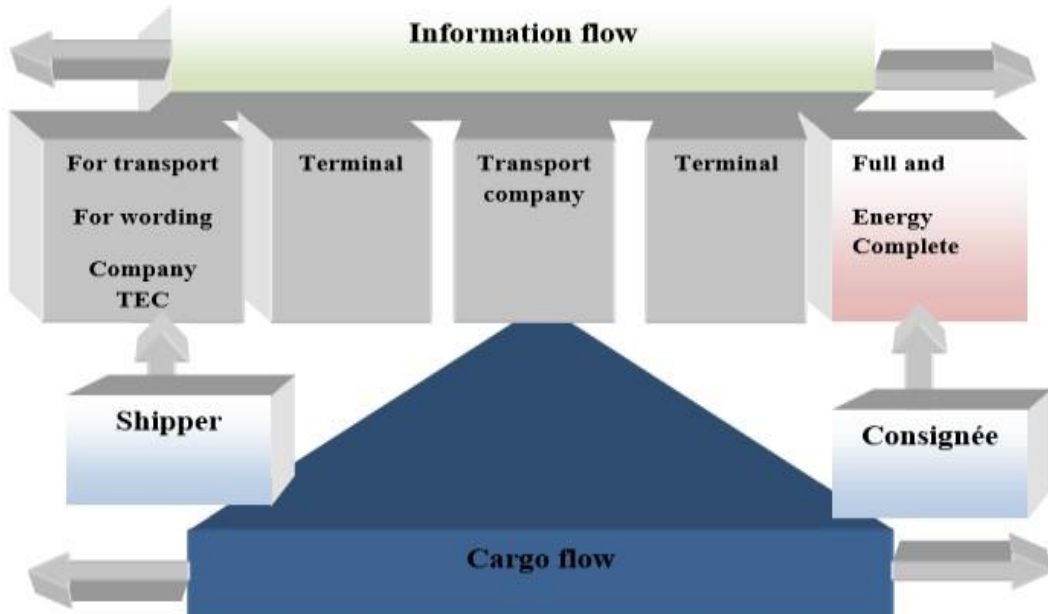


Fig. 1. Cargo and information flows in the transport chain

IT in SCM enables great opportunities, ranging from direct operational benefits to the creation of strategic advantage. It changes industry structures and even the rules

of competition. IT is key in supporting companies creating strategic advantage by enabling centralized strategic planning with day-to-day centralized operations.

The main indicator of the development of SCM is the growth of information networks. For the successful use of logistics information required to locate in the chain of communication networks, focused on logistics processes. Information and communication networks form the basis for the integration of long freight information, commodity flows. Here, for example, the use of Internet technology has a great impact on reducing delivery times. Consider the example of some company A, DLC equipment manufacturer, which could reduce the delivery time up to several days, and the replenishment time from 60 to 8 days. The use of integrated information systems can achieve significant economic benefits:

- may reduce the buffers to 20 or even 50%!
- may decrease the duration of production cycles to 50%; profit rises 30%, while costs are reduced by 20%.

And this is just one example of thousands of possible showing in practice the real possibilities of the enterprise by using the selected method. (Olga ZHURAVLEVA 2013).

Use of specific software systems for transport and logistics management

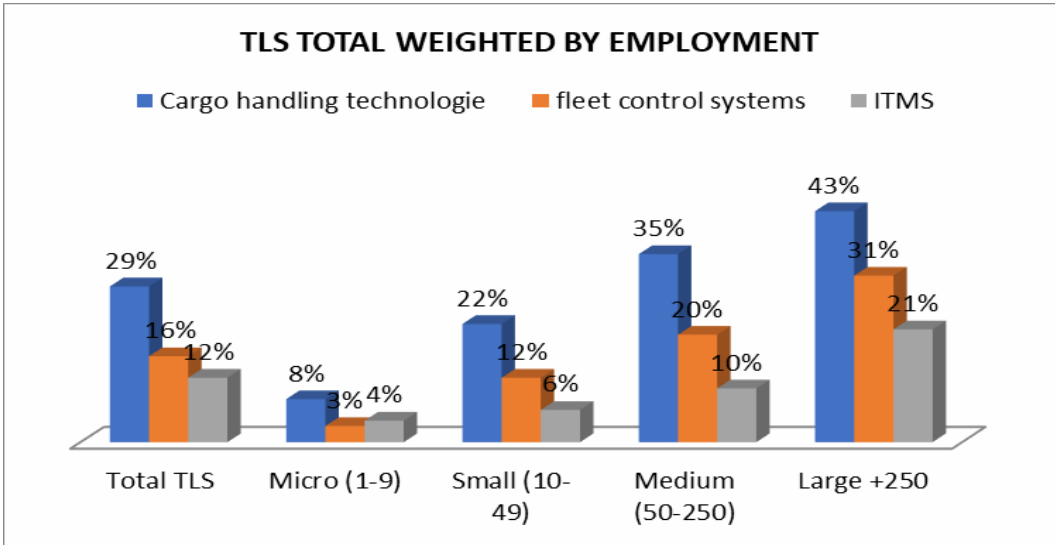
ICT are considered as a primary enabling tool for having safe and efficient operations of the transportation (Giannopoulos, 2004).

Different information and communication applications in the field of transportation have focused on applications and services designed to support the integration of the transportation and to support intermodal transportation through the transportation network. Function is a specific process, action or task that a system is able to perform (Giannopoulos G. A. (2004).

Specific software solutions for the transport sector, such as production, cargo handling technology, fleet control system and ITMS (intermodal transportation management systems) are also mostly used by large transport and logistics companies.

For example only about 20% of the small firms reported that they used fleet control systems, but diffusion increases to about 35% of medium-sized enterprises and 43% of large firms.

The pattern is similar for cargo handling technology and ITMS (intermodal transportation management systems).



Figures for TLS total weighted by employment.

Development and Application of information technology (IT) in different aspects of logistics.

The rapid development of modern logistics used platform based on the information technology is the results from few things. Information technology is a simple, cheap and secure solution. Internet of Things can go beyond it because can provide accurate flow of information of products in market to provide a reliable basis for logistics market analysis, forecasting and decision-making.

Table 1.1 Application of IT in different aspects of logistics

Activities/aspects	IT application Areas	Benefits
Transportation	Fleet management-car tracking, maintenance, driver management, speed management, fuel management and health & safety management, route management.	Recovery of stolen vehicles Increase in personal safety and security Reduction in insurance costs Decrease in unnecessary over time Increased customer satisfaction
Warehousing	Warehouse management- Receive goods Identify the goods Dispatch goods to storage Pick goods Dispatch shipment	Reduction in paper work Real time dispatch Time saving in locating of inventory Increase of safety and security of goods Cargo consolidation

Custom clearance	Documentation, duty payment, inspection,	Increased customer satisfaction Reduced paperwork in clearance Reduced administrative costs Enhancing compliance with KRA
Cargo management	Container leasing, cargo security, loading and offloading,	Improved security and safety Real time cargo tracking Cargo documentation

(Source: Macharia N. W. et al 2015)

The table above highlights activities that logistics firms engage in, the areas that IT is applied and the benefit of using IT in respective areas. Under the IT application areas in logistics, it has provided the following systems: fleet management systems such as GSM/GPRS network, GPS satellites and real time fuel management system, warehouse management systems, cargo management systems such as handling systems and GPS, GSM/GPRS cargo tracking systems and communication and information systems such as EDI (Macharia N W et al (2015).

Due to technological advancement, the logistics firms have been provided with the opportunity to embrace the above systems in the management of their aspects (Sullivan, 2005). The increasing emphasis of logistics is creating focus on the use of information technology by the firms. Cost reduction focus can become intense as companies continue to adopt use of information technology to leverage competitive advantages and increase efficiency and effectiveness to enhance their profitability, market share and customer satisfaction . Logistics managers therefore need to understand the benefit of technology to enable them align information technology with business strategies to be able to make informed business decision.

Research Design

The study used descriptive survey method is appropriate. Research design is defined as a plan, structure and strategy of investigation conceived to obtain answers to research questions and control variance According to Orodho (2008), research design refers to all the procedures selected by a researcher for studying a particular set of questions or hypotheses. He summarizes it as a programme to guide the researcher in collecting, analyzing and interpreting observed facts. A descriptive survey is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals (Orodho, 2009).

states that descriptive studies are not only restricted to facts finding, but might often results in the formulation of important principles of knowledge and solution to significant problems. This design was therefore, adopted for this study as it enabled the researcher to obtain a cross-referencing data and some independent confirmation of data, as well as arrange of options.

The main respondents were the Procurement and Transportation participants who were mainly involved in the company activities such as the vehicle Transport service, The Equipment Department ,The Inventory Management service , and Service Materiel and most of these respondents have Internet connections. The participants were regarded as a representative sample of the MPOI participants being involved in Internet-based activities. Only a few repair workshops that have an Internet access were included in this study to represent participants from the upstream activities. A small number of participants who were thought to be non-Internet users were also included. After making a careful selection of these the vehicle Transport service participants whose addresses were gathered from several regional directorate and departement of transportation ; Table 2 shows the number of the target respondents based on their usage of the Internet and information technology (IT).

Table 3 No of target respondents by internet and information technology (IT) usage

Target Respondent	Number in Sample
The vehicle Transport departement	15
The Equipment Department	10
The Inventory Management department	9
The Procurement department	6
Non Internet and information technology users	
The vehicle Transport departement	2
The Equipment Department	2
The Inventory Management department	1
The Procurement department	0

To achieve the validity of this study , a pilot survey was carried out where answers to research questions were sent to different laborers of company before the actual survey was carried out. The purpose of conducting the pilot survey is to ascertain feedback and information from the respondents and to scrutinize the weakness of the questions so as to increase the validity of the study. In the actual survey, interview questions were we have been interviewed 45 workers . A total of 45 (%) completed interview question were eventually and used for the analyses. The data were analysed using descriptive statistics including frequencies, mean, and standard.

Analysis and Discussion

The result from the questionnaire survey reveals that 40 (89 %) of the respondents have used the Internet whereas 9 (11 %) of the respondents have not (Figure 2).

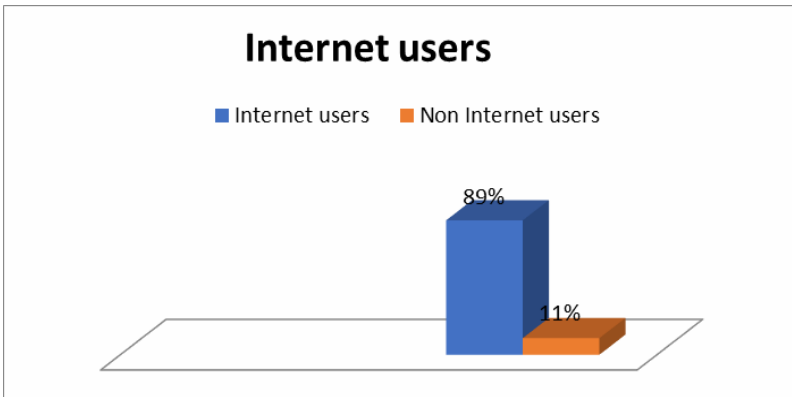


Figure 2 Internet Users

All the Internet users (40 Employees) utilized e-mail to communicate with their clients and counterpart (Table 3). From the same table, The result also indicates that only 30 employees of this companies have intranet facilities however none of them were connected to an extranet.

According to Lockett and Brown (2001) classified the complexity of Internet applications into five categories namely very low, low, medium, high and very high complexity. The classification explains a low level of complexity corresponds to basic Internet users whereas a high level of complexity requires advanced Internet users. This study uses only three categories namely low, medium, and high complexity as shown in Table 3. Most of the MPOI participants (40 employees) in this study were low-level users who used basic Internet applications such as e-mails, web sites and Intranet for their business activities. 7 employees were categorized as medium-level Internet users while 3 employees were high-level users who used more complex applications such as online order monitoring systems, and e-procurement.

Table 3 Types and level of internet application complexity.

Types of Application	Level of Application complexity	Utilize	Non utilize
E-Mail	Low	40	
Intranet	Low	30	10
Third Party Website	Medium	12	28
Internet EDI	Medium	5	35
Extranet	Medium	0	40
E-Banking		2	38
Online Order Monitoring System	High	2	38
E-Procurement	High	1	39

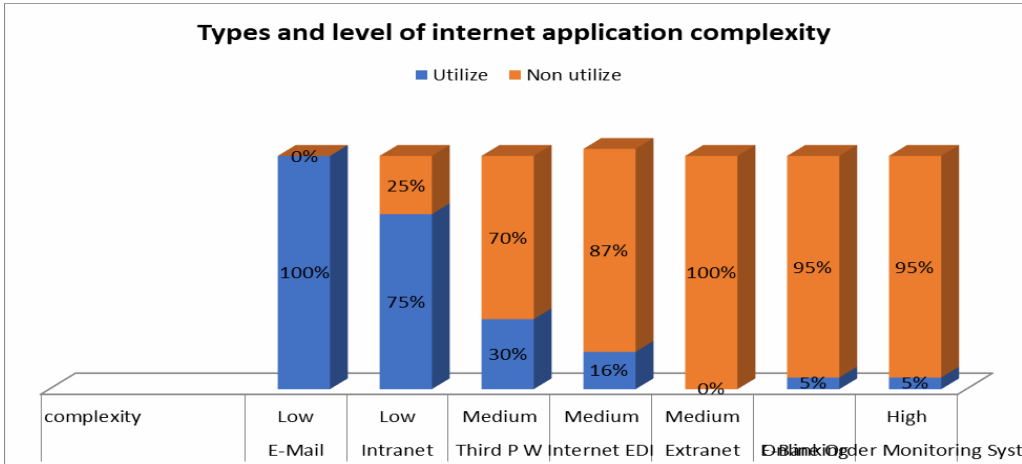


Figure 3. Types and level of internet application complexity.

Conclusion

Logistics is inconceivable without the active use of information technology. It is impossible to imagine the formation and organization of the chain of delivery of goods without intensive rapid exchange of information between participants in the transport process, without the capacity for rapid response to market demand for transport services.

Large enterprises, especially those related to international companies, among the first to feel the need to introduce information technology in management of production processes. Competition in the market of production and transport services in connection with the emergence of many small private companies.

this study concludes that to achieve the efficiency and effectiveness in logistics activities, the employees would need to adopt and implement advanced Internet technologies and encourage other department of company to make the same effort.

With the support by all participants, the employees of company would increase its competitiveness and be at par with other company of petrol and pape industries. Intensive support from the Government of Algerie to promote and encourage companies to adopt Internet technologies would help the petrol oil industry participants to achieve a better level of adoption. This is a key way to maintain long-term survival of the business operations.

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Prediction of Delays in Construction Projects in Algeria

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Abstract

Project construction has never been a simple act, because it is conditioned by specific constraints of cost, time, quality, and it includes a degree of uncertainty. So, time is a vital aspect by which project success is judged; for this purpose, deadline compliance is a paramount question in project construction. In Algeria, delay has invaded the majority of projects. Therefore, it is necessary to give more importance to time management to reach the stage of projects success. As saying goes, "you can't manage what you do not measure"; the quantification or the prediction of delays appears necessary to arrive at a good mastery and a better management of time. The objective of this paper is to quantify the probability of delays in construction projects. For this reason, data from 30 public projects has been collected, and then categorized into 4 groups according to their types: school groups, college, high school, administrative buildings and economic infrastructures. Subsequently, the simple linear regression method is used to develop prediction model for the public projects in Algeria; to enable managers and practitioners to predict possible delays. This prediction is intrinsic to minimize the risks, to widen the field of reflection and especially to increase the chances of project success.

Keywords: Delay, Project Construction, Prediction, Project Management, Project Success, Algeria

Introduction

Project success is the ultimate goal of the various project stakeholders; (Y.Frimpong 2003) defines Project success "as meeting goals and objectives as prescribed in the project plan. A successful project means that the project has accomplished its

technical performance, maintained its schedule, and remained within budgetary costs”.

Time is a vital aspect by which project success is judged; therefore, deadline compliance is a paramount question in project construction.

“One of the most important problems in the construction industry is delay; construction delays are considered one of the most frequently recurring problems in the industry” (Mahamid 2012). In Algeria, delay has invaded the majority of projects; “62% of projects have experienced timeouts” (Salhi.R 2018). For that reason, it’s necessary to give more importance to time management. And as saying goes, "you can’t manage what you do not measure"; the quantification or the prediction of delay appears necessary to arrive at a good mastery of project and a better management of time. because “the whole essence of controlling a project is to ensure delivery within a predetermined time and evaluating how long it will take to complete a project is the starting point of project control because it serves as a baseline to measure against”. (Yakubu 2010).so to deal with this problem we have to answer the following questions:

Haw can we evaluate the time necessary for execution of project and haw can we predest delay in construction project?

Research methodology

Data from 30 public projects in the region of Constantine -Algeria- has been collected, and then categorized into 4 groups according to their types(see table 1): school groups (8 projects), college (6 projects), high school (8 projects), administrative buildings and economic infrastructures (8 projects).Then, another classification has been down. For each groups; projects are classified according to their years of starting execution, 4 periods were introduced as follow: [2007-2008], [2009-2010], [2011-2012], [2013-2014]. Thus, we have calculated the sum of planned and actual durations (for the project that starting in the same period) (see table 2) then we have used this data to develop a prediction model using the simple linear regression.

Discussion and results

Descriptive statistics of the public projects:

Data concerning actual and planned duration for each type of public projects were collected ; The descriptive statistics of these projects (see table1) shown that the mean of the planned duration for the 30 publics projects was 298,90 with standard deviation of 129,925 ; while the actual duration for the same projects was 1019,30 in mean and 618,108 in standard deviation. Regarding the type of projects; the mean was calculated and it is found as follows: for the administrative buildings and economic infrastructures; the mean of the planned duration was 399,75 and for the actual duration it was 1683,75. For the school groups; the mean of planned duration varied from 231,75 days to an actual duration of 1163,75 days. While the college

varied from 278,67 planned days to 436,33 actual days. The mean of planned and actual duration for the high school were successively 280,38 days and 647,63 days.

From these results, we can notice that there is a large difference between the mean of the planned and actual duration and high values of standard deviation.

These results confirmed the affirmation of (Al –Momani 2000) that the time required to complete construction of public projects is frequently greater than the time specified in the contract.

Table 1: descriptive statistics of the public projects

Project category	Number of project	Duration		
			Planned	Actual
Administrative buildings and economic infrastructures	8	Min	152	699
		Max	826	2342
		Sum	3198	13470
		Mean	399,75	1683,75
		SD	212,464	527,612
School groups	8	Min	213	490
		Max	243	1777
		Sum	1854	9310
		Mean	231,75	1163,75
		SD	15,526	481,771
College	6	Min	213	243
		Max	304	639
		Sum	1672	2618
		Mean	278,67	436,33
		SD	40,377	134,464
High school	8	Min	152	253
		Max	365	1188
		Sum	2243	5181
		Mean	280,38	647,63
		SD	76,599	286,062
All	30	Min	152	243
		Max	826	2342
		Sum	8967	30579
		Mean	298,90	1019,30
		SD	129,925	618,108

Table 2: Classification of the public Project according to the year of starting execution

Project category	Period	SPD	SAD	Number of project	Total
Administrative buildings and economic infrastructures	2007/2008	1769	8228	4	8
	2009/2010	1247	4543	3	

	2011/2012	182	699	1	
School groups	2011/2012	456	1380	2	8
	2013/2014	1398	7930	6	
College	2011/2012	1064	1734	4	6
	2013/2014	608	884	2	
High school	2009/2010	365	640	1	8
	2011/2012	1513	4029	6	
	2013/2014	365	512	1	

*SPD: Sum of planned duration, SAD: Sum of actual duration

Linear regression

The simple linear regression was used to develop an equation that describes the relationship between the actual and the planned duration.

The planned duration was the independent variable (explanatory variable) and the actual duration was the dependent variable (explained variable).

The equation of the line of regression used to predict actual duration based on the planned duration was:

$$Y = 4,396X - 1021,567 \dots\dots\dots (1)$$

$$\text{Coefficient of correlation: } R = 0,848 \dots\dots\dots (2)$$

$$\text{Coefficient of determination: } R^2 = 0,718 \dots\dots\dots (3)$$

$$F(1,8) = 20,410; \text{ p-value} = 0,002 \dots\dots\dots (4)$$

The calculated Fisher statistic was $F(1,8) = 20,410$ and the p-value found was $0,002 < 0,01$ (see table 4); so, the model is significant at the level of 99%, in other words, there is a strong relationship between the planned and the actual durations; this strong relationship is already confirmed by the regression coefficient $R = 0,848$ (see table 3)

The coefficient of determination of this equation ($R^2 = 0,718$) indicate that the planned duration explain a high percent of the actual duration (71,8% of the variation in actual duration was predictable from the planned duration).

From these results, we can say that the model is appropriate for the prediction of actual duration and it can help the owners in the choice of contractors before awarding contract.

Figure 1: scatter plot of actual duration (AD) versus planned duration (PD) for public projects

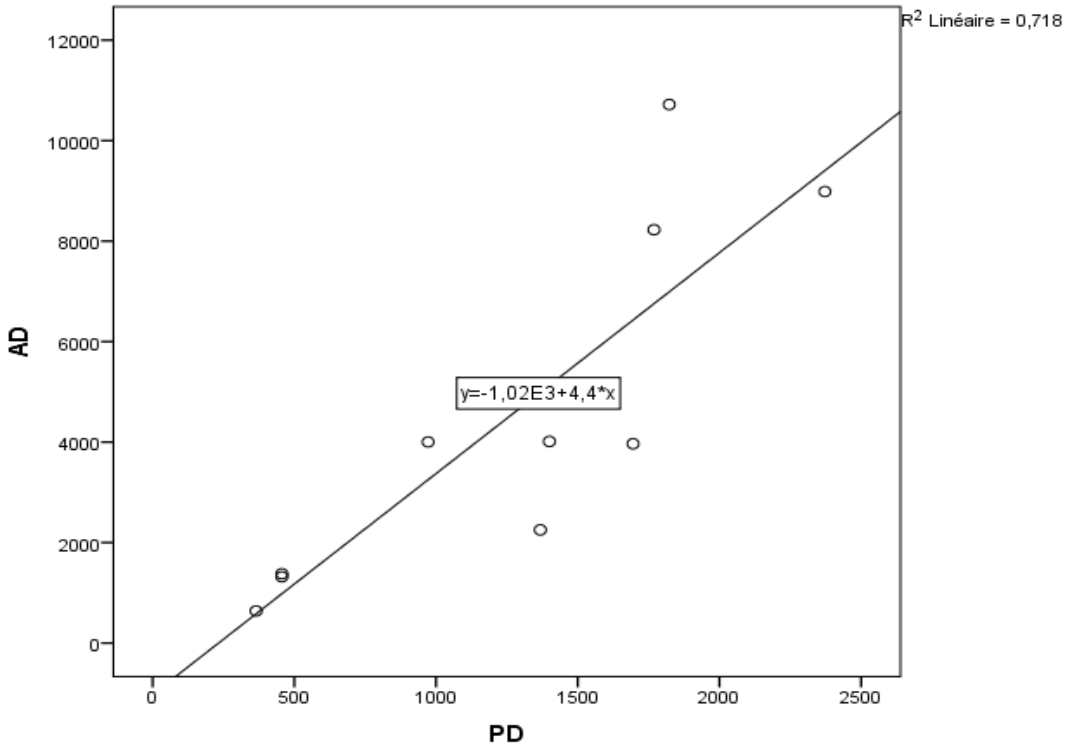


Table 3 : Model summary

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0,848 ^a	0,718	0,683	1996,447	0,718	20,410	1	8	0,002

a. Predictors: (Constant), Planned duration

Table 4: ANOVA

ANOVAa						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	81349848,691	1	81349848,691	20,410	0,002b

	Residual	31886411,309	8	3985801,414		
	Total	113236260,000	9			
a. Dependent Variable: Actual duration						
b. Predictors: (Constant), Planned duration						

Table 5: the coefficients of the line of regression

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1021,567	1385,667		-0,737	0,482
	Planned duration	4,396	0,973	0,848	4,518	0,002
a. Dependent Variable: Actual duration						

Conclusion

“The success of projects depends on their accomplishment in the expected time, with the least cost and the best quality” (Salhi.R 2018). In Algeria, time delay is one of the most recorded problems in construction project. Therefore, the quantification of the actual duration and the prediction of delays appear necessary for a good mastery of project time.

Data from 30 public projects were collected and categorised into 4 groups: school groups, college, high school, administrative buildings and economic infrastructures and then classified into 4 periods according to the year of starting construction. The information concerning the durations has been gathered and the comparison of the actual and the planned durations shows that there is a large difference between the mean of the planned and actual duration and high values of standard deviation.

A simple linear regression was used to predict the actual duration based on the planned duration. The tests used proved that the developed equation is statistically significant at the level of 99% and that the model is appropriate for the prediction of actual duration and it can be used by the owners before awarding contract, to minimize the risk of delay and to increase the chances of project success.

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The Struggle for Integration of Refugees and Immigrants: Examples of Integration of Refugees in European Cities and the Case Study of Athens

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Abstract

This paper focuses on the integration of refugees and immigrants into Greek society through the provision of housing. This topic is a hot one due to the fact that many refugees have arrived in Greece during the previous years and there is a need to remain for a long time. Thus, the provision of housing is imperative. However, due to the economic crisis, the creation of such spaces is expensive and unachievable. As a result, alternatives should be examined. For this purpose, different policies of the smooth integration of refugees and immigrants in European countries can provide such solutions. Three case studies were selected across Europe and they have been compared to the Athenian paradigm. Through this research, proposals about their successful integration have been derived. In that way, it will be possible to provide specific plans that reorganize various areas in Athens in order to make this vision a reality.

Keywords: refugees, immigrants, integration, non-used buildings, case studies, Athens.

Introduction

The refugee crisis is located at the foreground of urban history of the Greek cities for a century, considering the continuous flow of population to and from Greece, mainly after the Asia Minor Catastrophe. Indeed, during 1920s, almost 1,400,000 refugees fled to Greek territory (Hirschon, 1989 in Vergeti, 1992). The refugee flow continued during the 1980s and 1990s (Triandafyllidou, 2009; Mogli and Papadopoulou, 2018), culminating in the 2010s, as people from other countries viewed Greece as an entry point to Europe. According to Giannakopoulos and Anagnostopoulos (2016) who quote data of the UN Refugee Agency (2016), roughly 860,000 refugees and migrants have entered Greece during 2015-2016. Following the closure of “Balkan migrate route” in March 2016, dozens of thousands of refugees remained trapped in Greece (European Commission, 2018), despite the fact that the number of newcomers was contained (Figure 1). The initial reaction of the Greek government was the development of temporary housing structures organised in abandoned camps and parks, almost

in the entire Greece. However, as far as the probability of permanent settlement of a large number of people as well as the need for their integration in the Greek society increase, the questions still arise regarding the way in which those people will rehabilitate.



Figure 1. Arrivals per day during 2015-2019 (January). Source: <https://data2.unhcr.org/en/situations/mediterranean/location/5179>

Historical approach of the issue notes that during the 1920s the Refugee Restoration Committee (EAP) focused on the refugees' housing rehabilitation mainly in countryside areas but in cities as well, through the establishment of new settlements. Those settlements were developed according to a development plan, as well as granting the exchangeable Muslim property to the refugees (Lianos, 2016). However, there were many other settlements developed without plans. Informal self-housing was the main mechanism used in such cases. In those cases, settlements were located without criteria across Greece (Thessaloniki, Volos, Kavala, Serres, Agrinio, Kesariani, Vironas, Nea Ionia, Kokkinia) (Lianos, 2016). Although such areas were planned as residential areas (Bakogiannis, et.al., 2015), they still preserve their traditional character and mixed-used building forms.

At present, in the context of Emergency Support to Integration and Accommodation (ESTIA), housing land is in quest for 20,000 refugees in various areas of the country. In contrast with the housing programs of 1920s that had foreseen the construction of new residences, today's programs focus on the renting of buildings or apartments. Conducting a literature review, it was established that the housing methods provided to the refugees in Greece, nowadays, are the following:

- a) Apartments rented by the state.
- b) Apartments rented by refugees or immigrants. Usually, one group of refugees, relatives or not, reside in one apartment.
- c) Leased hotels by the state.
- d) Refugee hosting centers (hot-spots), which were organized in order to provide temporary residence to refugees. However, in reality, refugees stay in those centers for a long period of time. The centers usually present the below forms: (d1) designed buildings (d2) containers converted in residential spaces, like in the case of Eleona (d3) tent camps, like in the case of Moria in Lesvos.
- e) Refugee hospitality through cohabitation, like the "Home for Hope" project. In the context of this action, the owner of a house accommodates a specific number of people up to two months (up to eight months, in practice) with a small price in return.

- f) Occupation of empty spaces. Typical examples are the ones of City Plaza Hotel and the conquest of the building in 26th Notara Str. in Exacrheia.
- g) Municipal spaces and buildings, mainly in cases of adverse weather conditions.
- h) Public urban spaces, in cases of refugees or immigrants who haven't secured a space or tent to spend the night.

Taking all the above into consideration it is ascertained that there is no organized plan of housing for a large number of refugees and immigrants. As a result, it is not only a political, social and economic problem but also an urban planning one, since the impacts caused from a rough housing attempt of large groups of population affect the way cities function both in the short term as well as in the long term period. In the context of this research paper, good practices of refugees' housing through the re-use of existing/un-used buildings are examined (Section 2). For that purpose, the possibility of use of empty buildings in Athens is being investigated (Section 4), following an analysis of the current situation regarding the existing buildings of a specific area in the center of Athens (Section 3). Thus, useful conclusions result, which can contribute to the alleviation of the refugee phenomenon through smooth integration of refugees.

Case studies research

In the context of researching for good practices, two refugee establishment cases were examined in Italy and Germany. The choice of countries is related to the increased number of applications for granting asylum from the part of the refugees.

The first case concerns the Sicilian village of Sutera, whose population recorded a continuous drop between 1970 and 2010, a fact that is connected with the high percentages of unemployment in the area (Urbano, 2016; Tondo, 2018) as well as the isolation related to the absence of satisfactory road infrastructure and bad public transportation system (Zancan, 2016). The decision of local authorities (2014) (Urbano, 2016), to provide abandoned homes to 50 asylum seekers contributed to the increase of population of the village (Tondo, 2016), in 2016. The integration of residents was done in the frame of a European resettlement program which funds cities in order to host a certain number of refugees (Tondon, 2018). The financing touches 263,000 euro per year with a positive impact to the restoration and rent of these empty houses as well as the creation of new jobs (Zancan, 2016). The 1,000 m² school of the village continued to operate in spite of the fact that the plan before the establishment of refugees foresaw its closure (Cipriano, 2018; Tondon, 2018). In that way, the purpose of integration of refugees into the village's social fabric was easily achieved and the residents' objections were soon detained (Urbano, 2016). Today, Suttera is identified as one of the best examples of refugees' integration (Open Migration, 2018) which emits multiculturalism and achieves to approach again the interest of its own refugees (Italians that now live and work abroad or in other cities across Italy) visiting the village in purpose of tourism (Urbano, 2016). By highlighting the village as a good practice in combination with the highlighting of monuments of cultural inheritance is considered parameters that might favor the tourism in the close future (Zancan, 2016).

Relevant were the motives of integrating refugees in Golzow village, a rural and structurally disadvantaged region of Brandnurg, Germany (Schiffauer, 2019). The population of the village showed significant drop from the 1990s resulting, in the middle 2010s, in the consideration of closing the local school, since the necessary number of students were not available so that to operate, even one class. Thus, despite the initial anti-refugee climate that was developed (Bell, 2017; Schiffauer, 2019), local authorities proceeded to the establishments of Syrian families. Abandoned houses were available for housing refugees (Bell, 2017; Le Blond and Welters, 2017). In 2015, Syrian refugee children saved the school and new life breathed into this shrinking community (Le Blond and Welters, 2017). Up till 2016, 3 Syrian refugee families were permanently established at the village (Yowell, 2017) and have already joined the local society expressing their desire to become permanent residents of the village (Associated Press, 2016).

The above practices highlight the possibility of utilizing abandoned buildings in order to integrate refugees. Given the proportions, the adaptation of this specific practice by Greece could also have positive effects in the revitalization of areas as well as the parallel relief of a number of people that need a roof over their heads. Such a possibility is examined in the context of this paper. A central part of Athens is used as a case study.

Methodology

As a case study area, the 6th Municipal municipal district of Athens was selected. It includes the following neighborhoods: Ano Kypseli, Kypseli, Nea Kypseli, Amerikis Square and Attiki Square (Figure 2). The reasons why this specific area was selected are the following:

- It is located in the innermost part of Athens. However, it is not consist of a financial district but an area where various neighborhoods are located in.
- It is an area that has been home for a large number of refugees and immigrants. Thus, a proportion of residents feel unsafe and threatened by foreigners (xenophobia) (Bartatilas, 2015).
- Diversity is observed. Not only in people but also in buildings as a result of the alteration of their previous identity. Thus, they consist of transformed neighborhoods (Bakogiannis, et.al., 2015).

The question raised is: in which way a central area like this one, the character of which has been transformed over the years, can be an ideal place for permanent residence of refugees by reusing the existing building potential. The aim of this paper is to identify non-used buildings that, after a refurbishment, can be used as residences. In that way refugees can be smoothly integrated in the Athenian society. At the same time, those neighborhoods can be regenerated, as it was highlighted through the case studies research.

In order to gain that goal, land uses have been recorded (ground floor as well as storeys) through a field research. Locally listed buildings have been identified and assessed about their condition (Papadimitriou, 2015). As a result, conclusions have been drawn concerning the existing building potential is suitable to meet the required needs for housing in the central part of Athens.

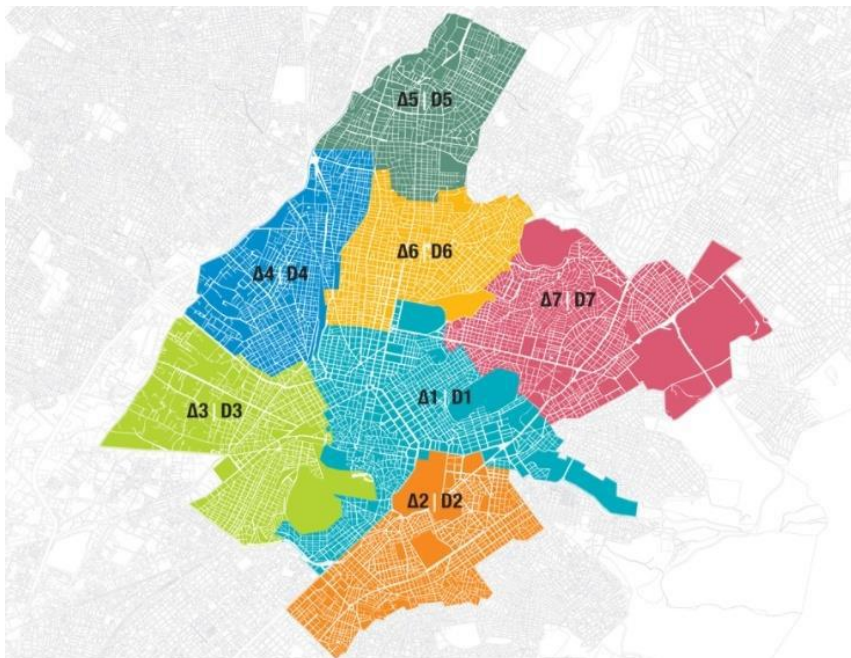


Figure 2. The Municipal Districts (MD) in the Municipality of Athens. MD 6 is the case study area. Source: <http://modmov.ellet.gr/maps/>

What is happening in the central neighborhoods of Athens?

Through the recording of land use in the study area, it was noted that the dominant use was residence. In total 11 different land use categories were registered (Figures 3 and 4). Central functions (commerce and leisure) are located along important roads and pedestrian streets. As a result, informal urban clusters are developed across the city center.

Such areas are Attiki Square and Amerikis Squares, as well as the areas along Patision, Acharnon, Kipseli streets and Fokionos Negri Pedestrian Street. At the above areas, commercial functions and leisure are located mainly at the ground floor of buildings. The biggest part of the area is occupied by residences that are located even on the ground floor of the buildings. It should be mentioned that in the context of this research an assumption was made in order for the recording process to be facilitated: semi-underground apartments were considered as ground floor apartments (Figure 5).

The second most popular land use is that of empty spaces. Such spaces are considered ground floor spaces which, although in the past were used, nowadays are not used, as an aftereffect of the economic crisis (Figure 3).

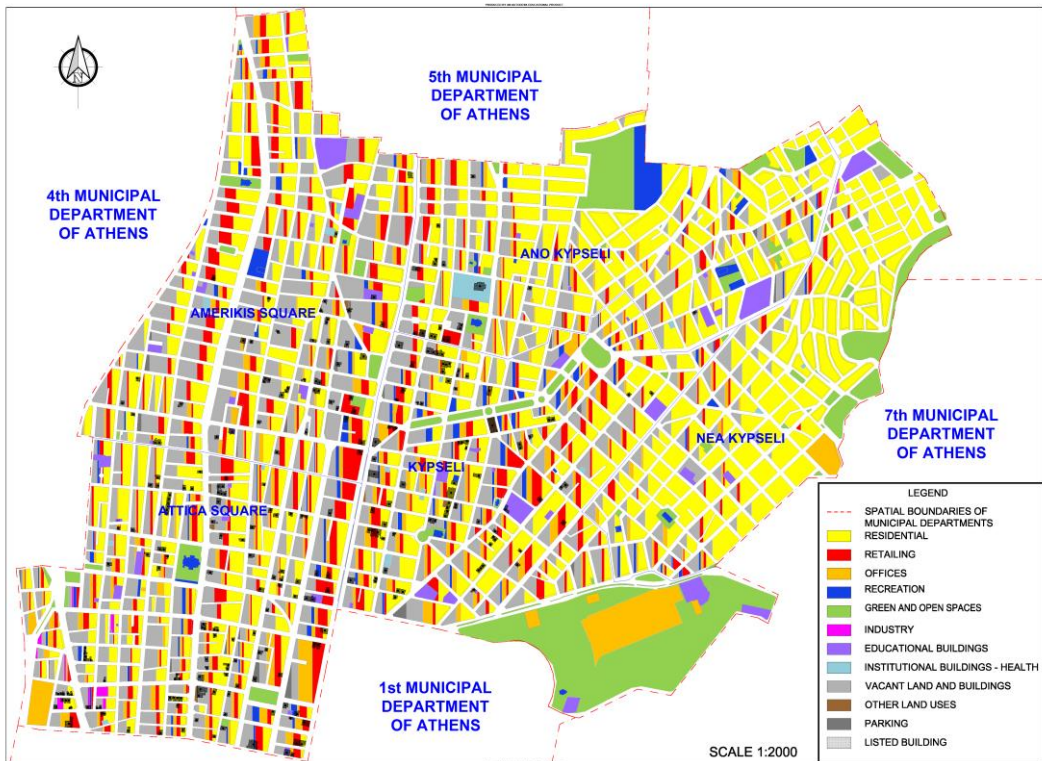


Figure 3. Land use recording (ground floors). Source: Own Elaboration.

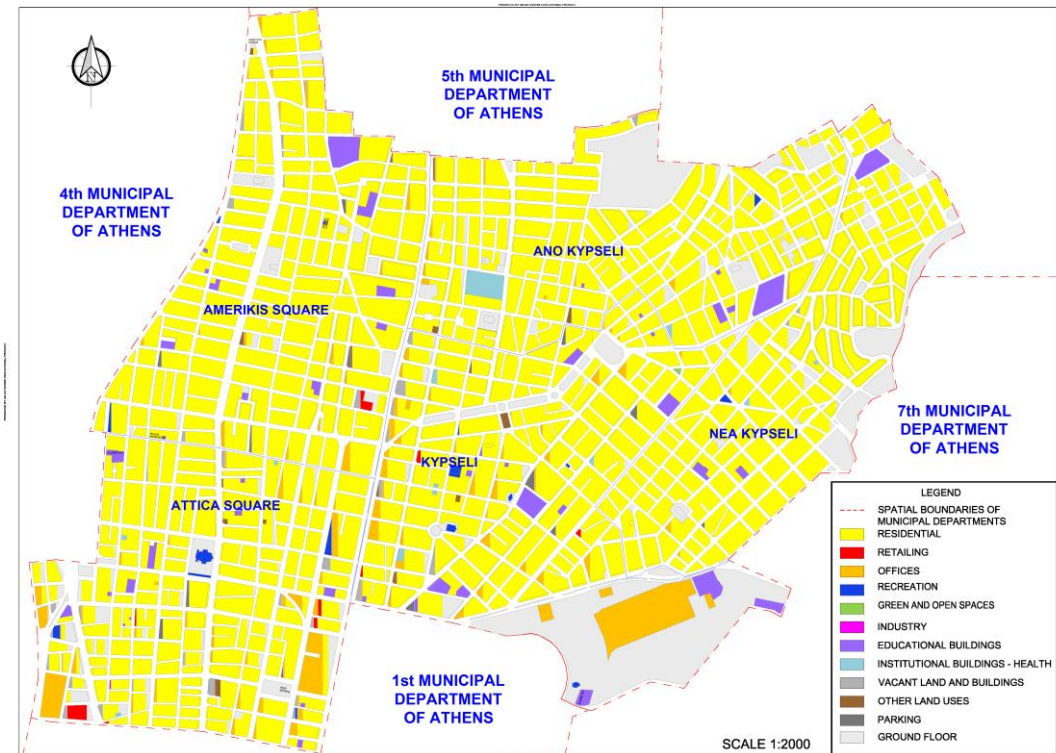


Figure 4. Land use recording (floors). Source: Own Elaboration

Figure 6 presents the listed and non-used buildings in the research area. In total, 288 listed buildings are located in the area, 120 of which are uninhabited. Therefore, 41.6% of buildings are not in use. Obvious is that Attiki Square and Amerikis Square areas are where the largest volume of such buildings is located. Many of them are mentioned as listed for over 30 years but so far no maintenance, restoration or reuse works have been made in order to operate again.

Most buildings are in bad shape, since damages are located both on their inside and outside, as well as on roofing and electrical equipment. Thus, budget line is in need for their repair in order to become habitable. Their surface is large since most of them were built during Interwar period. In this context, a building could be divided to, at least, two smaller in order to facilitate more families. Taking into account that a single person living by himself should have at a minimum 25 square meters of residential space, it is ascertained that 2,806 people can be housed in residences of a total surface of 70,155 square meters.

Bearing in mind that asylum applications up to 2017 were 58,661 (Newsroom, 2018), it is noted that such an intervention could satisfy about 4.8% of them. An important fact is that most uninhabited listed buildings are relatively close resulting in enabling their communication, the growth of social network with others of the same nationality and their feeling of a familiar environment towards them. However, due to the fact that the buildings are located in a large spatial unity, ghetto phenomena are unlikely to happen. Besides, the number of refugees that could live in this area utilizing the specific method is quite small in relation to the population of the study area.

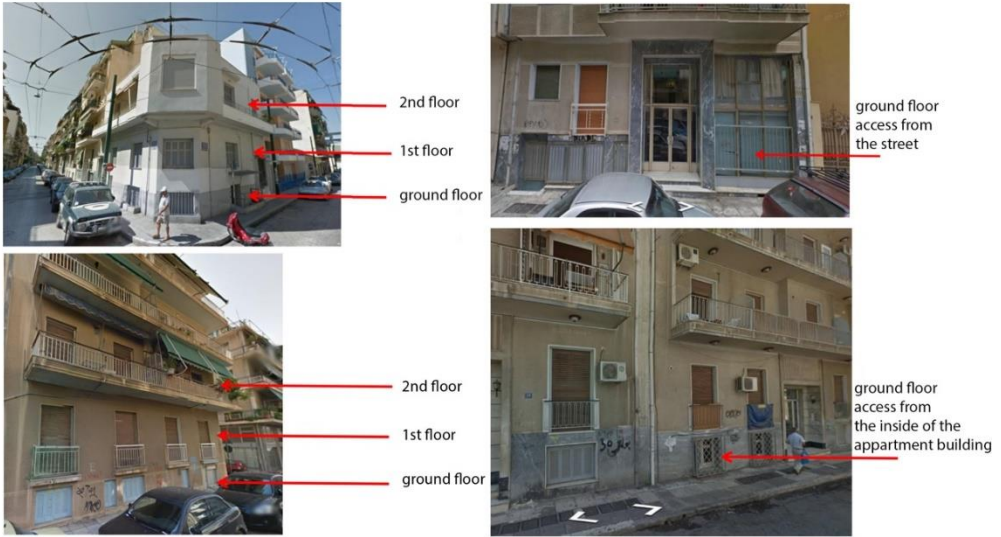


Figure 1. Buildings in the case study area. Source: Google Street Maps.

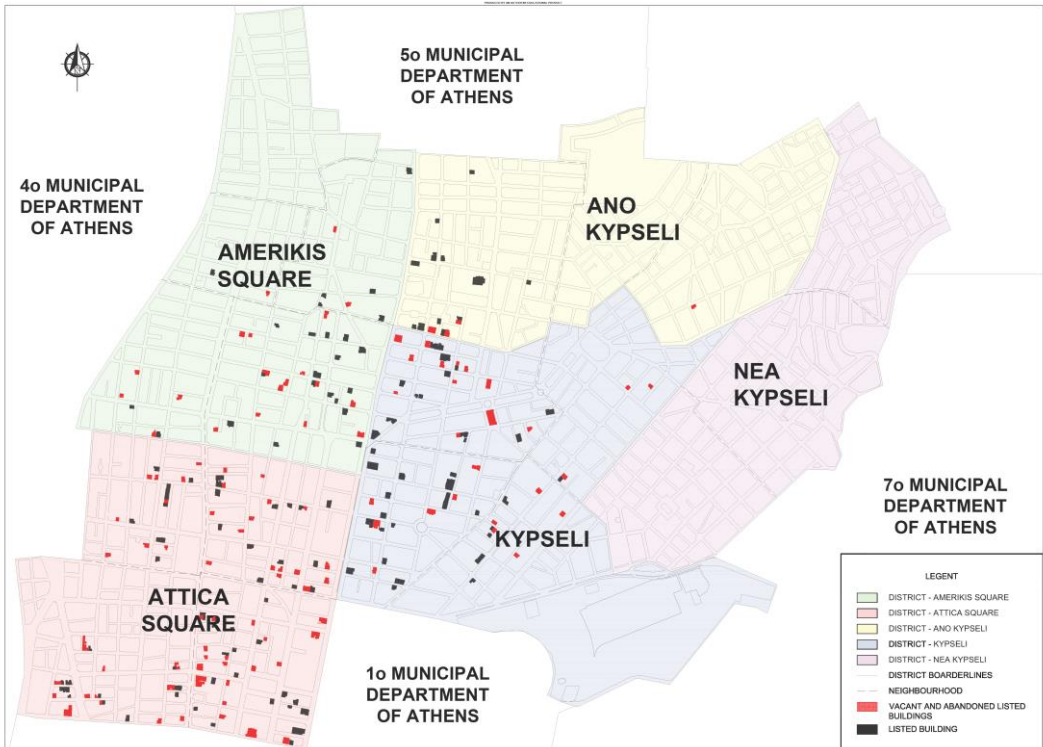


Figure 6. Listed and non-used buildings in the case study area. Source: Own Elaboration.

The possible facilitation of refugees in the study area can also have positive effects on the economic activity of the study area due to the fact that a large number of empty ground floor stores are now available. In time, the new population of the area could work professionally at the same area with positive effects in the economy of neighborhoods. Besides, there are many stores in several areas of the center where the owners are immigrants.

Conclusions

The refugee crisis concerns many people across Europe due to its large scale during the last years. In Greek society the phenomenon is intense and in combination with the economic crisis, it doesn't allow Greece to correspond in the best possible way. The finding of economic solutions is the target for the housing of the large number of people. In these interventions the use of the current buildings is imperative within cities and settlements of the country. The specific practice has been applied to different cases across Europe, like in the case of Suttera and Golsow villages examined above.

The reasons for characterizing this solution as viable are: (a) this specific solution is more economical, in relation to practices concerning the construction of new areas for refugee residences, meaning the extent of cities or creation of new settlements and (b) even though in cases of abandoned or listed buildings, their restoration is a procedure of great cost, however, European Union provides funding tools towards this direction, as shown from the examination of case studies across Europe. In this way, the absorption of capital is not superficial and budget lines function as a temporary liquidity injection in the Greek market but at the same time essential since buildings in the city are restored and their architectural inheritance and historic identity are preserved.

In this context, this specific study focused on the research of the current situation in central neighborhoods of Athens. Studying the land uses and the presence of possible usable buildings of the 6th municipal district of Athens, the following statements are noted:

- There is a large number of uninhabited listed buildings which were not used, for many years, and there is no effort of restoring them. Their possible usage of housing refugees can help up to 2,806 refugees to find a house. Such an action should not be confused with confiscation of the owners' estate but as a short term reciprocal concession of their property due to the benefit related to the free restoration and renovation of each building. The implementation of this specific action is in the political will, after the owners' consent of those buildings.
- The diffusion of an important number of refugees in a wide urban unity rather their concentration in a neighborhood can contribute in their smooth integration to the Greek society. The neighboring of their residences with Greek households and people of the same nationality in neighborhood level contributes to the growth of such social networks. Furthermore, the fact that central functions such as services, recreation and commerce are located, allows the creation of intercultural social networks.
- Beyond the benefits that owners of such houses are expected to have, some benefits for local society arise too: (a) aesthetic due to the improvement of structured environment, (b) reduction of the delinquency and the sense of insecurity, due to the previous ascertainment and (c) socio-economic benefits due to new residences. In this context, the development of motives for the integration of refugees can contribute to the activation of some of these non-used spaces located at the ground floors of the study area and their use for commercial purposes.

The implementation of this specific practice can be a pilot effort across Greece, in order to assess its results in the near future. In case the results are positive it could be assumed that it is possible to apply such interventions across Athens and other Greek cities in order for refugees and immigrants to be smoothly integrated into Greek society. At the same time, the building potential is preserved and cities are transformed into more compact urban cores and, therefore, more sustainable.

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Students Training Through Applied Activities at Department of Automation and Applied Informatics, University Politehnica Timișoara

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Abstract

The paper is focused on the practical knowledge transfer problems in higher education engineering. The objective is to improve the knowledge transfer in order to facilitate rapid workplace integration. The curriculum and the practical training of students at University Politehnica Timisoara, Department of Automation and Applied Informatics are presented and discussed. The implication of companies in the students' practical training is highlighted. A practical knowledge transfer system is proposed, based on logical distribution of the requirements for a single practical application, transversally, to the curriculum courses. The initial changes in the curriculum, introduced after the Bologna Declaration, are presented for the previously mentioned department. Ideas and questions were released which can be clarified, interpreted and criticized, providing a discussion base that can be benefic to the academic and industrial community. The presented changes were discussed with the economical zonal partners (companies: Continental Automotive, Hella, Nokia, Yazaki, Huf, Flextronics, etc.), being appreciated and sustained by the companies.

Keywords: Practical knowledge transfer, curriculum courses, syncretic project, project, higher education.

Introduction

One of the most important problems for every educational system is the knowledge transfer process. The knowledge transfer process includes the development of the student's practical skills. These skills allow the young people a rapid workplace integration. To provide practical skills is the major objective in engineering university education. The University Politehnica Timisoara, over time, has changed the university studies structure, following the previously mentioned major objective. For example, the implementation of the requirements asked by the Bologna Declaration is the beginning of the most recent adaptive process of the educational system for the job market. The educational system before 1989 is not referred due to complete lack of the university autonomy.

We will present the evolution and changes of the educational system in Timisoara after this date. We present, especially, the changes in the curriculum of the Automation and Applied Informatics (A.A.I.) Department at the Automation and Computer Science Faculty from Timisoara. These changes have been made with the purpose of applicative knowledge transfer towards the students. The practical training of students is not taken into consideration incidentally, but due to current demands of the real world.

The rule in the job market is to request skills and knowledge related to specific activities of companies or organizations. For companies and organizations with mainly applied activities and with less focus on research areas, it is important that graduate students coming from universities are possessing aptitudes and skills allowing them to start working immediately.

Many students are employed since the first study years. They adopt a study approach with limited opening for a professional field background. Therefore, they finalize their studies totally skilled depending on the employer. Their motivation relays in the perception that they will accumulate applied information at a future workplace immediately.

Thus, it is mandatory for the University to be preoccupied and to pay attention to solving, in the educational process, the problems involving the students' practical training. In the followings, the paper presents the applied approach at the Department of Automation and Applied Informatics, Politehnica University of Timisoara. The process is obviously dynamic, due to changes in the social-economic environment worldwide and similar approaches take place across the globe in environments that require it [1].

New products and projects, in an enterprise environment, are based on transferring knowledge from one team to another. The time required to do the transfer impacts the outcome of the entire project. Several methodologies and frameworks have been

developed to speed the knowledge transfer process.[2] Other models try to optimize the process itself by using state of the art artificial intelligence techniques [3] or furthermore a reinterpretation of knowledge management techniques [4][5]. All of these can be put together in future process management approaches in order to reach an innovative contribution.

The Curriculum Structure and the Knowledge Transfer Process at A.A.I.

Although, before 1989, the curriculum was the same nationwide, for a specific specialization inside a University. After that major turning point, new curriculum was conceived for every Faculty/Specialization. Inside every University, a specific specialization (e.g. Automation and Applied Informatics) implemented different concepts in terms of structure, as well as succession and content inside the current specialization (the 25% framing is quite ambiguous, since the ARACIS policy cannot decide the curricula's content but only the naming of the discipline).

Since the Bologna Declaration, at the Automation and Computer Science Faculty from Timisoara, the curriculum was implemented based on some common core disciplines, optional and independent courses, respectively packages of optional courses [6], [7]. The mandatory practical training takes place during the summer holidays, between the study periods, being independent/individual for each student.

The most recent version of the curriculum covers just the common core disciplines, the imposed subjects guiding the optional path of courses (the students are divided in two groups, each of the groups following by choice on of two optional main subjects – Control System Engineering and Programming Engineering), respectively the optional courses. There are no subject bundles. The practical training activity is focused on the third year of study and it has assigned 240 hours. In the fourth year of study there are additional 60 hours dedicated for the diploma project preparation (which includes documentation inside the companies). The 1st and 2nd figured are illustrating the current curriculum, detailing the 1st-VIth semesters and the schematic (because many optional disciplines are involved) for the Vth-VIIIth semesters.

1 st Semester	2 nd Semester	3 rd Semester	4 th Semester	5 th Semester	6 th Semester
Analysis	Computer Assisted Mathematics	System Theory 1	System Theory 2	Management and marketing	Culture and Civilization
Algebra and geometry	Probabilities and Statistics	Fundamentals of Measurement Techniques	Databases	Control systems structures and algorithms	Operating systems
Physics	<i>Fundamentals of Electrical Engineering.</i>	Object-oriented programming	<i>Concurrent Computing</i>	Algorithm design and analysis	Computer security
Computer programming	<i>Fundamentals of Engineering Electronics</i>	Communication	Modeling and Simulation	Optional course 1	Optional course 2
Fundamentals of Mechanics of Robotic Manipulation	Programming techniques	Digital circuits and signals	Event-Based systems	Data communication	Computer networks
Logic and discrete structures	Digital logic	Computer architecture	Microprocessors and Microcontrollers Systems	Embedded systems	Optional course 3
Foreign language 1	Foreign language 2	Data structures and algorithms	Microeconomics	Syncretic Project 1	Syncretic Project 2
Sport 1	Sport 2	Sport 3	Sport 4	Practice (80 hours)	Practice (160 hours)
Facultative course	Facultative course	Facultative course	Facultative course	Facultative course	Facultative course

Fig. 1 Curriculum for the 1st-VIth semesters A.A.I. specialization

5 th Semester	6 th Semester	7 th Semester	8 th Semester
SE	SE	DD	DS1

DD	DD	DS1	DS1
DD	DD	DS1	DS1
DS1	DS1	DS1	DS2
DD	DS2	DS1	PPD
DD	DD	DS2	
PS	PS	DS2	
PC (80hours)	PC (160 hours)	PPD (60hours)	
Legend: SE – social economic disciplines; DD – domain disciplines; DS1, DS2 – specialized disciplines; PS – syncretic project; PPD – diploma project preparation; PC – practice inside the companies			

Fig. 2 Curriculum (schematic) for the Vth-VIIIth semesters, at A.A.I. specialization

The following paragraphs are briefly addressing the curriculum in order to explain how knowledge and forming practical abilities are passed to the students.

The practical knowledge is transmitted during:

The laboratories and the projects required by some disciplines (it is known that there is a minimum of 4 disciplines that require realizing a practical project – an ARACIS requirement). The so-called Syncretic Projects are specific for the A.A.I. specialization in Timisoara and will be further detailed;

The practical activity inside companies;

The specific activities needed for diploma project elaboration. Also, inside the A.A.I department, collaboration with companies is developed for:

Facultative courses that are organized by the faculty and lectured by experienced employees from the companies;

Laboratories and punctual activities, diploma theses that are developed inside and with the equipment supplied by the companies;

Organizing specific laboratory rooms that are equipped by the companies in which the students can work on their practical projects. Projects themes are proposed and approved by the respective companies.

During discussions with different representatives from companies and graduates whom are engaged in the curricula elaboration, it has been agreed that one important objective is to increase the number and consistency of the projects as applicative oriented activities. Three types of projects were defined: A- projects that have 7-14 distinct hours incorporated into different disciplines; B- projects that have 42 hours as distinct disciplines (for the Vth and VIth semesters) which were subsequently named Syncretic Projects; C- diploma/license projects.

As already being mentioned, the Syncretic Projects are specific to A.A.I. Timisoara, and we will analyze them here (the other types of projects are generalized and widely known in the university system).

The objectives of the Syncretic Projects are as follows:

To learn the medium complexity projects, which can be found in real word applications or very close to the real-world ones (therefore competences are created for using and practicing the gained knowledge in certain situations);

To assure the multi-disciplinary and interdisciplinary character of education (the purpose of the projects is to use the multitude of gained knowledge from different automation and computer science disciplines);

To develop certain skills/habits and responsibilities for being able to finalize complex activities and then to present them publicly. Each project has a practical completion and therefore not limited to the widely-spread computer simulations;

To create a system that implies teamwork, with the scope of allowing students to cooperate and to auto-organize, aspects that promote communication, defining leaders in the professional activities.

Finally, it must be emphasized that one goal of the projects is to create teaching showcases that aid cooperation between different members of the teaching staff from various disciplines.

The Syncretic Projects were ones of the new disciplines that were included in the new curricula. The students are very determined to participate and solve the tasks required by these projects. Finalizing the subject/theme of the project involves the followings:

to participate at every practical activity that lead to a functional physical model as required by the project;

to create a documentation according to a template (written paper);

to present the projects solution to a committee composed by the teachers involved.

The study years that have 140 students (this is the tuition number at A.I.A Timisoara) are proposing 4 projects in the Vth semester and 4 projects in the VIth semester. The students can choose one of these projects each semester. The distribution of students is made based on the marks obtained in the previous study years. The activation of the Syncretic Projects from the proposed list is done in the descending order, considering the number of options for each project. The projects themes are focusing on microcontroller systems for different applications, positional systems with electric motors, energy measurement, control of mobile robots, control loops for “home automation”, etc. Managing the Syncretic Projects is a complex matter that implies also the management of materials and it involves many members of the teaching staff. From the experience gained in the previous years, with all difficulties involved, it is important that the students gained a big interest for Syncretic Projects and therefore are considered to be an important success.

Aside from the curriculum, but being considered as practical activities, several companies from and near Timisoara (also in cooperation of the student league ¹) organize laboratory type activities with one or two subgroups of students (15 and 30 students) at each company [8], in their own spaces and with their own material resources. Each company organizes a selection process that begins with presenting their activities in front of the students. Then the students submit their CVs and participate to an interview as in the normal company enrolling process. The selected students are participating at the particular activity offered by the company [9].

The Role of Class Teaching in Transmitting the Practical Knowledge

Apart from its importance between departments or teams in corporations or organizations, these approaches can be applied in knowledge transfer and cooperation between universities and between research centers. Analyses of the latter approach was observed [10][11] and argue that academic engagement as knowledge co-production impact strongly depends on sustained knowledge co-producing interactions. The role of class teaching therefore needs to consider these factors before a curriculum is chosen.

As a result of discussions with the students as well as with company representatives, we concluded that the curriculum is good but it requires something to connect the learned disciplines, to prove their utility, to identify the logical succession of courses and the validity of the taught knowledge. The practical activities presented earlier are not sufficient, even if they involve the application of the theoretical information delivered at courses. The proposed idea, which we consider that ensures the mentioned above desideratum, consists in the presentation of a solving model of a practical project (the same for every course) using a transversal approach – with a specific section at each of the common core disciplines. When the students finalize their studies, they have a fully solved project. Therefore, we propose to involve the courses in forming practical abilities of students.

This way, the existing courses from the learning plan of the A.A.I. specialization can demonstrate to students their utility as an ensemble and the existing connection between them. To achieve this, it would be required that one or maximum two applications to be common for every disciplines and the specific implementation stages of those applications to be treated rigorously, fully and concretely with every discipline, respectively to provide the required documentation.

For example, a project that can be considered simple in theory but proving lots of difficulties in practice for students is dedicated for automated opening (via local control or remotely using the internet, phone or radio transmitter) of a swinging gate, fig. 3. The project allows the “discovery” of the importance of every discipline from the leaning plan of the A.A.I.

¹ <https://labs.ligaac.ro/>

specialization, beginning with the mechanics up to management and marketing. Adding every year the course materials related to the given application/applications, the student will have in the IVth year of study an implemented practical example of how the mentioned application is realized covering all details. The students will notice the utility of the covered courses and therefore the information obtained during the studies will not be considered "useless" (a present idea in the student community related to some courses). If every course would show the practical sense of those presented during the associated laboratory activity, implementing its required part of the project, the student would see the outcome of the course and the whole ensemble. We consider that this would be a real gain. Obviously, different challenges/themes can be proposed for student to be able to find different solution based on the latest findings in the technical domains involved in order to elaborate studies and for research

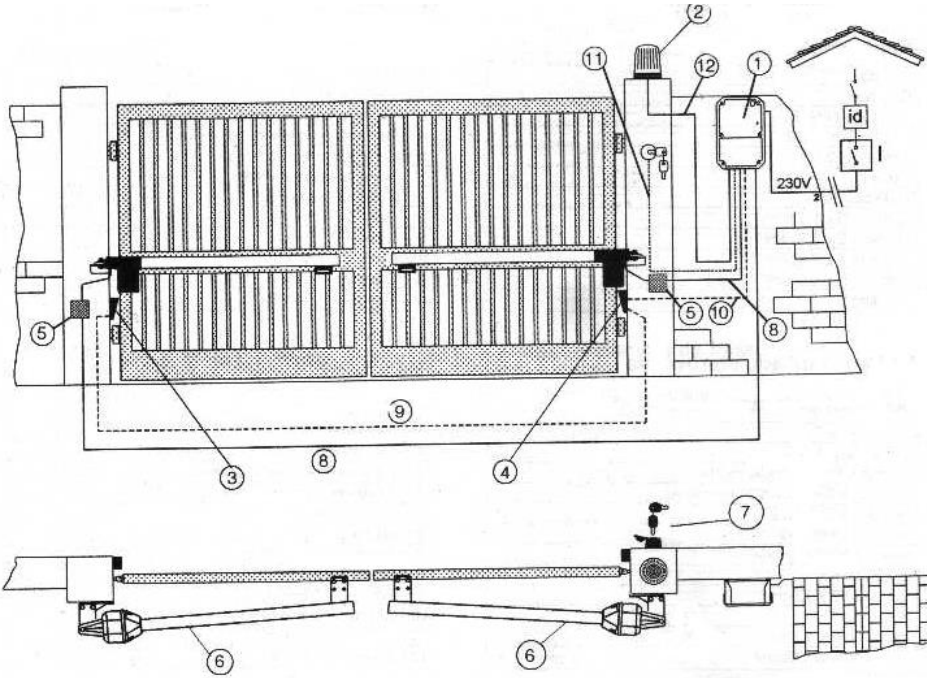


Fig. 3 The access gate with automatic opening system is composed of: 1. command block; 2. warning lamp; 3, 4. Infrared barrier and movement sensor; 5. Terminal box; 6. Electromechanical engaging units; 7. Key button; 8. Power cables for the engaging units; 9, 10. Power cables for the optical barrier, movement sensors; 11. The cable for the key button; 12. The cable for the warning lamp.

A considerable effort for the teaching staff, but not impossible to make, is to correlate the theme requirements to allow the knowledge taught in the curriculum courses to be processed in a way that can lead to a viable project.

As an example, detailing the sub-themes, the project focused on the automatic opening of the access gate, following the compliance with the curriculum from fig. 1, is depicted/structured as follows:

- Physics: the general presentation of the theme/project and the description of some principles that underlie the manufacturing of optical sensors or other types of sensors that can be used to solve the application.
- Mechanical engineering and robotics fundamentals: setting up a mechanical screw system for actuation and head race limiters, finding the maximum speed and extreme positions for the mechanism, calculation of the torque required by the motor, finding the means of actuation (motors) and the measuring method for the revolution/position/speed. The structure dimensions, its mass and the overload due to the wind, are considered known.

- Logic and discrete structures: choosing a working regime [installation regime (I); programming regime (P), working regime (L), service regime (S)] and the discussion of the logical structures that are leading to implementation.
- Computer programming: the program that determines the sense, the speed and the position from the two impulse trains that are out of phase by 90 degrees. This way, the first steps are made in using the positional transducers.
- Electrical engineering fundamentals: the power supply and blocks of electrical components are presented using various sources of energy. The necessary currents for the powering are calculated and static switches and relays are used.
- Electronic engineering fundamentals: a power supply is defined that allows the automatic switch between the main electrical network to the battery, or designing the power supply of some modules (power supply of the displays, the signaling light, the key switch and the radio receiver/emitter).
- Programming techniques: the software architecture schematics that includes discussions about the techniques that can be used for implementation/development of different tasks.
- Digital-logic: the automated device for implementing different working regimes.
- Systems theory: the systemic concept of the application, the mathematic modeling of elements of the application, of the electro-mechanic structure actuation.
- Principles, techniques and measuring devices: practical aspects that involve utilizing the transducers for measuring current, position, torque, the optical barriers, the digital-analogic and analogic-digital conversion.
- Object oriented design: the implementation of the working regime.
- Dedicated digital circuits design: the design of a positional decoder for TIRO transducers and displaying/writing the information on "7 segments" or over a data bus.
- Computer architecture: memory blocks EPROM, RAM and FLASH and addressing systems.
- Data and algorithms structures: data organizing (code areas and data areas).
- Systems Theory 2: processing/interpreting/analyzing the characteristics of the systems.
- Databases: developing a database application for storing some access related information, maintenance time and data/parameters for testing the system.
- Concurrent programming: developing human machine interface (choosing the working regimes, display) and the application that uses the webcam.
- Simulation, modeling and recognition elements: to use information from Systems Theory 1 and 2 for implementing a mathematical model for the access gate in a simulation environment (e.g. Matlab-Simulink), to extract the resulting conclusions, to present a parameters identification technique.
- Discrete events systems: designing the application using a discrete event system.
- Microprocessors and Microcontrollers based systems: the microcontroller module architecture that corresponds to the application, the sensors interface.
- Microeconomics: Costs related aspects, supplying logistics / manufacturing.
- Management and Marketing: market prospection, banners for promoting the product, sales organization.
- Algorithms and structures for automation of the processes: an algorithm for controlling the position and speed according to real data includes a demonstration using a simulator.
- Programming environments and technologies: choosing a programing environment and technology that assures the application development/testing.
- Control engineering (one of the imposed optional disciplines): the driving/the control algorithm with time optimization of closing/opening the access gate

- Programming engineering (the other imposed optional discipline): development and implementation of the service regime.
- Data communications: the wireless communication block with the remote control, the photocell connection, the USB communication
- The incorporated systems: connecting an embedded system available on the market with the application hardware components and the software implementation.
- Operating systems: the configuration of the operating system, installing the software/drivers/tools used for developing and using the application.
- Information security: securing the wireless communication and the Internet access.
- Computer networks: web server communication [a. installing the network on a computer: IP, netmask, DNS, gateway; b. installing and configuring the webserver; c. designing a PHP/Perl/C++(CGI) program that can access directly or indirectly (based on the programming language used) the serial line of communication with the microcontroller. The commands sent to the microcontroller are simple: OPEN, CLOSE, STATUS, etc.; d. Installing webcam via webserver (if the webserver and the camera are compatible); e. configuration of the access lists for accessing the webcam and CGI (via webserver).
- PLC applications (optional discipline 2): utilizing a PLC for creating an application for closing/opening the access gate.
- Mobile systems programming (optional discipline 3): developing an app for control/view using the mobile phone.
- Standards, graphic design technics, and intellectual property: the documentation related to the design, execution and utilizing the power block.

The above presented information reveals the correlation and covering of disciplines from the curriculum of the A.A.I. specialization. To consolidate the theoretical knowledge together with the practical one (the major objective) we consider that equipment can be built (in miniature and with reduced costs) and can be used in every laboratory activity associated to courses. Every laboratory class can be dedicated for applying the practical side of the theme taught at the course.

The advantage will be that the students know better, year after year, the laboratory equipment and they can connect/use the previous knowledge.

Instead of the access gate application other themes can be approached (robots, thermal processes, etc.) and the requirements of these application can be adapted to the disciplines.

Other Methods that Pursue the Learning Process towards the Applicative Knowledge

As a necessity of young people skill adjustment to the workforce market requirements or as a permanent learning structure, the companies developed training systems for their employees, strictly oriented towards certain competences and abilities. In the last years, several directions have emerged:

With their own resources, the companies organize training courses for future employees. When the courses are finalized, if the attending candidates are passing the exams, they are hired inside the company (ex. Continental Automotive).

Some companies have established the so-called Personnel Training Academies (ex. Alcatel, Hella) inside the company and it involves some professional trainers or even university staff.

The companies that develop products of a certain type/level (Vector from Austria for CAN/CANOE systems that are used in the automotive industry) organize training courses that are finalized with a certification.

Aside the companies, there are organizations that include authorized trainers and offer nationally certified/recognized courses (the POSDRU programs offer such examples).

Offering diploma project themes with a practical component that are financed by the companies. There are companies that finance not only the project implementation, but even the students and teachers that are involved and also their own employees (ex. Saguaro Technology applied such a method for the A.A.I. specialization from Timisoara).

The universities need to consider this trend and involve the teaching staff in the mentioned activities to teach these courses or even to obtain their own certifications. Often the companies are not interested in obtaining a “graduated engineer” but a

guarantee that a student will acquire some practical knowledge and abilities. The steps made in this direction are already known, confirming and acknowledging the merits and the orientation of some faculties/universities.

For example, following this trend, the Automation and Computer Science and the Electronics and Telecommunications Engineering Faculties have realized a laboratory sponsored by Vector (~250000 euro) used for CAN/CANOE communications training. The courses are held by the Austrian firm specialists with remuneration provided by various companies and free of charge for professors inside the University.

Prof. Ioan DUMITRACHE was coordinating during 2010-2013 the POSDRU project named "Increasing the competitiveness of the companies by improving and specializing the human resources in the new technologies areas, in a society based on knowledge for a durable development" – COMHIGHTECH², which laid the foundation for training activities organized by universities from Bucharest, Cluj-Napoca, Iasi and Timisoara, through courses accredited by the Ministry of Research and Education and certified. A network of training centers was created but maintaining this activity requires permanent efforts interacting with the companies by offering consistent technical and scientific materials oriented on the present issues.

The automation (PLCs, HMIs, industrial networking equipment, frequency converters, programming software for all levels etc.) and SCADA (especially licensed SCADA software, interfacing software, but also equipment for control rooms) equipment used in real industrial applications are difficult to be provided by the University. The equipment is of various producers, the equipment prices are high and a real application is even harder to implement because of all needed process components, respectively the evolution of the equipment is high-sloped (e.g. new products and technologies are released by different producers and old products are cancelled). In order to examine real applications, respectively to work with real data, the A.A.I. department approached a partnership with the local water distribution company (Aquatim S.A.) that possesses a large amount and various types of automation and SCADA equipment and solutions. Permanently updating and extending its facilities, Aquatim S.A. is able offer state-of-the-art equipment for analysis/development. Starting from SCADA projects, the partnership was extended in 2016 through a bridge grant, allowing groups of graduate students to analyze/implement SCADA/ automation/ communication solutions using modern hardware/software equipment in real scenarios. Groups of maximum 5 students are tutored by a company employee as well as by the grant staff. This way, the students are able to correlate theoretical knowledge, laboratory equipment and real industrial applications and modern solutions. Also, the accumulated knowledge is extended towards a larger variety of products/solutions, offering the students more possibilities for future employment or start-ups.

Conclusions

The methods used at the A.A.I. department from Timisoara together with new suggestions were presented in the paper to train students for being able to cope with the very dynamic workforce market that is oriented toward industrial applications. The current transformations were discussed with the economic partners from this area, being appreciated and sustained by the industry.

Companies like Vector, Hella, Continental Automotive, Alcatel – Lucent (Nokia), and others, cooperated efficiently with University Politehnica Timisoara. For elaborating the curriculum, boards of domains and specializations were gathered, consisting of company representatives interested in graduate students along with teaching staff and students. The involvement of companies in student training will be continued, not only through sponsoring various didactic, scientific and research activities, but also for the punctual didactic activities.

Because of the high volume of information available in all domains, it is required to acknowledge some curricular paths, by increasing the number of projects and laboratories together with the transformation of the courses content. A proposal was that all courses shall focus on the same practical application, in a transversal manner, so that at the end of studies the graduates will have a complete example that was studied in all details.

The changes made in the A.A.I. specialization were presented, together with some ideas and questions that can be further clarified, interpreted, criticized, etc. Based on the mentioned ideas, debates can be initiated with benefits to the academic and industrial community.

Acknowledgements

² <http://www.comhightech.ro>

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Influence of Nano Phase Change Materials on the Desalination Performance of Double Slope Solar Still

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Abstract

Solar still is the ancient low cost device to distillate the saline water. Paraffin is a kind of phase change material which has a thermal storage characteristic and it can absorb and release a large amount of latent heat during the phase transition process. Ethylene Glycol was used as a PCM to study the thermal characteristics of water and absorption rate. A Nano phase change material plays a vital role in solar energy conversion and is used to enhance the thermal conductivity behavior on thermal energy storage systems. Materials at the nanoscale have a larger surface area and it has higher thermal properties than the macro particles. Incorporating NPCM into basin material helps to improve the productivity and the evaporation rate. The performance of the single basin double slope solar still was higher than the single slope solar still. Despite significant efforts, there are some challenges, such as the thermo physical properties of basin material, flow rate, insulation material and thickness that must be overcome in order for this technique to be useful in practice. In this paper, a detailed comparison of the various solar stills, designs, fabrications and water production analyses are discussed. Hence it is confirmed that NPCM has a higher potential than PCM for saline water desalination processes. This study confirmed that the Paraffin composites are stable up to 160°C and it increases the efficiency due to increased thermal properties of NPCM.

Keywords: Solar Energy, Phase-change materials; Nano materials, Double slope Solar still, Desalination

1. Introduction

Saline water desalination is one of the major requirement tools for society and the environment. There are many desalination techniques available for purifying brackish water, but they are economically high and not portable for all the climatic conditions. The majority of seawater desalination systems rely on thermal energy storage technologies and solar energy. It was widely used because of its high profitability. Desalination is a popular method in nations with limited freshwater resources. Many researches state that pure water imbalance is a unique problem to human life. To overcome scarcity of pure water, various desalination technologies are used. Solar stills stand out among the various water desalination technologies because of their simplicity, convenience and climatic conditions. The key attribute of PCM, its latent heat storage made it useful in heating and cooling a number of applications, including solar stills, heat pump systems, and solar power plant applications. Many factors are affecting the water purification; energy and cost are the important factors for all the process. Solar distillation is a cost-effective method for producing pure water by consuming the solar energy [1]. This necessitates an energy input, which can be from heat, electricity or solar radiation. To meet this demand, desalination technology is more widely used. This energy is directly employed to evaporate water inside a device; for example, several types of stills are used to desalinate saltwater and there are many different types of desalination processes accessible in water purification.

One of the inventions in the Thermal energy storage systems (TES) in phase change material, which has demonstrated thermal physical qualities in a variety of climatic settings. The phase change materials are used to store heat during the day and can be utilized at night. Thermal conductivity of phase change material helps to increase the production rate. Paraffin wax and fatty acids are the higher thermal conductive PCMs. Solar energy promotes freshwater evaporation in solar distillation systems; it gives a high percentage of pure water with a large concentration than the initial brine water. The evaporated brine is cooled to produce distilled water. The solar water desalination system is functioned by simple concept of evaporation and condensation through the transmission of sunlight via the transparent cover of the Solar still. For solar desalination applications, PCM and nanocomposites are attractive materials [2-4]. The energy is stored through phase shift of the storage medium, such as solid to solid, liquid to solid, or gas to liquid, in phase change energy materials. It has a sensible heat property that displays the temperature difference between the charging and discharging steps. Many studies [2-4] have shown that adding nanoparticles with PCM improves the still's productivity and efficiency. It shows better performance in the Thermal energy storage systems. Many researchers pointed out that phase change materials of Paraffin could play a vital role in heat storage capacity and thermal conductivity of solar still applications. [8]. They claimed that these materials suspended in the Water basin could improve the thermal conductivity. The average amount of these suspended materials is less than 40%. Since then, a variety of PCM

materials have been tested in numerous applications, including the solar still. Such PCMs are designed to improve heat transfer conditions. Such compounds are intended to improve heat transfer conditions. As a result, PCM should have greater thermal conductivity, better stability, and superior rheological qualities. Thermal characteristics of the Paraffin can be tailored to improve the SS's efficiency by altering the thermal characteristic of heat transfer co efficient and thermal conductivity.

In this paper we discuss the solar still mechanism and techniques to improve the solar still productivity. In this paper, we mentioned the advantages of using paraffin material as a NPCM. Adding a NPCM is a novel way for improving the material's thermal properties. It demonstrates a higher level of performance in thermal energy storage systems. Phase change materials have been discussed in a number of articles as having the potential to improve heat transfer and thermal storage systems in solar still applications.

2. Solar Energy and its Applications in Solar Still

Since many energy storage systems are available based on solar energy, energy storage serves a crucial role in preserving available energy and enhancing its utilization. Because the world's population and industry are rapidly expanding, the need for energy is a concern for future generations. To replace conventional energy systems, there is an alternate option of using solar energy systems, which are readily available and *cost-free*. However, considering solar energy is only available during the day, research has concentrated on phase change materials that store heat during the day and then release it at night. *Water* purification process can be possible by the solar distillation method. There are many different types of solar systems mostly used based on the simplicity and efficiency of water production. Mainly solar stills are classified by active type and passive. The qualities and functionalities of these solar stills are used to classify them. Recent studies have discovered that the inclination angles of the slope, the depth of the basin, materials, and solar radiation are some of the primary influencing elements of solar water productivity [10]. The key factor is the temperature difference between the water in the solar still basin and the temperature of the inner side of the glass. The temperature difference between the water in the solar still basin and the temperature of the inner side of the glass is the most important component in increasing the efficiency of water production. Solar stills that are active produce more energy than those that are inactive. The internal air circulation has been slightly increased to increase the temperature difference between the glass and basin water. It improves heat transfer between the basin medium and the water cover. The rate of condensation increases as the inner glass surface cools. There are also a number of minor tweaks that help to improve their output in terms of meteorological parameters and design, such as the usage of some tweaks on the interior and external sides of the solar water basin. The better alternative for improving solar desalination is to use nano phase change materials. The primary goal of Paraffin phase change material is to establish a well-defined PCM

fusion for enhanced thermos-physical properties. The paraffin can be dispersed in the saline water or the synthesized PCM can be suspended in the water basin to create effective solar still. Thus, in PCM, the unique physicochemical properties of paraffin provide greater heat conductivity and rheological properties.

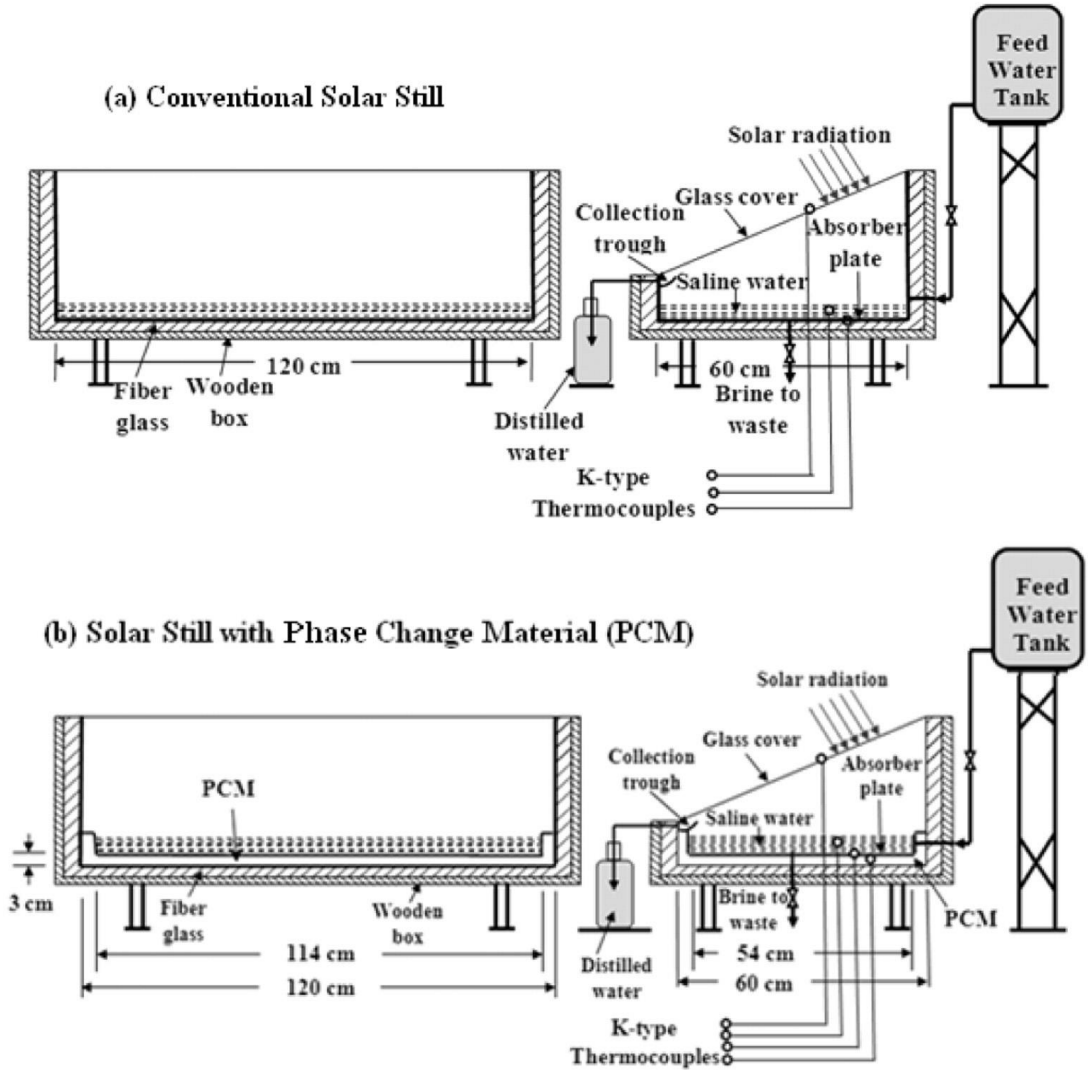


Figure 1. Different types of Solar still

2.1 Working Mechanism of Solar Still

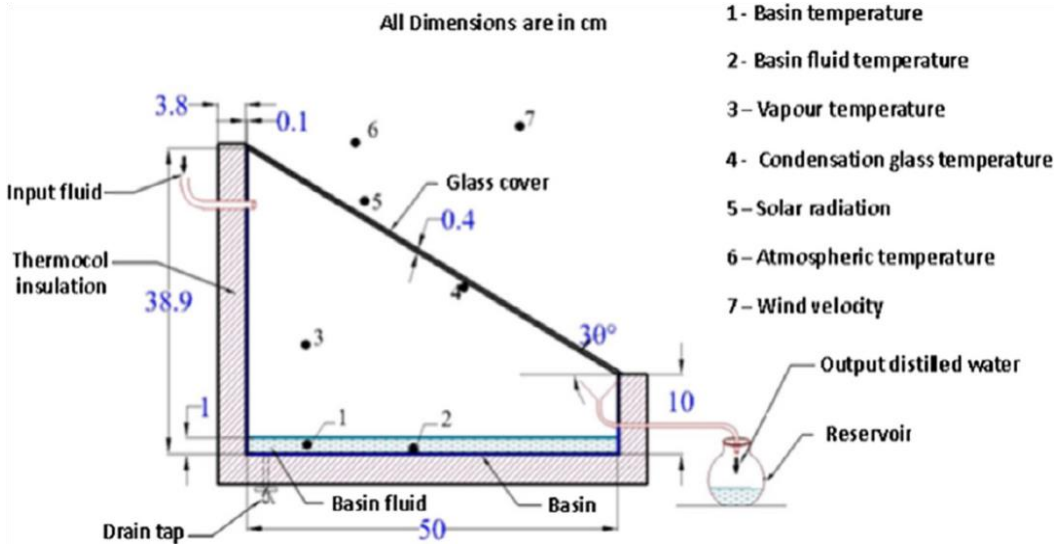


Figure.2 Mechanism of Solar still

The fresh water is distilled using a simple heat transfer mechanism in the solar still, which works on the principle of evaporation and condensation. Figure 1 depicts a schematic design of the solar still's concept and operation. The two forms of solar stills are active and passive and both rely on the evaporation and condensation processes. The basin, slope with glass cover and storage tank make up the majority of the solar still. The basin's surface is filled with saline water, which is heated by solar radiation and evaporates. The evaporating water condenses through the glass cover and the distillate collector subsequently collects the flow of condensed water. There are various sorts of ways that help to boost the productivity of water, such as using active components, external motors, pumps, fans, and absorption materials. Basin temperature and condensation temperature are the most important factors for solar water desalination [12]. Many studies have already been conducted on the use of sponge cubes, absorption materials, wick, black paints, fins, insulation, condenser and evacuation tubes in the modification of solar stills.

2.2 Improvement techniques of solar still by using Phase Change Materials:

The still output is inversely proportional to the depth of the water. Many studies have already concluded that the solar still basin's enormous surface area leads to high-efficiency water production. This method aids in increasing the rate of evaporation and lowering the volume ratio of the basin's surface. Organic PCM such as paraffin and fatty acids are well known, but inorganic phase change materials such as hydrated salts are the most common. The melting temperature of all phase change materials varies depending on the application. PCM are frequently employed in the energy

sector. The melting temperature of all phase change materials varies depending on the application. The phase change material is an unavoidable enhancing medium for solar still applications and organic PCM is the most widely used PCM in recent publications [14].

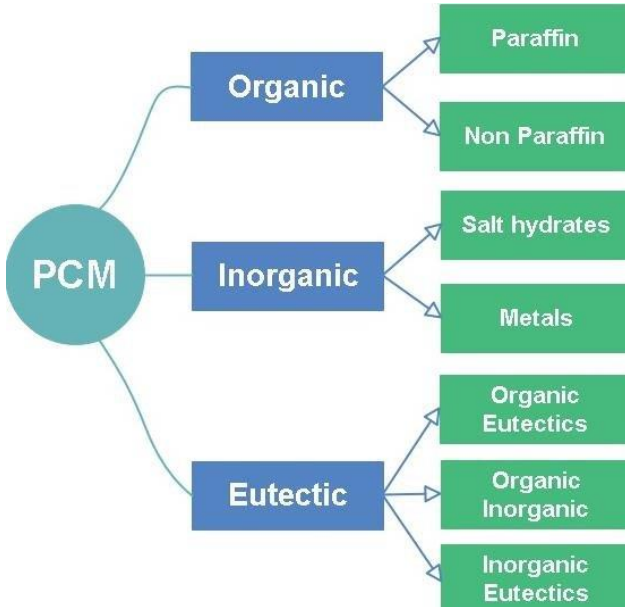


Figure 3. Classifications of Phase Change Materials

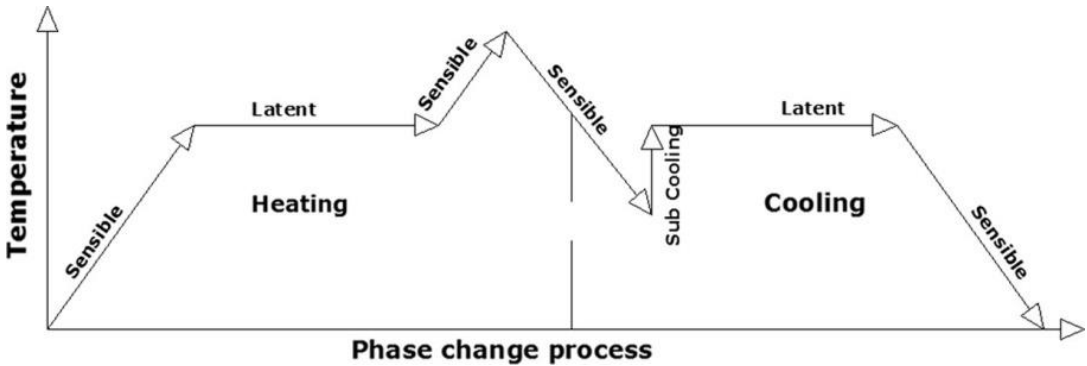


Figure 4. Schematic diagram of Phase change Process

PCM has a greater thermal conductivity property, allowing it to absorb and release heat during the phase shift process. During the transition, the temperature of these materials remains constant. During the transition of the heating process, the temperature of these materials remains constant. The melting point of PCM should be above 90°C in refrigeration applications and below 15°C in an air conditioning

applications. In comparison to sensible heat storage systems, latent heat thermal storage provides better charging and discharging qualities. It has a higher energy storage capacity and fusion heat. The most commonly used materials are organic and inorganic PCMs. For their properties of latent heat and high thermal conductivity, phase transition materials are commonly used in thermal storage applications. This type of material is referred to as latent heat storage material because of its consistent thermal conductivity. In the PCM, latent heat storage is essential; latent heat is the heat absorbed or released by the thermodynamic system. Latent heat of fusion is the latent heat associated with phase shifts in a thermodynamic system. Natural PCM (paraffin, unsaturated fats) and inorganic PCM (metallic salts) are the two types of PCM.

Table 1: Performance of Solar stills with Nano PCM

Author	Type of PCM	Type of Nanoparticles(NPs)	Size of NPs	Productivity
Kumeresan et al,	Paraffin	MWCNT	30-50 nm	3.56
yuvari et al,	1-Octadecanol	Graphene	NA	4.04
Teng and Yu	Paraffin	Al ₂ O ₃ and SiO ₂	20-40 nm	3.76
Ji et al,	Palmitic acid	MWCNT	25-50 nm	5.2
Li	Paraffin	Nano-graphite (NG)	35 nm	6.6

3. Paraffin and its Characteristics

Paraffin wax has high melting point in the desired operating temperature range. It melts constantly and freezes without much super-cooling. These features enable paraffin wax to find application in thermal energy storage systems. Natural PCMs are more artificially stable than inorganic Phase Change Materials, which soften uniformly without the need for super cooling. However, when compared to inorganic PCM, it has higher thermal conductivity. Most of the studies focused on improving PCM thermal characteristics like paraffin and fatty acids. In comparison to other PCM, paraffin is the most highly recommended material for latent heat thermal energy systems due to its poor thermal conductivity.

It was frequently utilized in TES applications because of its excellent properties, such as high sensible and latent heat, freezing and melting with low super cooling. They are also inexpensive; they are safe and paraffin is locally available different with a melting temperatures.

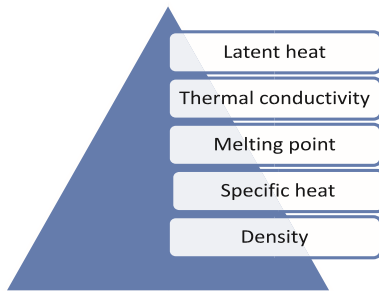


Figure 5(a). Important Properties of Phase Change Materials

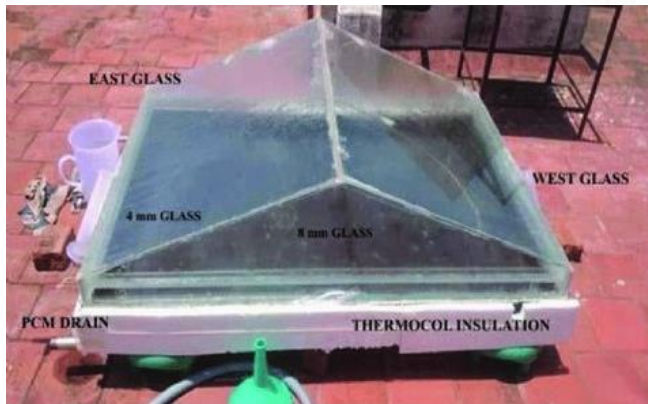
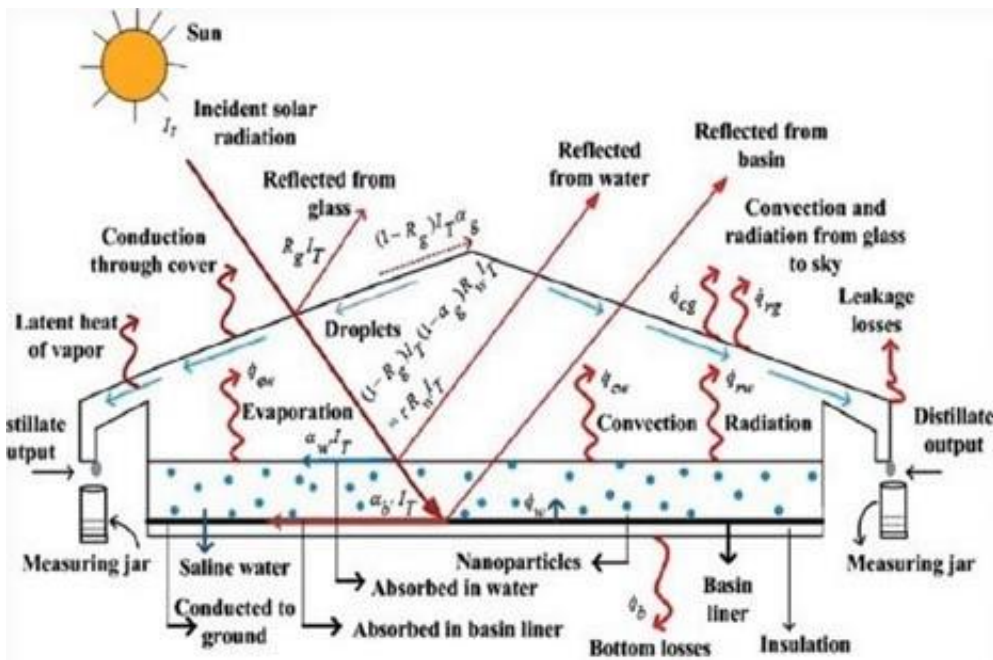


Figure 5(b). Mechanism of Double slope solar still

Table 2: Thermal Characteristics of paraffin

	Melting Temperature, °C	latent heat temperature, J/g	Freezing temperature °C	Freezing point of latent heat, J/g
Paraffin	51.6	181.11	52.4	-175.11
20 wt % paraffin with composite PCM	53.4	95.82	51.4	-92.15
40 wt % paraffin with composite PCM	52.8	105.73	52.1 7	-98.55
20wt % paraffin with composite PCM After preheating and cooling	52.8	91.65	51.23	-91.32
40 wt % paraffin with composite PCM After preheating and cooling	54.3	115.57	52.43	-97.90

Rayleigh and the Stefan numbers can be defined based on the temperature difference of PCM and the length of the solar still. The formulas are given below, [6]

$$Ra_f = \frac{g\rho_f^2 c_{\rho,f} \beta_f (T_h - T_c) H^3}{k_f \mu_f}$$

$$Ra_m = \frac{g\rho_f^2 c_{\rho,f} \beta_f (T_h - T_c) H^3}{k_m \mu_m}$$

$$Ste_f = \frac{c_{\rho,f} (T_h - T_c)}{h_{ls,f}}$$

$$Ste_m = \frac{c_{\rho,m} (T_h - T_c)}{h_{ls,m}}$$

The ρ and T are respectively thermal conductivity and temperature parameters,

Table 3. List of different passive solar stills with paraffin wax.

S. No	Authors	Types of Solar still	% increase in productivity

1	Ravishankar et al.,	Single basin and double slope	23.95%
2	Sathyamurthy et al.,	Single basin and triangular	99%
3	Sonawan et al.,	Single basin with single slope	61%
4	Yadav et al.,	Stepped with weir type	36.32%
5	Shalaby et al.,	Single basin and v-corrugated absorber plate	13%
6	Subramanian	Single basin with single slope	188%
7	Ashis Kumar et al.,	Single basin with dual slope solar still	64%
8	Avesahmad et al.,	Dual slope with single basin	26%

3.1 Mechanism of heat transfer in PCM:

The Phase Change Material is a latent heat energy storage material. While heating the PCM, the heat is initially stored as a sensible heat within the PCM until it reaches into melting point temperature. The form of sensible heat stores the heat when the PCM in melting point. During the daytime the solar radiation is high, so the PCM absorbs the thermal energy in the PCM and it releases at the night time when the solar radiation is entirely low. The amount of solar energy is stored in the basins absorber plate is determines the performance of solar still. The temperature difference is drawn in the below diagram. It shows the PCM temperature and thermal conductivity, melting point, specific heat and density. The solar still performance is relying on the basin water temperature and the glass temperature in the solar still over the time. The water basin temperature for the solar still PCM is around 81°C and glass temperature in the range of 21°C to 80°C.

Effects on latent heat capacity:

The phenomenon of how paraffin alters the latent heat capacity of thermal storage is difficult to attribute. In this section, we will look at how the physical and surface features of PCM can affect the storage of latent heat storage capacity. Several researchers have undertaken numerous studies on solar stills, as well as paraffin and PCM, with a variety of favourable outcomes that have been used to improve their production. Incorporating heat conductive paraffin's into the solar still produces effective results, and adding the paraffin is being considered as a key element in solar still efficient improvement applications.

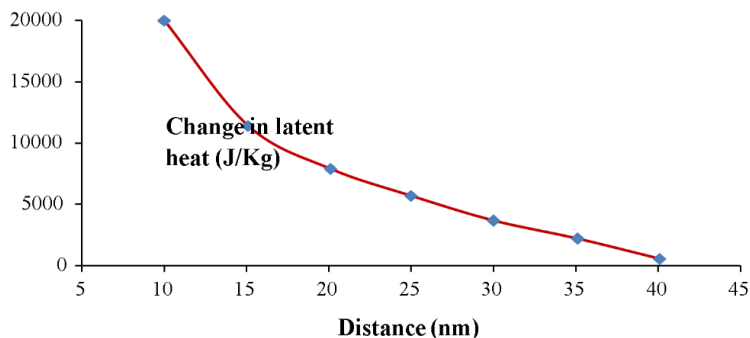


Figure 6. Change in Latent heat Capacity

3.2 Applications of Nano Enhanced Change Materials

The thermal conductivity of nano composite Phase Change Materials was shown to enhance when nano materials were dispersed in Phase change materials. Various nanoparticles, as shown in the diagram, contribute to improve the properties of TES. They demonstrated that the heat transfer effect in the surface medium has increased, as well as examining paraffin melting ability with nanoparticles. At the pipeline's entrance, a check valve is installed. To control the saline water flow rate, a check valve is installed at the pipeline's entry. It is positioned within the basin still, which is built of a 1.5 mm thick galvanized iron sheet measuring 0.5 m x 1.4 m. To maximize solar radiation absorption, the absorber surface is painted black. Nanocomposites phase change materials were prepared using various copper nanoparticles and carbon nanotubes, and experimental results showed that Nano PCM composites had better thermos-physical properties than those without Nano PCM. Previously, many studies on nano particle mixed organic materials were conducted instead of inorganic nanoparticles.



Preparation of nano Phase change material using paraffin and ZnO Nanoparticles

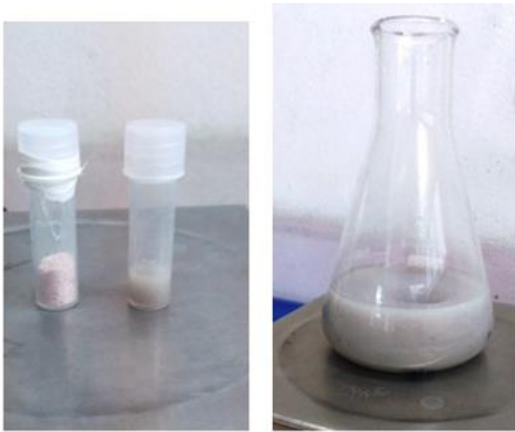


Figure 7. Preparation of Nano PCM.

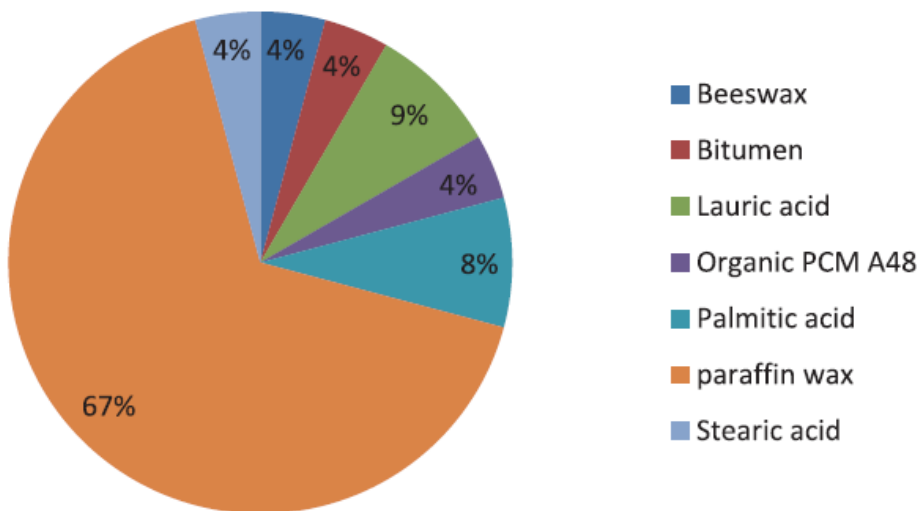


Figure 8. Different types of PCM used for solar still Applications

4. Effects of using the Nano PCM in Solar still

The performance of the desalination unit is depending on the solar radiation and water temperature, glass cover temperature and the Phase change material. Performance of the desalination unit for different composite materials were shown in Figure.9. the time-to-time production was measured with and with PCM. As mentioned in the earlier day time production is higher than the nighttime production. The results are shown that the maximum of temperatures and productivity occur later

than the peak of solar radiation. This is because some of the heat from the sun is still stored as sensible and latent heat within the PCM, which requires large time and energy to raise the temperatures.

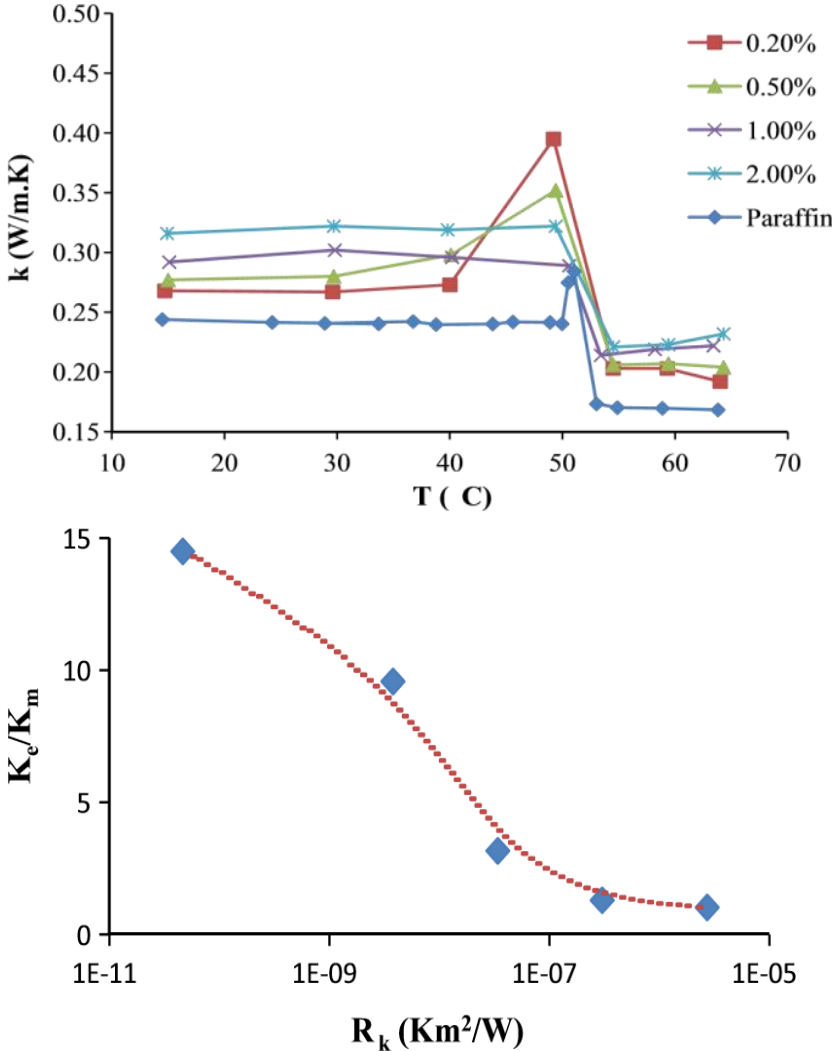


Figure 9. Paraffin enhanced solar systems

Conclusion

The thermal conductivity has played a major role in the thermal property of the PCM; paraffin has a comparatively low thermal conductivity than other PCM. The dispersion of the nano composite materials increased the thermal conductivity. The influence of PCM on the behavior of the solar still with PCM was explored theoretically by the nearest meteorological circumstances. The paraffin PCM has a large latent heat

capacity than other materials, and it is proven that paraffin materials can be used in the solar still for the better performance of solar still water purification. Moreover, from the studies we are confirmed that the Paraffin composites are stable up to 160°C. These materials being used for double slope solar still and it will increase the efficiency due to the increased thermal properties of Nano PCM.

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