International Journal of Innovation Engineering and Science Research

Editorial Board

International Journal of Innovation Engineering and Science Research

Volume 2 ISSUE 1 January-February 2018

International Journal of Innovation Engineering and Science Research

Open Access

The Hydrological Functioning of the Watershed of Lake Laya- El Hammam, East of Tunisia

Watershed of lake laya

Karim Lahmar
ISEAH Mahdia
University of Monastir,
Tunisia

ABSTRACT

The hydrological rate of flow of the watershed of Lake Laya El Hammam depends on its morphometric and geological features as well as its precipitation.The watershed of Lake Laya El Hammam is part of the coastal watersheds in the central-east of Tunisia. It is the only watershed which is not affected by hydraulic constructions such as dams. Besides, it features a surface area that extends to 204 km2 and a high recorded rainfall. To determine the hydrological rate of flow of the watershed, we had to identify its geological and morphometric characteristics, and gauge the flow of Lake Laya El Hammam. The final results have allowed us to identify: the general aspect of the flow of water in the watershed of Lake Laya El Hammam, the relationship lake/ sheet and the importance of gauging in Eastimating the rate of flow of water during periods marked by lack of rain.

Keywords— *watershed, hydrological rate of flow, Lake of Laya El Hammam, Tunisia.*

I. INTRODUCTION

The hydrological functioning of a watershed depends on the morphological characteristics as well as on the precipitation, the relationship lake/sheet and anthropic constructions such as dams, roads, etc. Much research was carried out in the world about this issue [1, 2, 3]. To identify the layers of trickling water, we often use empirical methods [4], a hydrological assessment [5] and gauging in the downstream areas of the lakes. The latter method is very efficient in giving the real measurements of the volume of water. Many techniques and methods are used to measure streams of water such as the volumetric (spillway), chemical (continuous and immediate injections) and electromagnetic methods besides gauging through the use of a float [6].

II. PRESENTATION OF THE SITE

The watershed of Lake Laya El Hammam is located in the East of Tunisa. It is made of ten main streams: Lake Bou Ali, Lake Naguar, Lake El Ghares, Lake El Kharroub, Lake Laya; Lake Mdarej, Lake El Khbir, Lake Guemguem, Lake Ghdir El Ajla and Lake El Hammam.

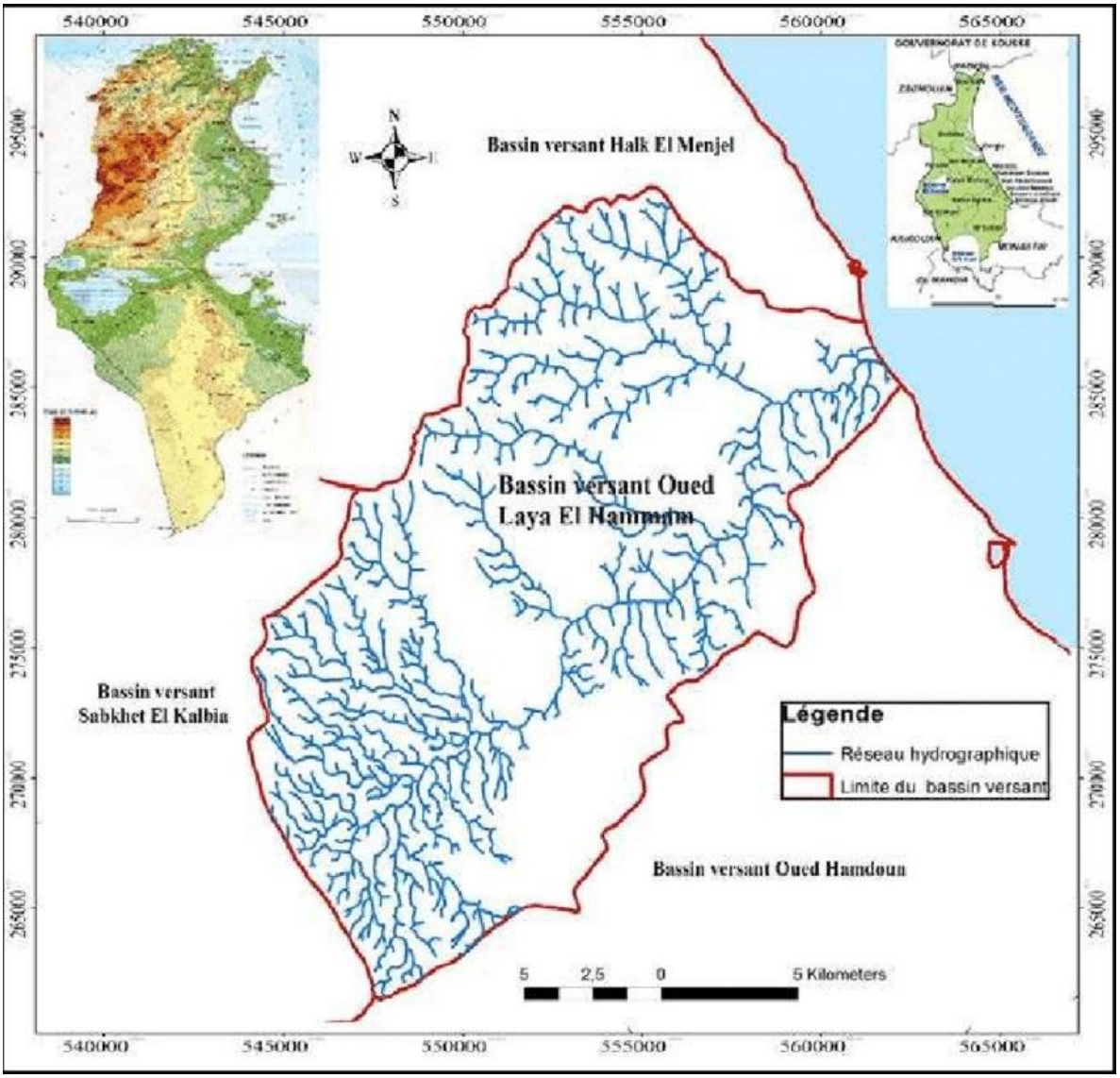


Fig.1. The location and altitudes of the watershed of Lake Laya El Hammam [7].

From a climatological viewpoint, the research zone is Mediterranean. According to the meteorological data provided by Khalâa Station, the average annual precipitation is 350 mm. The maximum monthly temperature in August is 37°C while the lowest one is in January and it reaches 9°C.

From a hydrogeological standpoint, the watershed of Lake Laya El Hammam is made of two geological units:

-The first includes metamorphic rocks (gneiss, limestone) which appear on the mountains surrounding the plain. Some cracks can be noticed here. The streaming of water is important in the rocks that are not fissured or slightly fissured.

-The second one includes sedimentary rocks which essentially appear on the plain:

The lakes beds are made of permeable, alluvial deposits (sand, gravel, pebble …). Rain water infiltrates during heavy showers when the intensity of the rain is greater than the permeability of the earth. Water also flows in the form of streams.

The formation of sandstones and clay can be observed in the northern part of the plain. Sandstones are relatively permeable and could contain water.

The deposits of Miocene separating Lake El Kharroub and Lake Mdarej are impermeable, which means that rain water takes the form of streams.

Detrital deposits are made of gravel, pebble and clay that have continental origins.

III. Equipments and Methods:

The gauging of the rate of flow of Lake Laya El Hammam was done with the help of a float (a piece of wooden square that is 15 cm long and 3 cm high). The station where the gauging of the lake takes place is divided into many sections. The measurement of water speed takes place in each section with the help of a float. The rate of flow at the station is calculated by the sum of the rates of flow recorded in the different sections according to the following formula:

$$Q = \sum_{1}^{n} V_n \times S_n$$

With: Q: Debit in the measurement station,
Vn: Speed of the water in the section n,
Sn: Surface of the water in the section of water n.

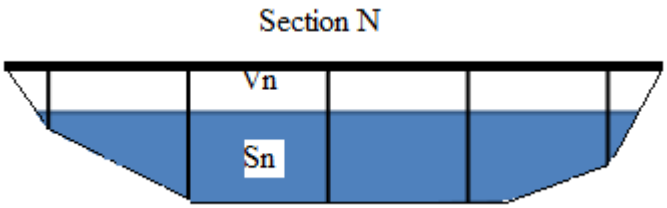


Fig. 2. Schema of the measurement of the rate of flow using a float.

This method of measurement of the water speed on the surface of the lake leads to good results when the water speed is the same on the surface as in depth.

The measurement of the rate of flow was carried out on four stations: one on Lake Naguer, on Lake El Kharroub, another one on Lake Laya and another on Lake El Hammam.

IV. Findings and Discussion

A. Morphometric Characteristics of the Watershed

The morphological characteristics play an outstanding role in identifying the importance of streaming. The graphic presentation of the hypsometric curve and the calculation of the morphological characteristics of the watershed are found in figure 3.

The hypsometric curve shows that the altitudes inferior to 100 m represent 23%; these are generally plains with a steep slope. The remaining surface area is made of mountains ranging from average to very steep plains which results in rapid water flow in 77% of the watershed surface.

The calculation of the capacity index of the watershed gave us a value of 2.41 indicating a watershed that has a long shape; this actually reduces the streaming speed of surface water.

According to its morphological characteristics, we can say that the watershed under study presents two streams: a first one in the mountains where the flow of surface water ranges from average to fast, and a second one in the plains where the flow is slow.

B. Relationship Lake Sheet:

The Establishment of the piezometric card of the alluvial sheet during the period marked by less water (March 2016) is presented in figure 3.

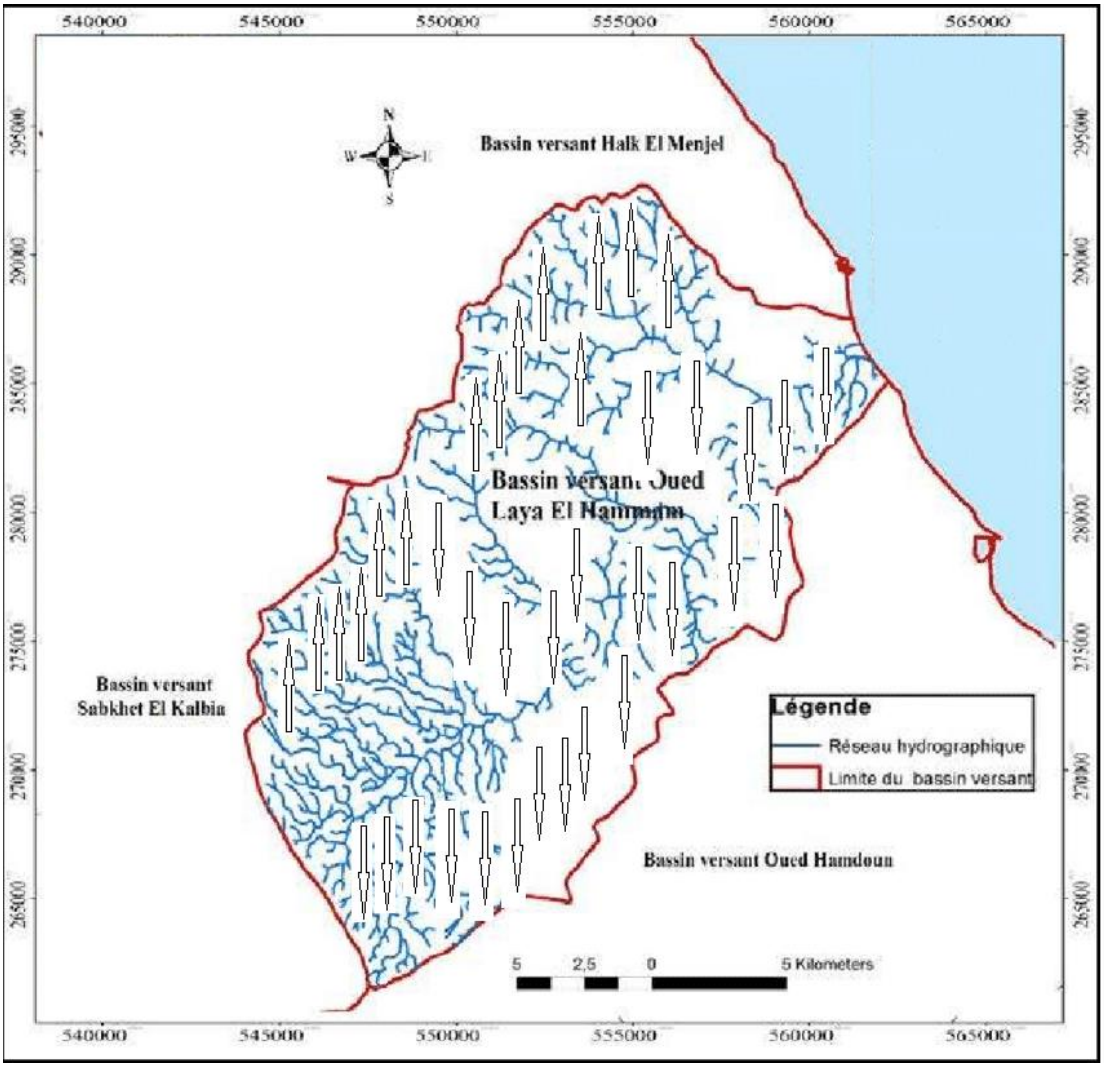


Fig. 3. the piezometric cards of the sheet of Lake Laya El Hammam in March 2016.

This card shows that the curves cut the lakes in a perpendicular way indicating that there is no hydrodynamic exchange between the lake and the sheet. This shows that the water is linked to the precipitation at the uphill part of the lake.

C. Estimation of the Rate of Flow starting from the hydric Report:

The table 1 shows that the flow of water, in March 2016, has reached 450 mm. The infiltration in the plain of Lake Laya El Hammam represents 26.6 % of the rain (CES 2015). The Estimation of the rate of flow of each stream based on the hydrological report shows that the contributions of Lake Laya El Hammam come mainly from the subwatersheds of Lake El Hammam (32%), Lake El Kbir (24%) and Lake Naguer (22.5%).

TABLE I. TABLE 1: THE TEMPERATURE (T) AND THE PRECIPITATION (P) IN ELKALAA STATION [8].

Mois	J	F	M	A	M	J	Jllet	Ao	S	O	N	D
P(mm)	52	48	35	42	26	1	1	1	58	40	74	72
T (C)	13.1	12.4	15.0	17.6	22.5	26	28.5	29.3	26.0	22.9	18.1	11.5

D. Gauging:

The calculation of the rate of flow of Lake Laya El Hammam and its two streams: Lake El Kbir and Lake Naguer present that rate of flow superior to that estimated by the hydric report. This is due to the

fact that gauging is instantaneous and to the presence of rain before gauging. The subwatershed of Lake Laya El Hammam often represents the high East rate of flow (77%).

IV. Conclusion

This research shows the importance of the hydrogeological and morphometric characteristics as well as the hydrodynamic exchanges between lake/sheet.

This research allowed us also to show that gauging with the use of a float during periods marked by a shortage of water represents a real rate of flow. However, the Estimation of the rate of flow based on the hydric assessment/report gives an average value of a monthly flow. Yet, it gives a correct proportionality between the rates of flow of the subwatersheds.

References

[1] Al Ali Y. Les aménagements de conservation des eaux et des sols en banquettes. Analyse, fonctionnement et essai de modélisation en milieu méditerranéen (El-Gouazine, Tunisie Centrale). Thèse de doctorat en structure et évolution de la terre des autres Planètes, Université Montpellier II. 2007.178 pages.

[2] Alberjel J., Boufaroua M., Pepin Y. Bilan de l'erosion sur les petits bassins versants des lacs collinaires en Tunisie semi-aride. Bull. Reseau Erosion, 1998.18 : 67-75.

[3] Baccari N., Lamachère J.M., Boussema M.R., Benmamou A., Nasri S. Influence du facteur lithologique sur l'échec des aménagments en banquettes de terre dans un petit bassin versant semi-aride Tunisien. Revue Geo-Eco-Trop, 2006.30 (2) : 97-108.

[4] Tixeront, J., Berkaloff, E., Caine, A., Mauduech, E. Biland'eau des massifs calcaires en Tunisie Gaz des captages de Tumis et de Bizerte. IAHS, 1951. Assemblee de Bruxelles.

[5] Thornthwaite, C. W. An approach towards a rational classification of climate.Geogr. Rev. 1948. 38, 55–94.

[6] Le Coz, J., Renard, B., Bonnifait, L., Branger, F., Le Boursicaud, R. Combining hydraulic knowledge and uncertain gaugings in the estimation of hydrometric rating curves: a Bayesian approach, Journal of Hydrology. 2014. 509, 573–587.

[7] Fourati Marwa Inventaire et diagnostic des aménagements antiérosifs dans le bassin versant d'Oued Laya El Hammam: Revue des Régions Arides. 2017. 41 :1. Numéro spécial – Journées Scientifiques de la Medjerda.

[8] CRDA Sousse : Commissariat Régional au Développement Agricole sousse Tunisie.

International Journal of Innovation Engineering and Science Research

Open Access

Internet of Things (IoT) and its Challenges for Usability in Developing Countries

Egemen Hopalı
PhD Program in Engineering Management Department
Institute of Pure and Applied Sciences, Marmara University
Istanbul, Turkey

Özalp Vayvay
Engineering Management Department
Institute of Pure and Applied Sciences, Marmara University
Istanbul, Turkey

ABSTRACT

In the recent years, Internet of Things (IoT) has acquired a remarkable attention. IoT projects a world where billions of smart, interacting things are able to offer various services to near and remote entities. This innovative technology enables users to identify and control services. Customers can benefit from the functional guidance. Therefore, the voice of customers is transmitted to manufacturers. The benefit and welfare that the IoT brings about are undeniable; on the other hand, there are some challenges to apply IoT. The main objective of this study is to reveal the usability challenges of IoT in developing countries through a detailed literature survey.

Keywords—*Internet of Things (IoT); innovation; cyber physical systems (CPS); security*

I. INTRODUCTION

Internet of Things (IoT) has acquired a remarkable attention in the last decade. This phenomenal innovation designs a world where billions of smart, interacting things are able to offer wide range of services to near and remote entities. There is a comfort has shown up with IoT. First advantage is the fact that smart products are intelligent items. They are able to recognize their production process and they can communicate with smart machines. Secondly, smart planner can optimize the process in real time. Finally, the innovative information and communication technologies (ICT) enable humans as smart operators to control and supervise activities.

Smart products are highly intelligent to plan and dispose tasks. Machine learning, machine to machine communication, human machine interaction, visualization and data analysis allow cyber physical systems to create self-learning. They can change production methods when it is necessary in the factory (Wittenberg, 2016 & Neugebauer et al., 2016).

Kevin Ashton defined IoT for the first time in 1999. This definition claims that ordinary objects can be combined with the sensors and Radio Frequency Identification Technology (RFID) thereby; things evolve into internet of things (Ashton, 2009). Despite of this definition, the first application of IoT has shown up in 1991 with the “Trojan Room Coffee Pot” (Ashton, 2009 & Santucci, 2009). A video camera was inserted into a coffee machine in order to pursue emptiness. In this way, the liquid level of the coffee machine was observed. (Lopez de Armentia et al., 2012). RFID plays a key role for IoT with its pursuit ability through Electronic Product Codes (EPC). Besides, large scale embedded sensors with 2D codes, common sensor devices and barcodes are well-known tools of IoT. Since these tools can be addressable and connected to the internet, their data can flow over the computers connected to internet. These items are able to solve the confusion by perceiving the environment and communicating with each other. Also, they can provide autonomous response in difficult scenarios without requiring human intervention (O’Leary, 2013 & Kopetz, 2011).

IoT represents the immense digitization of several items in the network structure. Cyber physical systems (CPS) such as artificial intelligence, robotics and clouds are assigned by IoT in order to eliminate the gaps between the digital and physical domain. IoT enables integration of numerous devices, even semi-finished goods. IoT applications are designed to create real time decision making processes by eliminating central control conditions of analysis. The novelty of this technology is that there is no need for integrated data process within standard technology. By this way, an ordinary object can evolve to an intelligent device and equipment in the smart factory can easily and rapidly communicate with the central control system.

IoT implementations are not just in use at the smart factory, it also influences the daily life of people in different areas such as agriculture, health, security, logistics, transportation, smart home and cities (Jing et al., 2014). IoT helps the plant breeding by the scale of humidity and temperature providing the best conditions for the plant growth (Sato et al., 2016). Automatic climate control systems and automatically working household appliances are some examples for smart home applications (Mayer, 2009 & Atzori et al., 2010). Especially, wearable technology makes the health track easier. Through the data obtained from a patient, wrong dose and timing of drugs can be detected. Wearable technology are transmitted this data to the closest healthcare organization so that prevents life-critical case. Based on the electronic medical record system, medical image processing analysis and biomedical signal processing are being used to diagnose possible illness in the future (Fan et al., 2014 & Ukil et al., 2016). The Blind Navigation System support visually impaired people in the shopping. According to this system, supermarket separates into cells and RFID tags locates predetermined places and these tags pin into navigation system. Therefore, WLAN and Bluetooth technologies can help people (Domingo, 2012 & Lopez de Ipina et al., 2011). IoT contribute the smart transportation by assigning sensors and actuators on the roads. This makes pursuit of transportation vehicles possible. Also, sensor technologies benefit from camera and pressure sensors in order to find and control parking space. Required directive is sent out to driver with SMS or a similar technology (Tsai et al., 2014).

IoT influence future business network by self-organizing ability and transmission feature of real time responses among various factories, companies, suppliers, resources, customers and every sort of organizations. Whole actors can reach maximum profit with limited resources by optimizing their configuration in real time (Qin et al., 2016).

IoT not only provides innovative changes for daily life of individuals but also makes the life easier and decreases the restrictions. New approaches and experiments are conducted in order to improve integration, object recognition and communication.

II. Challenges of IoT Applications in Developing Countries

The benefit and welfare that the IoT brings about are undeniable; however, there are some challenges to apply IoT. While the world is taking a digital shape, the countries import technology instead of producing. This approach makes them dependent on designers of digital world. For this reason, developing countries have to suitable for adoption of new technology. The main objective of this study is to reveal the usability challenges of IoT in the developing countries.

The speed and method for implementing IoT differs from country to country. The priority of countries holding high product range is to benefit from flexibility to increase productivity. On the other hand, quality-focused approach is adopted by countries in order to decrease deficient products. This approach requires IoT in order to optimize systems through data mining. Contrary to this, developed countries are focused on increasing automation rate due to the high labor force.

There are some structural hurdles for developing countries to implement IoT. Limited labor force skill is one of them. This obstacle slows down to adopt new technology. Also, the quality of labor force differs from industry to industry. Considering that the demand for value-added products increases rest of the world, low share of value-added products creates another drawback.

IoT practitioners suffer from lack of standardization. Standards evolve day after day so that makes the implementation of technology complicated. Also, lack of mobility is another challenge faced by IoT practices. This innovative technology delivers its many services to mobile users (Al-Fuqaha et al., 2015). Infrastructure is a crucial challenge for developing countries. It is obligatory for IoT applications to have a higher infrastructure. Therefore, interconnected devices can work efficiently and rapidly (Botta et al., 2016). Poor internet connectivity shows up as a challenge for developing countries. IoT uses internet; and for this reason internet network has to spread over whole nation.

Security issues are critical to implement IoT safely. This challenge is important due to the billions of devices connected through IoT, it requires an efficient security mechanism. IoT uses all kind of information and this need to be protected. This issue is more problematic for developing countries due to the vulnerable systems (Li et al., 2016, Gubbi et al., 2014 & Li et al., 2014). Considering the connected devices can be easily traced, privacy issues are another challenge (Whitmore et al., 2015).

In this new digital period, developing countries need to have talented engineers. Because of the fact that comprehensive knowledge of software, design of smart systems, production and design of intelligent robots are necessary. Thus, talented labor force enables developing countries stronger and provides the fundamental precaution.

IoT changes the features of workers in the industrial sectors. Companies need to have more competent labor force in order to manage new production technology and increase their revenue in the integrated digital world. Automation systems take places of unqualified workers in the production. Quality and maintenance process are conducted by automation. Due to the changing structure of labor force, departments integrated with customers such as marketing, sales, automation, information technologies and R&D should become widespread in the all sorts of companies. Especially, demand will increase for skillful employers who have comprehensive knowledge on software and competence on digital systems.

III. Conclusion

The benefit and welfare that the IoT brings about are undeniable; on the other hand, there are some challenges to apply IoT. The main objective of this study is to reveal the usability challenges of IoT in developing countries through a detailed literature survey. Thanks to this study, developing countries can detect structural hurdles to implement IoT. Lack of standardization and mobility, weak infrastructure, security and privacy issues, poor internet connectivity, limited labor force skill and low share of value-added products are main challenges for usability of IoT in developing countries. The novelty of this study is to present obstacles to implement high technology in developing countries. It may help to policy makers and practitioners in understanding and removing challenges in order to achieve successful IoT adoption.

In the near future, old style factories will be disappeared and smart factories will take place of them. Smart factory has a conscious and intelligent structure so that enables information exchange. Smart products are able to connect the whole factory through intelligent actors such as sensors, robots, conveyors, actuators. Developing countries have to eliminate challenges and adopt new technologies in this new era. IoT practices are crucial to provide automation and competitive advantage.

Ongoing improvement process of IoT technologies makes the lives of individuals easier. IoT is important for the comfort of nations but also it is important for the daily life within different perspectives. This technology proportionally grows based on the market demand and the needs of customers.

References

[1] Al-Fuqaha, A., Guizani, M., Mohammadi, M., Aledhari, M., Ayyash, M. (2015). Internet of things : A survey on enabling technologies, protocols, and applications. IEEE Communications Surveys & Tutorials, 17, 2347-2376.

[2] Ashton, K. (2009). "That 'internet of things' thing," RFiD Journal, 22, 97-114.

[3] Atzori, L., Iera, A., Morabito, G. (2010). The internet of things: A survey. Computer networks, 54, 2787-2805.

[4] Botta, A., Walter, D., Valerio, P., Antonio, P. (2016) "Integration of cloud computing and internet of things: a survey." Future Generation Computer Systems 56: 684–700.

[5] Domingo, M. C. (2012). An overview of the Internet of Things for people with disabilities. Journal of Network and Computer Applications, 35, 584-596.

[6] Fan, Y. J., Yin, Y. H., Da Xu, L., Zeng, Y., Wu, F. (2014). IoT based smart rehabilitation system. IEEE transactions on industrial informatics, 10, 1568-1577.

[7] Gubbi, J., Buyya, B., Marusic, S., Palaniswami, M. (2014). Internet of Things (IoT): A vision, architectural elements, and future directions. Future Generation Computer Systems, 29, 1645-1660.

[8] Jing, Q., Vasilakos, A. V., Wan, J., Lu, J., Qiu, D. (2014). Security of the internet of things: Perspectives and challenges. Wireless Networks, 20, 2481-2501.

[9] Kopetz, H. (2011) Internet of things. in Real-time systems, ed: Springer, 307-323.

[10] Li, L., Shancang L., Shanshan, Z. (2014) "QoS-aware scheduling of services-oriented internet of things."IEEE Transactions on Industrial Informatics 10 (2): 1497–1505.

[11] Li, S., Theo, T., Honglei, L. (2016) "The internet of things: a security point of view." Internet Research, 26 (2):337–359.

[12] López de Armentia, J., Casado-Mansilla, D., López de Ipina, D. (2012). "Fighting against vampire appliances through eco-aware things," in Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2012 Sixth International Conference. 868-873.

[13] López de Ipiña, D., Lorido, T., López, U. (2011). Indoor navigation and product recognition for blind people assisted shopping. in International Workshop on Ambient Assisted Living, 33-40.

[14] Mayer, R. E. (2009). Multimedia learning: Cambridge University Press.

[15] Neugebauer, R., Hippmann, S., Leis, M., Landherr, M. (2016). Industrie 4.0- From the perspective of applied research. 49th CIRP Conference on Manufacturing Systems, Procedia CIRP 57, 2-7.

[16] O'Leary, D. E. (2013). BIG DATA', THE 'INTERNET OF THINGS'AND THE 'INTERNET OF SIGNS. Intelligent Systems in Accounting, Finance and Management, 20, 53-65.

[17] Qin, J., Liu, Y., Grosvenor, R. (2016). A categorical framework of manufacturing for Industry 4.0 and beyond. Procedia CIRP 52, 173-178.

[18] Santucci, G. (2009). From internet of data to internet of things. in Paper for the International Conference on Future Trends of the Internet.

[19] Sato, H., Kanai, A., Tanimoto, S., Kobayashi, T. (2016). Establishing Trust in the Emerging Era of IoT. in 2016 IEEE Symposium on Service-Oriented System Engineering (SOSE), 398-406.

[20] Tsai, C., Lai, C., Chiang, M., Yang, L. T. (2014). Data Mining for Internet of Things: A Survey. IEEE Communications Surveys & Tutorials 16 (1), 77-97.

[21] Ukil, A., Bandyoapdhyay, S., Puri, C., Pal, A. (2016). IoT Healthcare Analytics: The Importance of Anomaly Detection. in 2016 IEEE 30th International Conference on Advanced Information Networking and Applications (AINA). 994-997.

[22] Whitmore, A., Anurag, A., Li, D. X. (2015) "The Internet of things—a survey of topics and trends."Information Systems Frontiers17(2): 261–274.

[23] Wittenberg, C. (2016). Human-CPS Interaction – requirements and human-machine interaction methods for the Industry 4.0. IFAC-PapersOnLine 49-19, 420-425.

International Journal of Innovation Engineering and Science Research

Open Access

Properties of MIM 4140 Alloy After Injection Molding and Sintering

Denis Chemezov
Vladimir Industrial College
Vladimir, Russian Federation

ABSTRACT

Testing results of a multi-cavity mold for injection molding of MIM 4140 alloy are presented in the article. Recommendations for manufacturing of forming parts of the mold were given. Based on an implemented technological process of casting and subsequent laboratory researches an information was obtained about the condition of a casting (hardness on Super-Rockwell, shrinkage and quality of a surface layer of material before and after heat treatment). Calculated overall dimensions of the forming parts of the project mold will allow making forecast of shrinkage of MIM 4140 alloy after injection molding.

Keywords *– a casting, a mold, MIM 4140 alloy, a surface layer, injection molding.*

I. INTRODUCTION

It is possible to obtain the small parts of a complex configuration by widespread methods of processing. Mechanical processing of these parts leads to increasing of implementation time of an operation (at compliance of high dimensional accuracy), range of standard and special cutting tools, and in more cases it is used an unrational workpiece and etc. Casting [1] reduces manufacturing time of these parts. However, difficulty of formation holes of the small diameter in the parts and not high accuracy of casting leads to restriction of the use this method in production. For implementation of all technical requirements for manufacturing of the described parts in serial production, rationally to select the technology of filling metals into a mold under pressure by injection method with subsequent sintering process of the obtained casting [2, 3]. MIM technology allows to obtain the finished parts of different assignment from alloys based on iron (low-alloy steel, corrosion resistant steel, tool steel, special steels), non-ferrous alloys (alloys of copper, heavy metals, hard alloys, light metals) and ceramic materials. The part manufacturing by means of MIM technology and its quality control are ensured by designing of tooling (the mold), selecting of the composition of initial mixture and determining of the material properties.

II. MATERIAL AND METHOD

The some properties of material of the one-type castings obtained by MIM technology were exposed by the research.

The manufactured casting has the shape of a body of rotation with the blind central hole. On the outer diameter of the casting by injection molding an area with a radius output is formed. The outer diameter of the casting is performed in a form of a cone. The drawing of the casting with diametric, linear and angular sizes is presented in the Fig. 1.

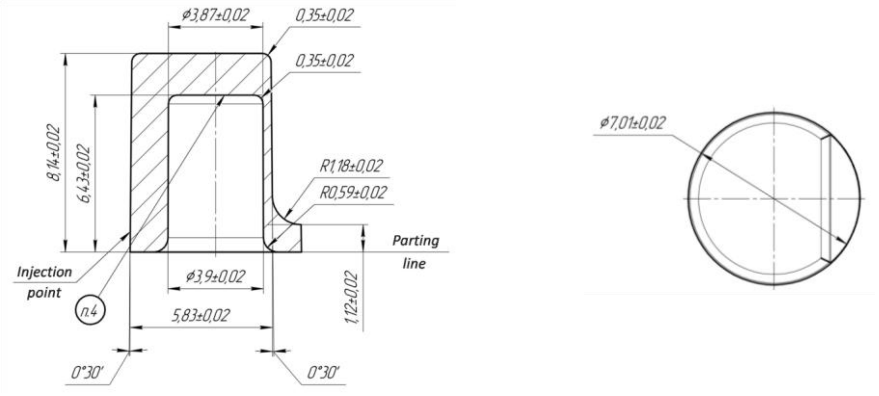


Fig. 1. The drawing of the part “Plunger”.

Unspecified tolerances in the drawing of the part were taken ±0.02 mm.
The castings were made from MIM 4140 alloy (low-alloy) [4]. Alloy contains 0.2 – 0.3% of molybdenum, 0.3 – 0.5% of carbon, 0.8 – 1.2% of chromium, 0.6% of silicon, 1.0% of manganese and rest it is iron. Density of material is 7.5 g/cm^3, ultimate strength – 1654.74 MPa, yield strength – 1241.06 MPa, elongation – 5%, Young's modulus – 203395.33 MPa, Poisson's ratio – 0.28, unnotched Charpy impact energy [5, 6] – 74.5701 N·m.
Offset of the parting line of the mold is allowed no more than 0.1 mm. Number marking of the each cavity must perform by depth of 0.2 mm. The drawings of the forming parts of the mold are presented in the Fig. 2 and 3.

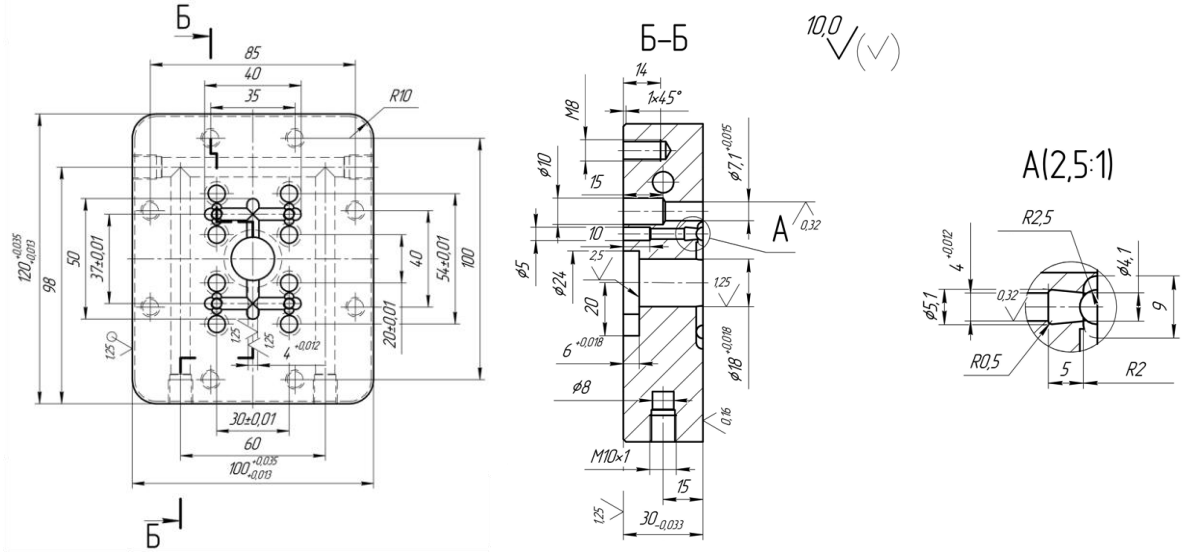


Fig. 2. The drawing of the part "Insert 149-13" (the forming part of the mold).

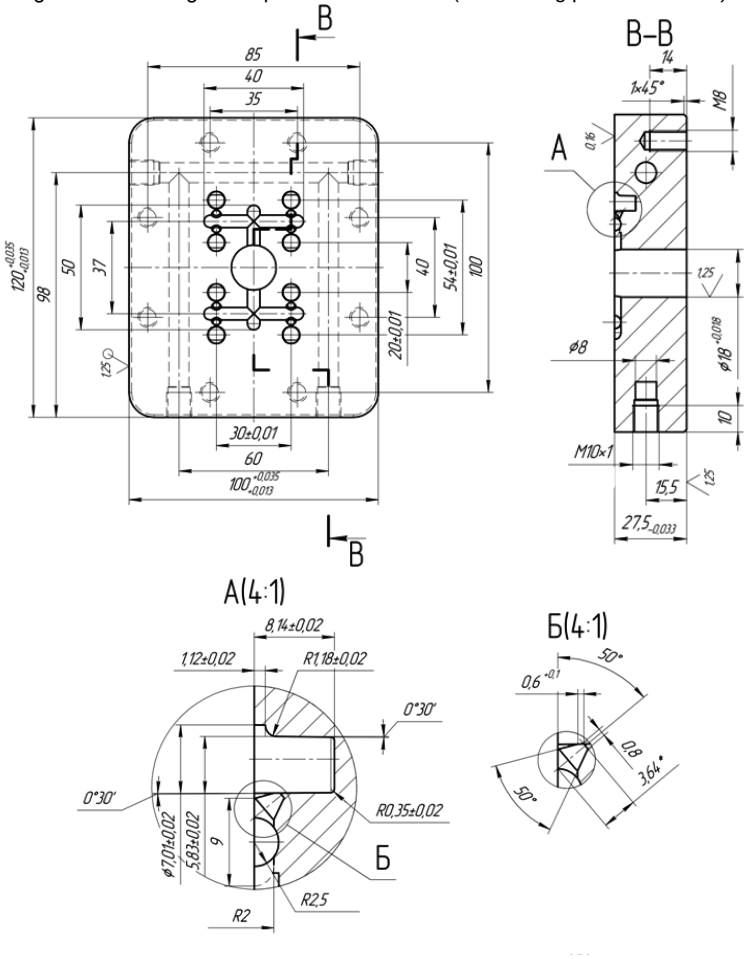


Fig. 3. The drawing of the part "Insert 149-14" (the forming part of the mold).

The part "Insert" is made from alloy tool die steel T30402. For implementation of casting process, the part is exposed to heat treatment to hardness of 58...62 HRC. Surface roughness of the gating system should be 0.63 μm. The remaining technical requirements for manufacturing of the part are according to GOST 27358-87.
Roughness of the forming surfaces obtained by electrical discharge machining should be 0.63 μm.
Preliminary quality control of the assembly mold was carried out by mating of the three-dimensional models of the parts in the unit. The general view of the mold is presented in three-dimensional formulation (Fig. 4). The assembly process of the multi-cavity mold for injection molding of MIM 4140 alloy is presented in the Fig. 5.

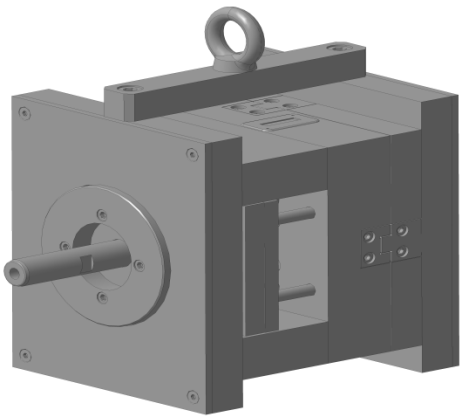


Fig. 4. The three-dimensional model of the eight-cavity mold.

Fig. 5. The assembly process of the eight-cavity mold for injection molding of MIM 4140 alloy.

Manufacturing of the castings was performed on the injection molding machine Arburg Allrounder 270C 400-100 [7]. High reliability and repeatability of the injection molding machine allow to perform casting of the parts with minimal deviations. The requirements for manufacturing of the castings and the mold for injection molding are presented in the table 1.

TABLE I. THE REQUIREMENTS FOR MANUFACTURING OF THE CASTINGS AND THE MOLD.

Parameter	**Value**
Release program of the parts	40000 pieces per year
Mass of the part	1.1 g
Calculated shrinkage of polymer material during molding process of the part	18%
Molding temperature	180 °C
Pressure	1000 – 1700 kg/cm^2
Downtime under pressure	3 s
Molding cycle	35 – 60 s
Temperature of cooling liquid (air)	40 – 60 °C
Number of the mold cavities	8
Design of an inlet channel or a sprue	tunnel
Operation mode of the mold	automated
Requirements for material of the forming parts of the mold	hardness of the forming parts at least 60 HRC, high wear resistance
Calculated guaranteed life of the mold	300000 cycles

Operations of flash trimming and sprues separation are not acceptable.

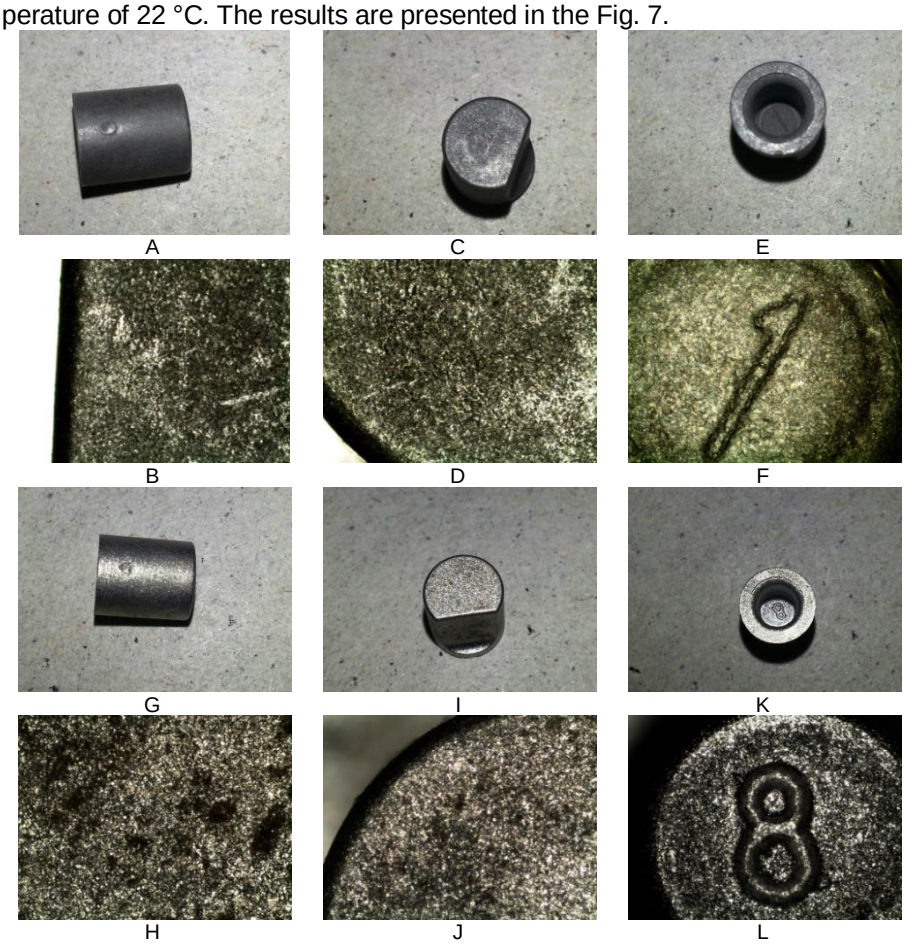
III. Result and discussion

Calculated shrinkage of the casting is achieved after material cooling in the mold. Required shrinkage of the part is achieved after heat treatment (sintering). Accuracy of linear, diametrical and angular sizes of the part is confirmed at measurement by measuring tools. Comparison of shrinkage of the castings material before and after heat treatment is presented in the Fig. 6.

A B

Fig. 6. Shrinkage of the castings material after heat treatment (A) and before heat treatment (B).

The condition of the surface layer of the castings before and after heat treatment was determined on the video-measuring microscope VP-6440 (United Kingdom) [8]. The microscope of this model is characterized by a permissible absolute error of measurements of linear dimensions along the axes X, Y and Z in the range ±(2.5 + L/150) μm (where L is a measured length in mm) and discreteness of reference of linear measurements – 0.0005 mm. Working with the microscope was carried out at an ambient temperature of 22 °C. The results are presented in the Fig. 7.



A C E

B D F

G I K

H J L

Fig. 7. The condition of the surface layer of the castings before heat treatment (A – F) and after heat treatment (G – L). Magnification ×5.

After cooling of the casting in the mold it is observed high density of material. Before heat treatment, the casting material is very brittle. After heat treatment, high density of material remains. On the surface layer of the casting material microporosity is formed. Porosity in researched material of the

casting increases resistance to cracking. Surface roughness of the casting material after MIM technology is very low.
Hardness measurement of the casting material after heat treatment was performed by the method of Super-Rockwell on the special hardness tester. Hardness (17 HRC) was obtained at indentation in the casting material of the diamond cone (indenter) with an angle of 120° at the apex. Force of indentation of the indenter was taken 150 kg.

IV. Conclusion

Thus, based on of the conducted analysis of the properties of MIM 4140 alloy after manufacturing of a semi-finished product by injection molding and sintering, it is possible to draw the following conclusions:
1. The configuration and manufacturing features of the mold are presented. Quality control of assembly of the mold should be implemented by the three-dimensional model. Casting modes are used for serial production of these castings. Recommended pressure at molding simultaneously eight castings is 1500 kg/cm^2. Temperature of the casting process of MIM 4140 alloy is similar to temperature of the casting process of thermoplastics.
2. At average hardness of material, high dimensional accuracy and low roughness of the surfaces, the casting (the part) is ready for assembly and subsequent operation. Porosity, formed after heat treatment, provides the higher crack resistance of the casting material.

References

[1] Precision Castings Division. Cost Drivers and Design Considerations for Investment Casting.
[2] R.M. German and A. Bose. Injection Molding of Metal and Ceramics. Princeton: MPIF, 1997.
[3] V. Raymond. Metal injection molding development: modeling and numerical simulation of injection with experimental validation. Mémoire présenté en vue de l'obtention du diplôme de maîtriseès sciences appliquées, 2012. 122 p.
[4] Materials standards for metal injection molded parts. Published by metal powder industries federation, 2016. 39 p.
[5] ISO 148-1 Metallic materials – Charpy pendulum impact test – Part 1: Test method.
[6] H. Kurishita, H. Kayano, M. Narui, M. Yamazaki, Y. Kano and I. Shibahara. Effects of V-notch dimensions on Charpy impact test results for differently sized miniature specimens of ferritic steel. Materials Transactions – JIM. Japan Institute of Metals. 34 (11), 1993. pp. 1042–1052.
[7] Hydraulic ALLROUNDER's. Injection moulding machines for diverse applications. ARBURG GmbH, 2013.
[8] Optical instruments. Bowers group.

International Journal of Innovation Engineering and Science Research

Open Access

Risk Organization for ERP Projects

Mehmet ERİŞ, Özalp VAYVAY
Marmara University Graduate School of Pure and Applied Sciences Engineering Management Department
Goztepe Campus, Istanbul TURKEY

ABSTRACT

Software projects' past goes back to four or more decades. We encounter the first software project risk management paper in 1991[1] and the study [2] reports that in 1995 US spent $250 billion to software projects and these projects had estimated $59 billion in cost overruns and another $81 billion had spent on canceled software projects.Although failures are tremendous, we have observed the project risks and critical success factors are given like shopping lists and so the remedies of risk factors. Very few studies exist for searching the relationships of these risk factors and the relationship between remedies and risk factors. We are trying to construct a simple model of risks and remedies borrowing concepts from systems and control theory.

I. Introduction

During early days of software utilization when computers were very scarce and ultra expensive, their usage were limited to mainly defense sector. Although these organizations have project culture and familiar with high risk, high budget projects, it is not uncommon for them to have high rate software project failures. These failures are due to lack of risk management. Lack of risk awareness causes to optimistic enthusiasm, which cause project developers to make high-risk commitments according to Boehm (1). ***"Identifying and dealing with risks early in development lessens long-tem costs and helps prevent software disasters."*** says Boehm in his study (1) that is the earliest risk management publication as best of our knowledge. Projects are managed by unrealistic optimism, and the concerns are discarded. Talking about risks is not welcomed.

Risk management is essential for the project success. For a software project to be successful, critical success factors are required. The probabilities combined with the possible negative impact of lack of critical success factors can be defined as risk factors.

Failure statistics goes back to the late 1980s and they state that 35 percent of companies faced at least one software project failure (1). One of the most cited past research is the Chaos Report 1995 (2). The Chaos Report states that US annual expenditures to IT application have risen to $250 billion, 31.1% of the projects are cancelled before completion, 52.7% of the projects are overrun than their budgets by 89%.

Importance of risk management becomes more evident as the reports present high rate of failures. The IT expenditures amount and high rate of failures signify the value of efforts to successfully manage projects. The competitive advantage offered by the IT to organizations that successfully implemented software projects makes just ignoring the IT projects impossible. The competition pressure forces the organizations to deploy IT projects. The lack of understanding of both how organizations might benefit from IT and what makes IT projects successful will result with failure. The literature gives us the Critical Success Factors and risk management helps prioritizing the critical success factors and remedies for the lack of them; and helps continuously monitoring and communicating risks.

As years followed, organizations used Information Technologies to standardize and integrate their business processes. The standardization and integration of business processes resulted with software companies to develop software packages, called Enterprise Resource Planning. Although experience built up since the early years of software projects, the project success is not still within easy reach. This is mainly because as the experience built up, the complexity of the projects are also increased.

An ERP system consists of one application, one database and user interface. It integrates and standardizes the organization's processes everything from supply-chain management, manufacturing, distribution, human resources, accounting [3].

II. Literature

The first as best of our knowledge is Boehm's work (1). He states that if there exists an explicit concern of software risks those risks would be avoided before they are realized. The lack of risk concerns will cause an optimistic attitude towards and result with unrealistic promises.

Boehm (1) describes the basic risk management process; suggests decision tree for risk response decisions; and lists the following risk factors:

1. Personnel shortfalls
2. Unrealistic schedules and budgets
3. Developing the wrong functions and properties
4. Developing the wrong user interface
5. Gold-plating
6. Continuing stream of requirements changes
7. Shortfalls in externally furnished components
8. Shortfalls in externally performed tasks
9. Real-time performance shortfalls
10. Straining computer-science capabilities

Following Boehms's (1) work, we have the Keil et al's work (4), the main contribution of Keil et al is the classification of risks according to the project team's control.

Keil et al (4) perform a Delphi Study and give the risk factors as:

1. Lack of top management commitment to the project
2. Failure to gain user commitment
3. Misunderstanding the requirements
4. Lack of adequate user involvement
5. Failure to manage end user expectations
6. Changing Scope/Objections
7. Lack of required knowledge/skills in the project personnel
8. Lack of frozen requirements
9. Insufficient/inappropriate staffing
10. Conflict between user departments

Keil et al, contribution is developing a risk categorization framework and categorizing the risks according to the framework developed. One of the dimensions of the risk categorization is the "level of control". Risk management is thought as the responsibility of the project manager and "level of control" defines if project manager has some control over mentioned risk. For instance the project manager has little control over the top risk: "Lack of top management commitment to the project".

As the ERP projects gain importance both from external pressures to implement them and both from difficulties of implementation, literature shifts to the ERP projects.
Implementing an ERP system is a careful exercise in strategic thinking, precision planning, and negotiations with departments and divisions [3].

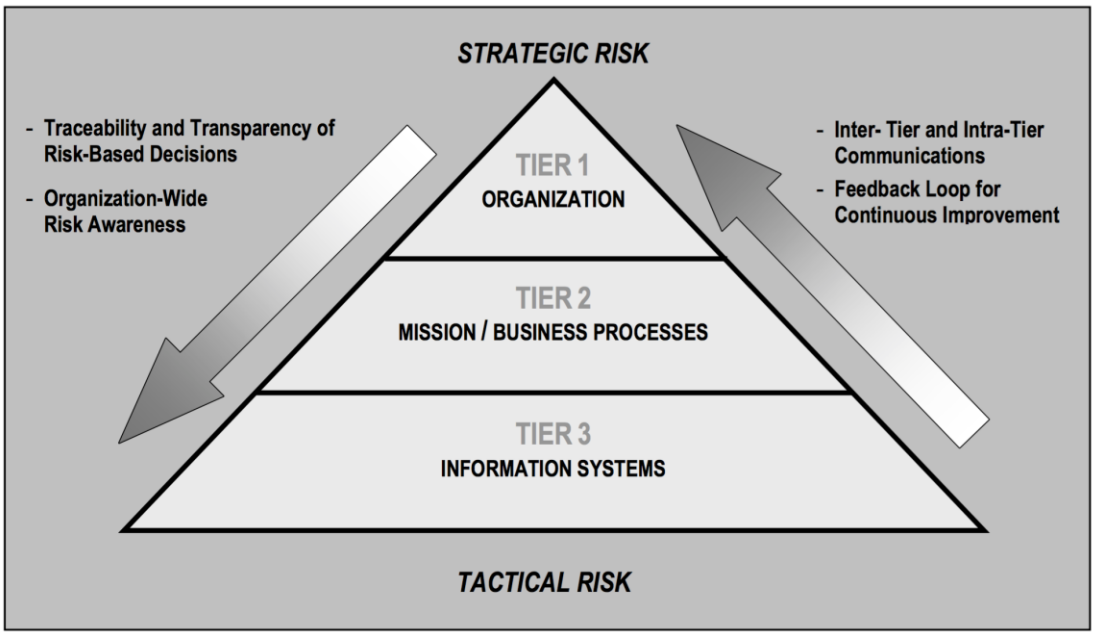
Aloini et al [5], reviews the literature and finds the most mentioned risk factors as such:

1. Inadequate selection
2. Poor project team skills
3. Low top management involvement
4. Ineffective communication system
5. Low key user involvement
6. Inadequate training and instruction
7. Complex architecture and high number of implementation modules
8. Inadequate BPR
9. Bad managerial conduct
10. Ineffective project management techniques
11. Inadequate change management
12. Inadequate legacy system management
13. Ineffective consulting services
14. Poor leadership
15. Inadequate IT system issue
16. Inadequate IT system maintainability
17. Inadequate IT supplier stability and performances
18. Ineffective strategic thinking and planning
19. Inadequate financial management

III. Risk Model

ERP projects are interdisciplinary so they both affect and are affected by multiple departments of organizations. They include technological and management aspects and these projects are affected strongly by sociological factors. So risk management of ERP projects should not be sole responsibility of the IT Department. Success and failure of an ERP project, affects the whole organization. This means that the Top Management is responsible for execution of an ERP project.

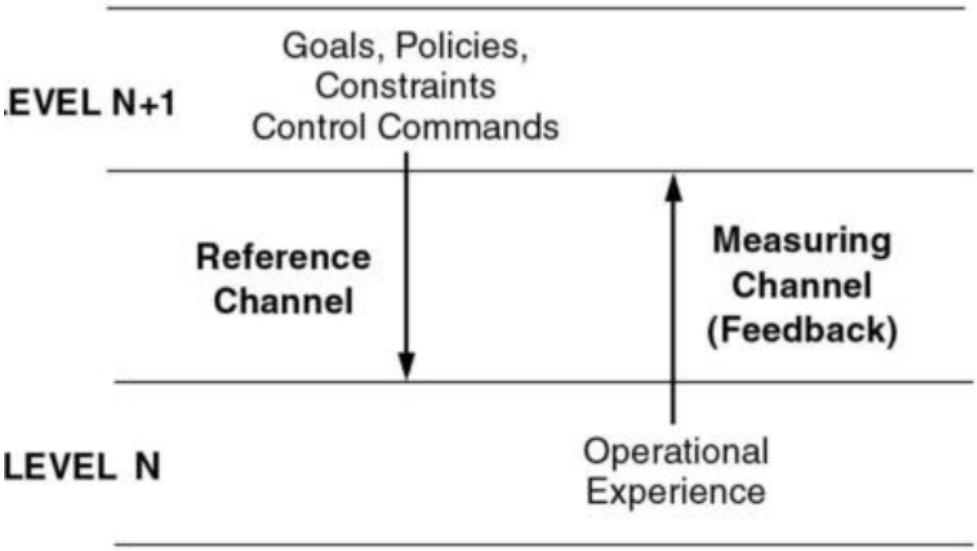
We borrow Three Tier Risk Management Structure from NIST Special Publication 800-39 Managing Information Security Risk [6],



There exist Organization at Tier 1, Mission/Business Processes at Tier 2 and Information Systems at Tier 3.

The risk executive function is required to successfully manage risks. The executive establishes risk management roles and responsibilities. We are inspired by the Keil et al'swork, classification of risk according to the level of control imposed by project team and distribute the roles and responsibilities of ERP risk management to the related tiers. The risk executive function and the tier view of organization are borrowed from NIST Special Publication 800-39 Managing Information Security Risk [6].

Tier 1 represents the Business Functions; these functions are implemented via Business Processes that reside at Tier 2. Business processes are realized within the support of the IT Systems at Tier 3.



There are control layers between tiers. Upper layers provide goals, policies and constraints and receive feedback from lower layers. Top management provides goals, resources and policies and monitors the goal achievement, resource sufficiency and usage, and policy conformance.

We have divided the responsibilities for the ERP Implementation to the four groups: (1) Top Management, (2) BPR Team, (3) IT Department and (4) Users. Top Management resides at the Top Level – Tier 1. BPR team resides at Tier 2 and IT Department and Users of ERP reside at Tier 3.

	Responsibilities	Monitoring	Required Qualities
Top Management	(1) Goal Setting Resource (2) Providing	(1) Goal Achievement (2) Resource Sufficiency and Resource Usage Efficiency	(1) Commitment-Leadership (2) Good Management Skills (3) Communication
BPR Team	(1) Redesign of Organization Processes (2) Estimating Gains from Reengineered Business Processes (3) Change Management (4) ERP Selection (Determining Suitability for Organization Processes)	(1) Compliance to Organization Business Processes (2) Monitoring Gains (Post Implementation)	(1) Personnel Skills (2) Communication (3) Organizational Knowledge (4) Analytical Skills
IT Department	(1) ERP Selection (IT Infrastructure Fit – Usability – Maintainability – Reliability - Flexibility) (2) Technical Implementation of Business Processes (3) User Training (4) Operation of ERP System	(1) IT Performance and Reliability (2) User Training Level (3) User Experience	(1) Technical Skills (2) Project Management Skills (3) People Skills
Users	(1) Compliance to ERP Processes	(1) Data Correctness	(1) Commitment (2) Responsible Usage

IV. ERP System Attributes (Criteria)

Success of the ERP Project strongly depends on the selected ERP. There are quite many studies about ERP Selection Process and Selection Criteria [8]. The most mentioned risk from literature review from Aloini et al's work (2007) is "Inadequate Selection". We have developed a framework to evaluate an ERP. There exist four aspects defining an ERP: Functionality, Quality, Compatibility, and Usability.

- **Functionality:** Functionality defines the Business Processes supported by the ERP. The main functionality of an ERP is the standardization and integration of organizational business processes. The conformance of processes of ERP packages to target organizations has the utmost importance.

- **Quality Aspects:** Quality aspects cover the reliability, maintainability, flexibility, after sales support. Reliability also includes lack of faults.

- **Compatibility Aspects:** Compatibility is about the IT infrastructure belonging to the organization required for the ERP to be operational.

- **Usability Aspects:** Usability refers to the ease of use by the users and ease of operation by the IT department. Without user friendliness, the aimed user acceptance and process efficiency could not be achieved.

Besides the risks or Critical Success Factors addressing the implementation phase of an ERP project. ERP selection is the risk belonging to the pre-implementation phase. Any ERP software that does not meet the four general requirements (Functionality, Quality, Compatibility and Usability) will cause the project to fail or fall short from target goals.

V. Assignment of Risk Factors to Organizational Units

No	Risk Factor	Responsible
1	Inadequate selection	Covered by BPR Team (Business Process Fit) Covered by IT Department (IT Infrastructure Fit)
2	Poor project team skills	Covered by Top Management (Resource Provider)
3	Low top management involvement	Top Management
4	Ineffective communication system	Organizational Quality (affects all activities)
5	Low key user involvement	IT Department User Training
6	Inadequate training and instruction	IT Department User Training
7	Complex architecture and high number of implementation	BPR and IT Department (IT infrastructure, Business Processes)

	modules	
8	Inadequate BPR	BPR
9	Bad managerial conduct	Top Management (Project Risk Governance)
10	Ineffective project management techniques	Top Management (Project Risk Governance)
11	Inadequate change management	BPR Team
12	Inadequate legacy system management	IT Department
13	Ineffective consulting services	IT Department
14	Poor leadership	Top Management
15	Inadequate IT system issue	IT Department
16	Inadequate IT system maintainability	IT Department
17	Inadequate IT supplier stability and performances	IT Department
18	Ineffective strategic thinking and planning	Top Management
19	Inadequate financial management	Top Management

VI. Conclusion

Software projects and ERP projects risk management literature gives the responsibility of risk management to the project management team. Many of the high level risks are out of project team's control. During our study we have identified the project relevant organizational units and defined their responsibilities. One of the most critical risk factor is the selection of ERP and we have defined a model describing the attributes of an ERP. Selection of suitable ERP and distribution of responsibilities of an ERP project is essential for the project success.

References

[1] Boehm B. W., Software Risk Management: Principles and Practices, IEEE, Jan 1991

[2] Johnson, J. Chaos: The dollar drain of IT project failures. *Applic. Dev. Trends 2,* 1 (1995), 41–47)

[3]Prasad Bingi ,Maneesh K. Sharma &Jayanth K. Godla (1999) Critical Issues Affecting an ERP Implementation, Information Systems Management, 16:3, 7-14

[4] [Keil M., A Framework for Identifying Software Project Risks, November 1998/Vol. 41, No. 11 COMMUNICATIONS OF THE ACM]

[5] Aloini D., Dulmin R., Mininno V., Risk management in ERP project introduction: Review of the literatureInformation & Management 44 (2007) 547–567

[6] NIST Special Publication 800-39, Managing Information Security Risk Organization, Mission, and Information System View, March 2011

[7] Kılıç, H. S., Zaim S., Delen D., Development of a hybrid methodology for ERP system selection: The case of Turkish Airlines, Decision Support Systems 66 (2014) 82–92

[8] Engineering a Safer World: System Thinking Applied to Safety, Nancy G. Leveson.

International Journal of Innovation Engineering and Science Research

Open Access

Risk Management in City Rail Transportation System Project: A Case Study of Istanbul

Hakan İNAÇ

PhD Program in Engineering Management Department
Institute of Pure and Applied Sciences, Marmara University
Istanbul, Turkey
hkninac@gmail.com

Özalp VAYVAY

Professor,Engineering Management Department
Institute of Pure and Applied Sciences, Marmara University
Istanbul, Turkey
ozalp.vayvay@gmail.com

ABSTRACT

Today, the most important modes of transportation for cities are public transportation. Public transport provides citizens with fast, reliable, timely and inexpensive transportation.Public transportation systems are constructed according to the size of the cities. Bus systems are the most common means of public transport in small-scale cities. However, as cities grow, the rail system becomes an important model for public transportation.

Turkey's largest city of Istanbul has a population of over 14 million. With a 149 km rail system line, it is aimed to create a railway system network of 1.000 km for public transportation in Istanbul.

In this context, 276 km railway system construction is continuing. The completion of the investments financed by the municipality and the government at the targeted time and in the desired qualification is very important in terms of the quality of life of the citizens. For the Rail System Lines, risk management is required to achieve the intended objectives.

In this study; continuing rail system projects in Istanbul; design, engineering services (supervisor) and construction phases. For the study, a risk matrix was created and a questionnaire survey was conducted with 60 senior experts working on the Istanbul rail system projects in the public and private sectors. Survey results and evaluations were given in the study.

Keywords— *risk management;survey;stakeholders management; sustainablity; istanbul; rail system.*

I. INTRODUCTION

Public transportation is the indispensable mode of transport for large-scale metropolises. Due to the high population in cities and the limited volume of roads, the primary transport problem is traffic congestion and therefore high travel times. The basic recommendation of transport analysts in this regard is to increase the capacity and capacity of the public transportation network. Traffic congestion is a continuing problem in large-scale cities.

Transportation; is one of the most important subjects of everyday life in contemporary Istanbul. Railway System Lines are the most important mode of transportation for large cities, providing uninterrupted high-capacity transportation.

Currently, there is a 150 km rail system network in Istanbul under operation and uses an average of 2 million 281 thousand passenger rail systems per day. With the completion of the rail system lines being constructed, the rail system will be 430 km long in the near future and the planned rail system network will finally be available in Istanbul with a 1,000 km rail system network [1].

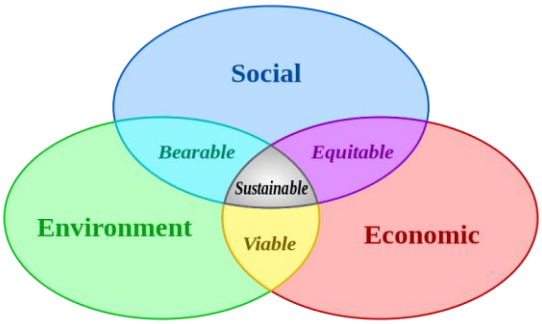
Project and Risk Management in Railway System Construction, construction of 276 km railway system in progress in Istanbul; design, supervisor and construction, all of which are the responsibility of all the public and private sectors.

Literature shows that risk management in construction projects is full of deficiencies that affect its effectiveness as a project management function and in the end, projects' performance [6].

Railway system projects; it is the most important priority of public institutions to live safely in the target time, cost and quality standards.The purpose of the private sector working in project works is to complete the contracted projects with low cost. We can explain these different aims of stakeholders with the concept of sustainability.

Sustainability as a concept; Social refers to a multi-purpose structure in which environmental and economic goals are jointly assessed.A schematic representation of a multi-purpose sustainable project management is given in "Fig. 1,"[2].

Figure 1.Sustainable development of project management.



Stakeholders with different goals need to be managed. The main question of rail system project is how to control stakeholder management effectively.

Each and every stakeholder is a very critical and a very sensitive issue for an organization. As they definitely affect the working of the organization and like said earlier no company or organization would ever exist without the help and support of these stakeholders. One of the most important parts of project management is to develop and control relationships with the stakeholder as they are a very vital part of the organization [3]. The main of effective stakeholder management steps is Purpose of management needs to be defined.

Managing risk with stakeholders is important. Rail System Projects consist of project stakeholders with different roles and responsibilities, different goals and expectations, different risk-taking capacities and different risk management skills [5]:

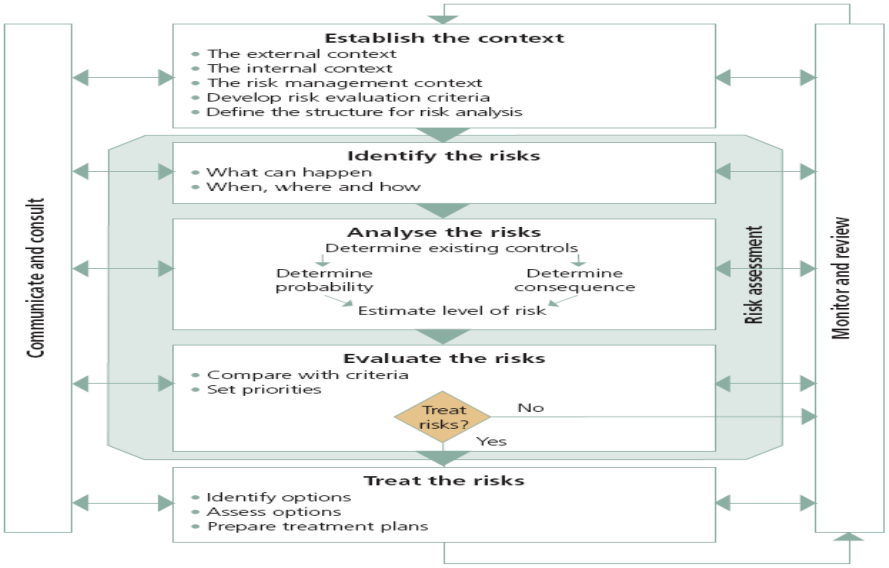
Public Sector (Municipality, State)
Supervisor
Contractors
Project Owner
Sub-employer
Supplier
Citizens

It is crucial for Risk Management to be effective and successful, as it is the mutual exchange of views and determination of risk prevention plans among the Project Stakeholders to identify, mitigate, or reduce risks at various stages of the project. As a result, the whole project is interacting with each other and the success or failure of one will affect others.

In a multi-purpose project management, it is necessary to fully define the obstacles in front of the objectives.

The Risk Management Processconsists of a series of steps that, when undertaken in sequence, enable continual improvement in decision-making.Steps to be followed in risk management are given in figure 2 [4].

Figure 2.Summary of risk management steps.



There are various benefits of risk management on projects. a few of which are given below.

- ✓ It supports the realization of the project objectives,
- ✓ Informed consent of the Project Organization on the identification and prevention of risks,
- ✓ Facilitates compliance with national and international legal requirements
- ✓ It forms the basis for planning and decision-making processes,
- ✓ Improve the efficiency and efficiency of construction activities,
- ✓ Increase cooperation and confidence among project stakeholders.

II. METHODOLOGY

Organizations from many industries have recognized the increasing importance of risk management, and many companies have established risk management departments to control the risks they are, or might be, exposed to. The construction industry and its clients are widely associated with a high degree of risk due to the nature of construction business activities, processes, environment and organization [8].

In the past four decades, research on risk management has grown considerably in the construction industry "Ref.[8]" due to the fact that construction projects are permanently exposed to risks and are perceived as projects with greater inherent risk due to the involvement of many stakeholders [10].

With the effective use of the Risk Management System, risks can be identified before they occur and possible effects can be avoided.In other words, proactive management approach should be adopted instead of reactive management approach. With the proactive approach, it is possible to take action before the risks occur, not after the risks have arisen.It is necessary to identify the risks that can be encountered in the process from the beginning to the end of the projects, to evaluate these risks, to completely prevent the risks or to determine the actions to reduce their effects.

In this study, possible risks of Railway System Projects built in Istanbul have been analyzed.

The Railsystem Projects are long-term, complex, large public projects with high uncertainties and correspondingly high risk diversity. The main risks that may be encountered in the Rail System Projects are distributed to the participants and their responses are given in the requested Risk Assessment

Surveys. For this reason will not be mentioned here again. Categorizing risks can be a good way to manage it more easily.

TABLE-1.IMPACT ANALYSIS

Impact Level	*Impact Band*	*IMPACT Financial*	*IMPACT Schedule*	*Performance /Quality*
1	Low	X <=%1	It will not prevent you from being in the process of working, or it will not affect you for more than 3 months.	Jobs that are abundant in the work schedule and that are possible with the actions to be taken to close the delay during the program
2	Medium	%1< X<%5	The completion of the work will last between 3 and 6 months.	Work that does not interfere with the provisional acceptance, which is available in the program of work and which can be delayed by the actions to be taken to close part of the program during the program
3	High	%5< X<%10	The work can be completed between 6 and 9 months	Jobs that have an effect on the work schedule, which can delay the admission.
4	Very High	%10< X<%20	Affecting completion of work for 9 to 12 months	Delays ad hoc acceptance, affects the work schedule, and requires a change of method.
5	Extremely High	X>=20	Having completed the work more than 12 months	Risks that require re-planning for the delivery of the work, that require action to be taken seriously, proposed action and presented with a set of solution planning proposals

When assessing the likelihood of risk occurrence, the following evaluation table will be used.

TABLE-2.PROBABILITY ANALYSIS

Level	*Band*	*Minimum %*	*Maximum %*	*Likelihood*
1	Low	%0	%5	The possibility of coming to the plaza requires extraordinary conditions, and it is not expected to occur even in the long run.
2	Medium	%5	%40	It is not expected to appear and may appear over the years.
3	High	%40	%70	A short chance to come up in the short term may arise in months or years.
4	Very High	%70	%95	It may occur in weeks or months.
5	Extremely High	%95	%100	They are almost certainly the risks to be encountered.

The risk level, also called "Risk Score" value, is analyzed by the following sample matrix.

TABLE3.RISK SCORING MATRIX

Risk Scoring &PrioritisationMarix							
Probability / Likelihood	5	Ex High	11	16	20	23	25
	4	Very High	7	12	17	21	24
	3	High	4	8	13	18	22
	2	Medium	2	5	9	14	19
	1	Low	1	3	6	10	15
		Band	Low	Medium	High	Very High	Ex High
		Impact / Consequance					

Risk effects can be handled in two categories as direct effects and indirect effects. Direct effects are those where the effects can be detected immediately or in a short time when the risk is realized and these effects can be measured. An example of direct effects; Expiration of project duration, cost increases, quality problems (faulty, incomplete manufacturing, etc.). Recognition of indirect effects and results (effects) take place depending on time. It is difficult to measure these effects. Examples of indirect effects; Prestige loss, disputes, claims, user complaints, business difficulties, etc "Ref [11]".

III. Application And Analysis

The purpose of risk identification is to identify risk,to classify the possible risks that a large infrastructure project may face [7].

The following risks were used in the survey study:

1. DESIGN RISKS
   a) Design Errors (incorrect design entries and assumptions, design oversight and lack of verification activities)
   b) Delays in the Design Business Program (Design, behind schedule)
   c) Interdisciplinary Design Coordination Failure
   d) Lack of Communication Between Designers and Administrators, Consultants and Contractors
   e) Design Changes During Construction

2. INTERNAL RISK
   a) Incorrect and incomplete forecasting of budget (uncertainties etc.)
   b) Cash Balance for receipt (payment difficulty)
   c) Contractor Cash Balance (payment difficulty)
   d) Risks Caused by Contractual Conditions
      i. Project Scope (uncertainties, changes)
      ii. Project Time
      iii. Costs and Payment Model (unit price, lump sum, etc.)
      iv. Sharing of responsibilities (do, design-build, build-operate-transfer) to.
      v. Guarantees
   e) Prolongation of decision-makingperiod

3. EXTERNAL RISK
   a) Change in InterestRates, CreditRequirements
   b) Exchange Rate Changes
   c) PriceIncreases (inflationandcommoditypriceincreases)
   d) LegislativeChangestoaffecttheproject (tax, accounting, import, laborlawandotheradministrativeand legal legislation)
   e) Communicationwiththepublicandthepublic (criticismandreactions)

4. ENVIRONMENTAL RISKS
   a) Problemsexperiencedduringtheexpropriationprocess
   b) Preservation of HistoricalandCulturalHeritage (archeologicalexcavationnecessity, projectchangeetc.)
   c) Negativeenvironmentalimpact of theproject (damagetopublicareas, trafficjams, damagetothirdpersons, security of goodsand life, dust, noisepollution, etc.)
   d) Construction of infrastructuredisplacements
   e) Dependence of the Project (permits, instructions, protocols, approvals, etc. to be obtainedfromtheofficialinstitutionandthirdpartiesforstartingandfinishingtheworks)

5. ORGANIZATIONAL RISKS
   a) RapidStaffCirculation (staffentry-exit)
   b) Communicationbreakdownbetweenprojectstakeholders (Administration, Consultant, Contractor, Designer) (Documentandinformationflow, coordinationmeetings, accurateandtimelyreporting, etc.)
   c) Delays in vehiclesupply
   d) Disruptions in thesignalingsystem
   e) Lack of test andcertificates

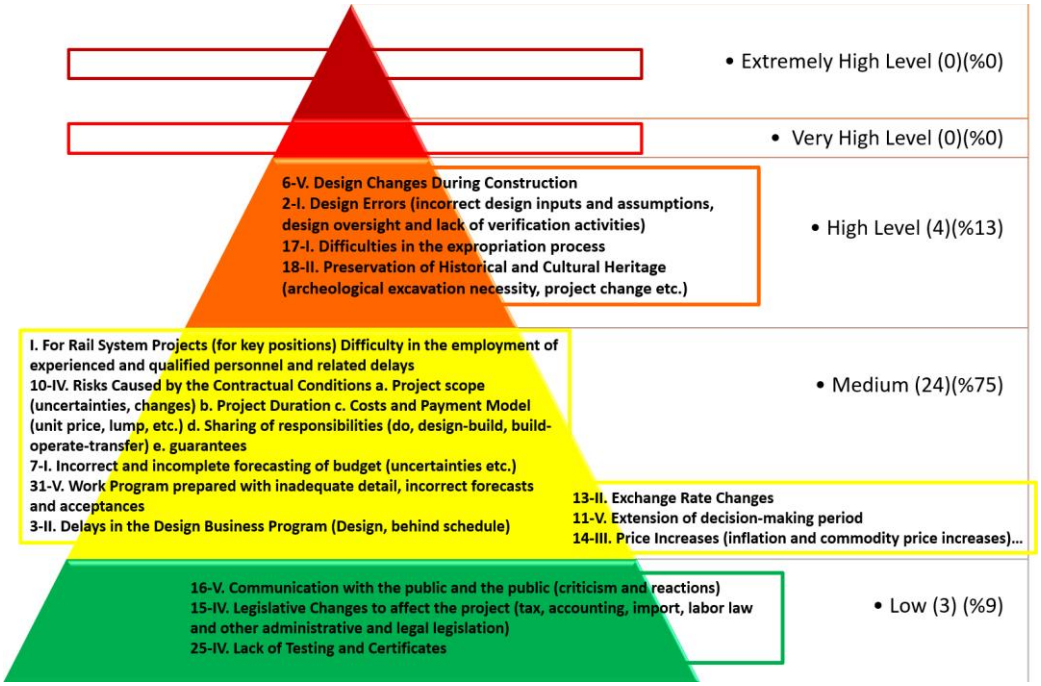
6. PROJECT MANAGEMENT RISKS

a) ForRailSystemProjects (forkeypositions) Difficulty in theemployment of experiencedandqualifiedpersonnelandrelateddelays
b) Effectiveoperation of OccupationalHealthandSafety Management System
c) Inadequatequalityconditions (insufficientqualityassuranceandqualitycontrolsystems, qualitydocuments, recurringnonconformities, etc.)
d) Inabilityto define qualityrequirements (incompleteanduncertainties in technicalspecifications)
e) Work Program preparedwithinaccurateforecastsandacceptancesthatare not in sufficientdetail
f) Adaptation Issueto New Technologies (lack of experiencedstaff, additionalcosts, changeresistance, etc.)

According to the questionnaire, 31 Risks determined by the participants and the results obtained by the participants are given below according to "Risk Score: In this study, "qualitative risk" analysis method was used to determine the risk perception using the 5-point indicator as the risk assessment method.

The risk map at the end of the trial is presented in Fig. The four major risk parameters identified as high level risk by experts participating in the trial are shown in the figure.

Figure 3.Risk Assessment Map for Railway Systems



IV. Conclusion

With this work, we analyzed which phases of a Railsystem Project passed. We have exchanged views with all stakeholders. We have included all practitioners who face risks in their work with expert assessment.

When we analyze the risks; problems related to design change, site delivery and expropriation, archaeological excavations, design delays, infrastructure failures, problems with the work program and similar risks were assessed in the high risk group.

Solution suggestions for reducing these risks have been discussed with experts. Several suggestions have been made in this context. First, the concept of "the results of uncertain projects can not be predicted" has been developed. This term can provide an opportunity to develop a correct approach for the projects. The right design and plan will reduce the risks that can occur. Birth. Working with Supervisor for the correct coordination of the workings should be started from the first step. Supervisor must work at all stages of the project, which will be important in terms of sustainability of the work. Uncertainties in the projects should be reduced. In the construction phase, only the main project should be found and project changes should not be accepted. Innovative innovation practices like building information modeling should be continued.

In the whole of Istanbul, it is necessary that all of the project management processes for the turn-key delivery of the Rail System projects, which are under construction and planned to be carried out, are carried out in the target time, under the predicted cost and quality standards,

The main objective is to define and evaluate the risks that we may encounter in the timeframe from initial to delivery of the Project with Risk Management which is one of the project management information fields and to determine the actions to prevent or mitigate these risks and thus reach our targets as we have anticipated.

Another important issue is that all project stakeholders receive adequate support from their affiliated Senior Management staff so that Project Management practices can be implemented effectively and efficiently at every level.

Dissemination of web-based management portals for Project Management applications; it will provide access to and sharing of important information about the project and the project as well as archiving the information.

REFERENCES

[1] Istanbul Metropolitan Municipality (IMM), "Annual Report", 2017, Istanbul, Turkey.

[2] Johann Dréo, "Sustainable development", 9 March 2006. *https://en.wikipedia.org/wiki/File:Sustainable_development.svg*

[3] J. Shethna, "Effective Stakeholder Management", Sept. 2016, *https://www.educba.com/effective-stakeholder-management/*

[4] Rusul M. Kanona, Arab Academy for Banking & Financial Sciences, Fall 2007

[5] Istanbul Metropolitan Municipality (IMM), Department of Rail Systems "Rail System Projects", unpublished.

[6] A.F. Serpellaa, X. Ferradaa, R. Howarda and L. Rubioa, "Risk management in construction projects: a knowledge-based approach", Procedia - Social and Behavioral Sciences 119 (2014) 653 – 662, 2014, [27th IPMA World Congress]

[7] T. Wang, S. Wang , L. Zhang , Z. Huang, and Y.Li, "A major infrastructure risk-assessment framework: Application to a cross-sea route project in China", International Journal of Project Management 34 (2016) 1403–1415, 2015

[8] A.S. Akintoye, M. J. MacLeod, "Risk analysis and management in construction", International Journal of Project Management Vol. 15, No. 1, pp. 31-38, 1997.

[9] Chapman, C., & Ward, S. (2011). How to manage project opportunity and risk. Jonh Wiley and Sons Ltd.

[10] A.F. Serpellaa, X. Ferradaa, L. Rubioa and Sergio Arauzoa , "Evaluating risk management practices in construction organizations", Procedia - Social and Behavioral Sciences 194 (2015) 201 – 210 , [28th IPMA World Congress, IPMA 2014, 29 September – 1 October 2014, Rotterdam, The Netherlands].

[11] N. Banaitiene and A. Banaitis, "Risk Management in Construction Projects", 2012 Banaitiene and Banaitis, licensee InTech., Chapter 19, http://dx.doi.org/10.5772/51460.

International Journal of Innovation Engineering and Science Research

Open Access

Exponential decay for the solution of the nonlinear equation induced by the mathematical model in mass production process with one sided spring boundary condition byfeedback control

Daewook Kim

Department of Mathematics and Education, Seowon University, Cheongju 28674,South Korea

This work was supported by National Research Foundation of Korea(Grant NRF-2016R1C1B1016288).

ABSTRACT

In this paper we consider the initial-boundary value problem for a nonlinear equation induced with respect to the mathematical models in mass production process with the one sided spring boundary condition by boundary feedback control. We establish the asymptotic behavior of solutions to this problem in time, and give an example and simulation to illustrate our results. Results of this paper are able to apply industrial parts such as a typical model widely used to represent threads, wires, magnetic tapes, belts, band saws, and so on.

Keyword:*Mass production process asymptotic Behavior one sided spring boundary condition boundary feedback control*

I. Introduction

In this paper, we consider the following initial-boundary value problem for a nonlinear Kirchhoff type equation with one sided spring boundary conditions by boundary feedback control with respect to the mathematical models in mass production process :

$$u_{tt}(x,t) - a(x)B(\| \nabla u(t) \|^2)\Delta u(x,t) + Ku(x,t) \quad (1)$$

$$+\lambda u_t(x,t) + \eta u_{xt}(x,t) = 0, (x,t) \in (0,1) \times (0,T);$$

$$u(0,t) = 0, \quad a(1)u_x(1,t) + h_1 u(1,t) = s(t), \ t \in (0,T); \quad (2)$$

$$u(x,0) = u_0(x), \quad u_t(x,0) = u_1(x), \ x \in (0,1), \quad (3)$$

where K, η and h_1 are given nonnegative constants; λ, and T, the given positive constants; $u_0, u_1, a(x)$, and B, the given functions; and $u(x,t)$, the transversal displacement of the strip at spatial coordinate x and time t. The hypotheses on these functions for our purpose will be specified later. (1) describes the nonlinear vibrations of an elastic string. And also, (2) means both ends attached with springs depends on spring constant h_1. In (1), λu_t is called a weak damping term and we call $-\lambda\Delta u_t$ instead of λu_t a strong damping term. We also consider the following control function in (2) as a feedback control:

$$s(t) = -h_2 u_t(1,t) - h_3 \sin t, \quad t \geq 0, \tag{4}$$

where h_2 and h_3 are positive constants under the condition $\sin t < 2B(\| \nabla u(t) \|^2)\cos t$.

Mathematical models in mass production process, control engineering, and biological system are often governed by nonlinear Kirchhoff type equations. The purpose of this paper is to study the existence and uniqueness of solutions of the model system with mixed boundary conditions. Moreover stability problems which investigate decay estimates of energy for the model system, are given.

Recently, the important problem of vibration suppression of axially moving string-like continua has received attention by our results [10, 11, 12, 13]. Axially moving string is a typical model widely used to represent threads, wires, belt, magnetic tape, cables and band-saws, especially when the subject concerned is long and narrow enough. Several our results have derived and studied linear and nonlinear mathematical models which describe the movement of such systems [10, 11]. And also, some our result has derived and studied some engineering system with respect to boundary feedback control [12].

Its original equation is given by

$$\rho h \frac{\partial^2 u}{\partial t^2} = (p_0 + \frac{Eh}{2L}\int_0^L (\frac{\partial u}{\partial x})^2 dx)\frac{\partial^2 u}{\partial x^2} \tag{5}$$

for $0 < x < L$, $t \geq 0$, where $u = u(x,t)$ is the lateral displacement at the space coordinate x and time t; E, the young's modulus; ρ, the mass density; h, the cross section area; L, the length; and p_0, the initial axial tension. This equation was first introduced by Kirchhoff [14](See Carrier[5]); hence, (5) is known as the Kirchhoff-type equation. When $K = \lambda = \eta = 0$ and the Cauchy or mixed problem for (1) has been studied by many authors(see [18, 8]). In particular, many authors have investigated the nonlinear wave equation when $a(x) \equiv 1$ without the coriolis force term (i.e., $\eta = 0$) acting on the system (1)-(3)(see [18, 8, 21, 7, 2, 16, 17]).

On the other hand, in Chen et al.[6] investigated the equation

$$\frac{\partial^2 u}{\partial t^2} + 2\gamma \frac{\partial^2 u}{\partial t \partial x} + (\gamma^2 - 1)\frac{\partial^2 u}{\partial x^2} = \frac{3E}{2}\frac{\partial^2 u}{\partial x^2}\left(\frac{\partial u}{\partial x}\right)^2, \tag{6}$$

where $u(x,t)$ is the transverse displacement at the axial coordinate x and time t; γ, the axial speed; and E, the Young's modulus (all dimensionless). Furthermore, Aassila and Kaya[1] investigated the system (1)-(3) with $a(x) \geq a_0 > 0$ and $a(x), a_x(x) \in L^\infty(\Omega)$, and the Dirichlet boundary condition without the coriolis force and forcing and dissipative terms. In case of system with mixed boundaries, some systems with various boundaries are studed by Bentsman and Hong[3], Vitillaro[20], Bociu and Lasiecka[4] and so on. In addition, Long[16] investigated the system (1)-(3) with $a(x) = 1$ and without the coriolis force. The authors mentioned above have only studied the local existence(no global existence) of solutions to their problems because of the nonlinearity of the term $a(x)B(\| \nabla u \|^2)$. And also, many researchers(See [3, 9]) investigated the asymptotic behavior of a solution for various practical systems by using some simulation.

The first objective of this paper is to verify the exponential decay for solutions to the system (1)-(3) with the boundary feedback control; For the guarantee of the energy decay of solutions to the system (1)-(3), we give the global existence result for the main system. Lastly, we try to show the system with controlled free boundary rather than without control has more stabilized vibration at the boundary by using simulation results.

II. Preliminaries

Throughout the paper, we will abbreviate to some notations $\Omega = (0,1)$, $T > 0$, $L^p = L^p(\Omega)$, $H^1 = H^1(\Omega)$, $H^2 = H^2(\Omega)$, where H^1, H^2 are the usual Sobolev spaces on Ω.

The norm in L^2 is denoted by $\|\cdot\|$. We also denote by $\langle\cdot,\cdot\rangle$ the scalar product in L^2 or pair of dual scalar product of continuous linear functional with an element of a function space. We denote by $\|\cdot\|_X$ the norm of a Banach space X and by X' the dual space of X. We denote by $L^p(0,T;X)$, $1 \le p \le \infty$ for the Banach space of the real functions $u:(0,T) \to X$ measurable, such that

$$\| u \|_{L^p(0,T;X)} = \left(\int_0^T \| u(t) \|_X^p \, dt\right)^{1/p} \quad \text{for} 1 \le p < \infty,$$

and

$$\| u \|_{L^\infty(0,T;X)} = \operatorname*{esssup}_{0<t<T} \| u(t) \|_X \quad \text{for} p = \infty.$$

And also we put for some positive M,

$$W(M,T) = \{v \in L^\infty(0,T;H^2): v_t \in L^\infty(0,T;H^1(\Omega)), v_{tt} \in L^\infty(0,T;L^2(\Omega)), \quad (7)$$

$$\| v \|_{L^\infty(0,T;H^2(\Omega))} \le M, \| v_t \|_{L^\infty(0,T;H^1)} \le M, \| v_{tt} \|_{L^\infty(0,T;L^2)} \le M, \quad (8)$$

$$|u(1,t)| \le M, |u_t(1,t)| \le M\}. \quad (9)$$

Lemma 2.1 $(b1, Theorem 6.2.1, p.137)$ *There exists the Hilbert orthonormal base* $\{\widetilde{w}_j\}$ *of* L^2 *consisting of the eigenfunctions* $\widetilde{w}_j$ *corresponding to the eigenvalue* λ_j *such that*

$$0 < \lambda_1 \le \lambda_2 \le \cdots \le \lambda_j \le \cdots, \lim_{j \to +\infty} \lambda_j = +\infty \quad (10)$$

Furthermore, the sequence $\{\widetilde{w}_j / \sqrt{\lambda_j}\}$ is also the Hilbert orthonormal base of H^1. On the other hand, we have also $\widetilde{w}_j$ satisfying the following boundary value problem:

$$-\Delta \widetilde{w}_j = \lambda_j \widetilde{w}_j, in \Omega, \quad (11)$$

$$a(1)\widetilde{w}_{jx} + h_1 \widetilde{w}_j(1) = 0, \widetilde{w}_j \in C^\infty(\overline{\Omega}). \quad (12)$$

Lemma 2.2 $(a1, ModifiedImbeddingtheorem)$ *The embedding* $V^\circ C^0(\overline{\Omega})$ *is compact, where* $\| v \|_V = \| \nabla v(t) \|$ *and*

$$\| v \|_{C^0(\overline{\Omega})} \le \sqrt{2} \| v \|_V, \quad for v \in V. \quad (13)$$

The proof of Lemma 2.2 is also straightforward and we omit it.

III. The existence and uniqueness theorem of solution

We make the following assumptions:

$(A_1) h_1 \ge 0,\ K \ge 0,\ \lambda > 0,\ \eta \ge 0$ and $2\lambda \le \eta$;

$(A_2) a(x) > 0$ for all $x \in \overline{\Omega},\ a(x) \in L^\infty(\Omega), a_x(x) \in L^\infty(\Omega)$;

$(A_3) 0 < l_1 \le essinf_{0 \le x \le 1} a(x), esssup_{0 \le x \le 1} a(x) \le L_1, L_1(< +\infty) > 0$;

$(A_4) 0 < l_2 \le essinf_{0 \le x \le 1} a_x(x), esssup_{0 \le x \le 1} a_x(x) \le L_2, L_2(< +\infty) > 0$;

$(A_5) B \in C^1(\mathbb{R}_+), B(\tau) \ge b_0 > 0, \quad B'(\tau) < \delta,$ where δ is a positive constant,

$0 < \tau \leq \| \nabla u(t) \|^2$ for $0 \leq t \leq T$;

$(A_6) K_0 = K_0(M,T) = \sup_{0 \leq \tau \leq M^2} B(\tau) > 0$ for $0 \leq t \leq T$.

Theorem 3.1 (Global Existence)

Let $B: [0,+\infty] \to [0,+\infty]$ satisfy the non-degeneracy condition $(i.e. B(\| \nabla u_0 \|^2) > 0)$. Let us assume that (A_1)-(A_6) hold and initial data $(u_0, u_1) \in H^2(\Omega) \times H^1(\Omega)$.

Then there exists a positive number M for every $T > 0$ such that the system (1)-(3) admits a unique global solution u in $W(M,T)$.

Proof. By using Galerkin's approximation, Lemma 2.1, Lemma 2.2 and a routine procedure similar to that of cite [10], we can the global existence result for the solution subject to (1)-(3) under the assumptions(A_1)-(A_6).

Remark 3.2 *In case of system using strong damping term instead of weak damping term, we can easily get the same result of solutions guaranteed by the boundedness of $R_m(t)$ which is using the above proof.*

Now we introduce an example to illustrate Theorem 3.1 as follows:

Example 3.3 *We consider the following nonlinear wave equation with spring boundary conditions*

$$u_{tt}(x,t) - \exp(x)(\| \nabla u \|^2)\Delta u(x,t) + u(x,t) + u_t(x,t) + u_{xt}(x,t) = 0$$
$$in \quad (x,t) \in (0,1) \times (0,\infty),$$
$$u(0,t) = 0, \exp(1)u_x(1,t) = -u(1,t) + s(t) \; on \; (0,\infty),$$
$$u(x,0) = \exp\left(-64\left(x - \frac{1}{2}\right)^2\right), u_t(x,0) = 0 \; in \; (0,1),$$

where $\delta(> 0)$ is a constant. We can choose the suitable constants h_2, h_3 of $s(t)$ in (4).

Actually, the above example satisfies the assumptions (A_1)-(A_6) and the given conditions for existence. Therefore, its global unique existence is guaranteed by Theorem 3.1.

IV. Asymptotic Behavior

In this section, we study the asymptotic behavior of the generalized energy as $t \to +\infty$

$$F(t) = \frac{1}{2}\left[\| u_t(t) \|^2 + \int_0^1 a(x)B(\| \nabla u(t) \|^2)|\nabla u(x,t)|^2 dx + K \| u(t) \|^2\right] + \frac{h_1 b_0}{2}|u(1,t)|^2 + h_3 b_0 u(1,t)\sin t, \quad (14)$$

where u is the unique solution of the system (1)-(3) given by Theorem 3.1.

To continue the proof, we need to introduce three new functionals

$$E_0(t) = \frac{1}{2}\int_0^1 [|u_t(t)|^2 + |\nabla u(t)|^2]dx, \quad (15)$$

$$E(t) = \frac{1}{2}\int_0^1 [|u_t(t)|^2 + a(x)B(\| \nabla u(t) \|^2)|\nabla u(x,t)|^2 + K|u(t)|^2]dx, \quad (16)$$

$$F(t) = E(t) + \frac{h_1 b_0}{2}|u(1,t)|^2 + h_3 b_0 u(1,t)\sin t. \quad (17)$$

In general, we say that $E_0(t)$ is the kinetic energy and $E(t)$ is the energy including not only kinetic facts but also potential facts.

Theorem 4.1 (Energy Decay)

Let $q > \eta + L_1\delta \geq 0$ and $\lambda \geq \frac{L_2^2 K_0^2}{L_1 \delta} \geq 0$, and suppose that every definition and hypothesis in the previous chapter holds. Then, the solution $u(x,t)$ of the system (1)-(3) satisfies the following energy decay estimates: There exists a positive constant C_4 such that

$$E(t) \leq \alpha_1 E_0(0)\exp\{-C_4 t\} for\ all\ t \geq 0.$$

Proof. Multiplying the first equation in the system (1)-(3) by u_t and applying the boundary condition (2), we have

$$\begin{aligned}
&\frac{1}{2}\frac{d}{dt}\| u_t(t) \|^2 + \int_0^1 a_x(x)B(\| \nabla u(t) \|^2)u_t(x,t)u_x(x,t)dx \\
&+\frac{1}{2}\frac{d}{dt}\int_0^1 a(x)B(\| \nabla u(t) \|^2)u_x(x,t)u_x(x,t)dx \\
&-\frac{1}{2}\int_0^1 a(x)(B(\| \nabla u(t) \|^2))' u_x(x,t)u_x(x,t)dx \\
&+\frac{h_1}{2}B(\| \nabla u(t) \|^2)\frac{d}{dt}|u(1,t)|^2 + h_3 B(\| \nabla u(t) \|^2)\frac{d}{dt}(u(1,t)\sin t) \\
&+h_2 B(\| \nabla u(t) \|^2)|u_t(1,t)|^2 - h_3 B(\| \nabla u(t) \|^2)u(1,t)\cos t \\
&+\frac{K}{2}\frac{d}{dt}\| u(t) \|^2 + \lambda \| u_t(t) \|^2 + \eta\int_0^1 u_{xt}(x,t)u_t(x,t)dx = 0.
\end{aligned}$$

Dividing both sides by $B(\| \nabla u(t) \|^2)$ since $B(\| \nabla u(t) \|^2) > 0$, we get

$$\begin{aligned}
&\frac{1}{2B(\|\nabla u(t)\|^2)}\frac{d}{dt}\left[\| u_t(t) \|^2 + \int_0^1 a(x)B(\| \nabla u(t) \|^2)|\nabla u(x,t)|^2 dx + K \| u(t) \|^2\right] \\
&+\frac{d}{dt}\left[\frac{h_1}{2}|u(1,t)|^2 + h_3 u(1,t)\sin t\right] \\
&+\frac{1}{2B(\|\nabla u(t)\|^2)}\int_0^1 a_x(x)B(\| \nabla u(t) \|^2)u_t(x,t)u_x(x,t)dx \\
&-\frac{1}{4B(\|\nabla u(t)\|^2)}\int_0^1 a(x)(B(\| \nabla u(t) \|^2))' u_x(x,t)u_x(x,t)dx \\
&+h_2|u_t(1,t)|^2 - h_3 u(1,t)\cos t \\
&+\frac{1}{2B(\|\nabla u(t)\|^2)}\left[\lambda \| u_t(t) \|^2 + \eta\int_0^1 u_{xt}(x,t)u_t(x,t)dx\right] \\
&= 0.
\end{aligned}$$

From the assumptions (A_3)-(A_6) and the Cauchy-Schwarz inequality, we deduce that

$$\begin{aligned}
&\frac{1}{2B(\|\nabla u(t)\|^2)}\frac{d}{dt}\left[\| u_t(t) \|^2 + \int_0^1 a(x)B(\| \nabla u(t) \|^2)|\nabla u(x,t)|^2 dx + K \| u(t) \|^2\right] \\
&+\frac{d}{dt}\left[\frac{h_1}{2}|u(1,t)|^2 + h_3 u(1,t)\sin t\right] \\
&+\frac{1}{2B(\|\nabla u(t)\|^2)}\left[\left(\lambda - \varepsilon L_2 K_0 - \frac{\eta}{2}\right)\| u_t(t) \|^2 + \left(q - \frac{L_2 K_0}{2\varepsilon} - \frac{\eta}{2}\right)\| \nabla u(t) \|^2\right] \\
&-\frac{1}{2B(\|\nabla u(t)\|^2)}\left(q + \frac{L_1\delta}{2} - \frac{L_2 K_0}{4\varepsilon}\right)\| \nabla u(t) \|^2 \\
&+\frac{1}{2B(\|\nabla u(t)\|^2)}h_3 u(1,t)\sin t \leq 0,
\end{aligned}$$

where $\sin t < 2B(\| \nabla u(t) \|^2)\cos t$.

Letting $\frac{L_2K_0}{2q-\eta} \le \varepsilon \le \frac{L_2K_0}{2(\eta+L_1\delta)}$ by the condition for q of Theorem 4.1 which is the positive constant and using the global existence results(i.e., $\| \nabla u(t) \| \le M$), we have

$$\begin{aligned} &\frac{1}{2B(\|\nabla u(t)\|^2)}\frac{d}{dt}\left[\| u_t(t) \|^2 + \int_0^1 a(x)B(\| \nabla u(t) \|^2)|\nabla u(x,t)|^2 dx + K \| u(t) \|^2\right] \\ &+\frac{d}{dt}\left[\frac{h_1}{2}|u(1,t)|^2 + h_3 u(1,t)\sin t\right] \\ &+\frac{1}{2B(\|\nabla u(t)\|^2)}[C_1 \| u_t(t) \|^2 + C_2 \| \nabla u(t) \|^2 + h_3 u(1,t)\sin t] \le 0, \end{aligned} \tag{18}$$

where $C_1 = \lambda - \varepsilon L_2 K_0 - \frac{\eta}{2}, C_2 = q - \frac{L_2K_0}{2\varepsilon} - \frac{\eta}{2}$ and C_1, C_2 are nonnegative constants from the assumptions of Theorem 4.1.

Multiplying (18) by the Kirchhoff part $B(\| \nabla u(t) \|^2)$, we get the following result from (A_5):

$$\begin{aligned} &\frac{1}{2}\frac{d}{dt}\left[\| u_t(t) \|^2 + \int_0^1 a(x)B(\| \nabla u(t) \|^2)|\nabla u(x,t)|^2 dx + K \| u(t) \|^2\right] \\ &+\frac{1}{2}\frac{d}{dt}[h_1 b_0 |u(1,t)|^2 + h_3 u(1,t)\sin t] \\ &+\frac{C_3}{2}[\| u_t(t) \|^2 + \| \nabla u(t) \|^2 + h_3 u(1,t)\sin t] \le 0, \end{aligned}$$

where $C_3 = \min\{1, C_1, C_2\}$.

From (14)-(17), we deduce that

$$\frac{d}{dt}F(t) + \frac{C_3}{2}E_0(t) \le 0. \tag{19}$$

Proposition 1 (Energy equivalence)

$$\alpha_0 E_0(t) \le F(t) \le \alpha_1 E_0(t) for all t \ge 0,$$

where $\alpha_0 = \min\{1, l_1 b_0 + K\}$ and $\alpha_1 = \max\{1, K, L_1K_0, b_0(h_1+1)M\}$.

Proof. By the assumptions (A_3) and (A_6), we have

$$\max\{1, K, L_1K_0, b_0(h_1+1)\mathrm{M}\}E_0(t) \ge \mathrm{F}(t).$$

And also, applying the assumptions (A_3) and (A_6), Lemma 2.2, and the positivity of $\frac{h_1b_0}{2}|u(1,t)|^2$, we deduce

$$\min\{1, l_1 b_0 + K\}E_0(t) \le F(t).$$

From (19) and Proposition 1, we get

$$E_0(t) \le E_0(0)\exp\{-C_4 t\} \text{for all } t \ge 0 \text{ and as } t \to +\infty,$$

where C_4 is a positive constant.

From Proposition 1, we get $F(t) \le \alpha_1 E_0(t)$. This implies that

$$F(t) \le \alpha_1 E_0(0)\exp\{-C_4 t\} \quad \text{for all } t \ge 0 \text{ and as } t \to +\infty.$$

By the positivity of $\frac{h_1b_0}{2}|u(1,t)|^2$, we also deduce

$$E(t) \le \alpha_1 E_0(0)\exp\{-C_4 t\} \quad \text{for all } t \ge 0 \text{ and as } t \to +\infty.$$

V. Numerical Results

Now, we try to deal with numerical simulation results for the special system under some assumptions of Example 3.3 In the numerical results section, we consider two parts, that is, simulation of solution's

shapes controlled system or not in time with respect to energy decay of solutions on the free boundary.

5.1 Solution's Shapes in time

When it comes to the numerical results of solutions, our purpose is showing solution for 3-dimension($i.e.\,\mathrm{u(x,t),x,t}$) in the system. We consider that boundaries $\exp(1)u_x(1,\mathrm{t}) = -u(1,t) + \mathrm{s(t)}$ at $x = 1$ in the system as we know. The system of special case makes with special boundary feedback control $-u_t(1,t) - \sin t$. Solution's shapes in full-time and $t = 1$ including boundaries are given in Figures 1

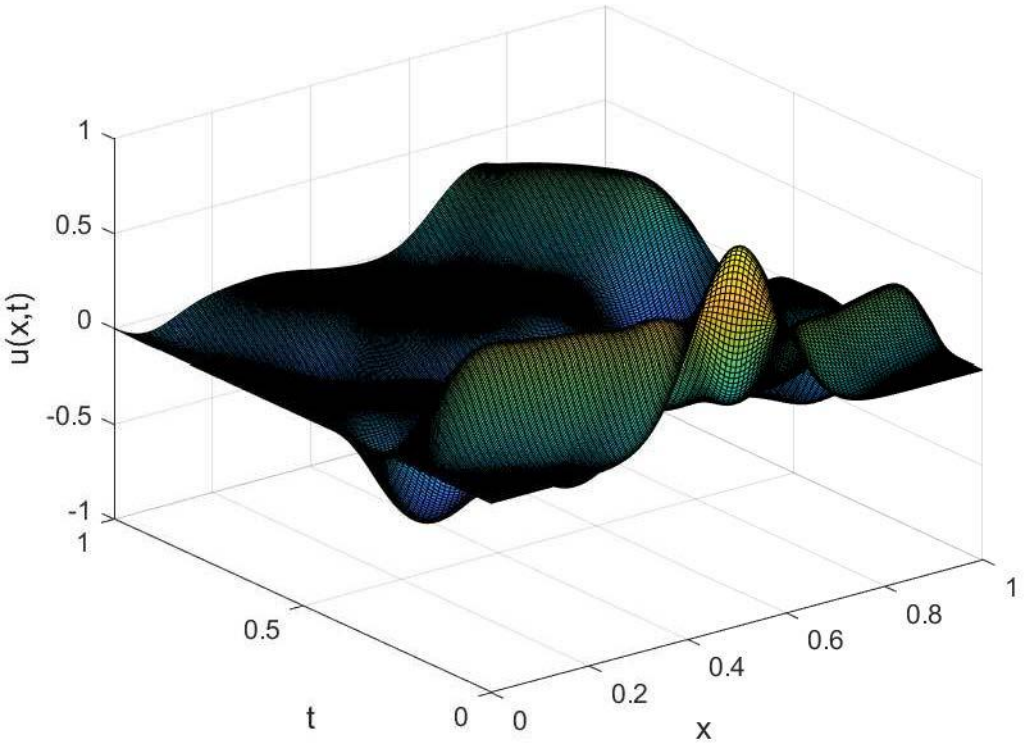


Figure 1: Solution's shapes on the whole time with spatial parts by boundary feedback control

5.2 Simulation of the main system with boundary controlled or not

In this section, we try to compare main system with boundary feedback control and main system with boundary feedback control. The aim of this section is showing the system with controlled free boundary rather than without control has more stabilized vibration at the boundary. The system with boundary feedback control (See Figure 1) has stable solution and relating energy unlike the system without boundary control (See Figure 2).

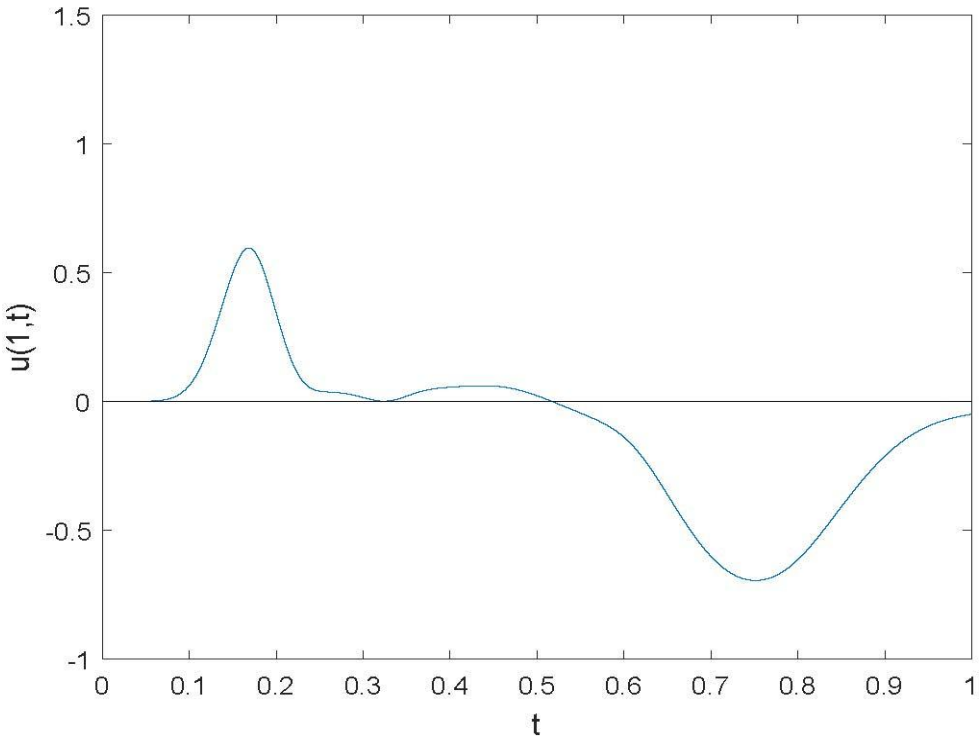


Figure 2: One sided spring boundary solution's shapes on the main system without boundary feedback control

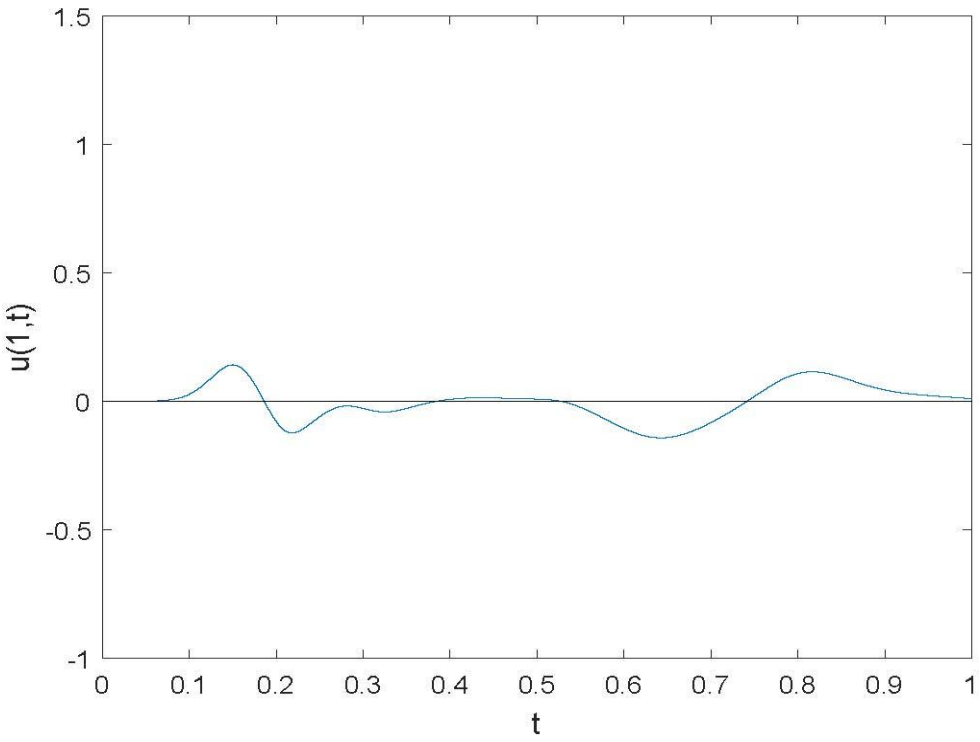


Figure 3: One sided spring boundary solution's shapes on the main system with boundary feedback control

In Section 5, for the numerical results, we used the standard finite difference method(FDM) and MATLAB.

VI. Conclusions

We dealt with analytical results and their numerical simulations. We established the global existence and uniqueness of weak solutions to this problem in time, and give an example and simulation to illustrate our results. Finally, we try to get the asymptotic behavior of energy and its simulation results. Actually, we get the result that the system with controlled free boundary rather than without control has more stabilized vibration at the boundary. These results are very useful, indeed, our results are able to apply industrial parts such as a typical model widely used to represent threads, wires, magnetic tapes, belts, band saws, and so on.

References

[1] M. Aassila and D. Kaya, *On Local Solutions of a Mildly Degenerate Hyperbolic Equation*, J. Math. Anal. Appl., **238** (1999), 418-428.

[2] A. Arosio and S. Spagnolo, *Global solution to the Cauchy problem for a nonlinear hyperbolic equation, in "Nonlinear Partial Differential Equations and their Applications, Collе'ge de France Seminar"*, (H. Brе'zis and J.-L. Lions, Eds.), Vol. **IV**, pp. 1-26, Research Notes Mathematics Vol. **129**, Pitman, Boston, 1984.

[3] J. Bentsman, K.-S. Hong, *Transient Behavior Analysis of Vibrationally Controlled Nonlinear Parabolic Systems with Neumann Boundary Conditions*, IEEE Transactions on Automatic Control, **38** (1993), 1603-1607.

[4] L. Bociu, I. Lasiecka, *Local Hadamard well-posedness for nonlinear wave equations with supercritical sources and damping*, Journal of Differential Equations, **186** (2002), 259-298.

[5] C.F. Carrier, *On the vibration problem of elastic string*, J. Appl. Math., **3** (1945), 151-165.

[6] L. Chen, W. Zhao, H. Ding, *On Galerkin Discretization of Axially Moving Nonlinear Strings*, Acta Mechanica Solida Sinica, **22** (2009), 369-376.

[7] R.W. Dickey, *The initial value problem for a nonlinear semi-infinite string*, Proc. Roy. Soc. Edinburgh Vol. **82** (1978), pp. 19-26.

[8] Y. Ebihara, L.A. Medeiros, M.M. Miranda, *Local solutions for a nonlinear degenerate hyperbolic equation*, Nonlinear Analalysis, **10** (1986), 27-40.

[9] K.-S. Hong, *Asymptotic Behavior Analysis of a Coupled Time-Varying System: Application to Adaptive Systems*, IEEE Transactions on Automatic Control, **42** (1997), 1693-1697.

[10] D. Kim and I.H. Jung, *Asymptotic behavior of a nonlinear Kirchhoff type equation with spring boundary conditions*, Computers and Mathematics with Applications **62** (2011), 3004–3014.

[11] D. Kim, S. Kim and I.H. Jung, *Stabilization for the Kirchhoff type equation from an axially moving heterogeneous string modeling with boundary feedback control*, Nonlinear Analysis: Theory, Methods and Applications **75** (2012), 3598–3617.

[12] D. Kim, Y.H. Kang J. B. Lee, G. R. Ko and I.H. Jung, *Stabilization of a nonlinear Kirchhoff equation by boundary feedback control*, Nonlinear Analysis: Theory, Methods and Applications **75** (2012), 3598–3617.

[13] D. Kim, *Stabilization for the viscoelastic Kirchhoff type equation with nonlinear source*, East Asian Math. J. **32** (2016), 117–128.

[14] G. Kirchhoff, *Vorlesungen über Mechanik*, Teubner, Leipzig, 1983.

[15] J.L. Lions, *Quelques méthodes de résolution des problémes aux limies non linéaires, Dunod Paris Gauthier-Villars*, 1969.

[16] N.T. Long, *On the nonlinear wave equation* $U_{tt} - B(t, \| U_x \|^2)U_{xx} = f(x, t, U, U_x, U_t)$ *associated with the mixed homogeneous conditions*, J. Math. Anal. Appl., **274** (2002), 102-123.

[17] J.Y. Park and T.G. Ha, *Existence and asymptotic stability for the semilinear wave equation with boundary damping and source term*, J. Math. Phys., **49** (2008), 053511-053511-26 .

[18] S.I. Pohozaev, *On a class of quasilinear hyperbolic equation*, Math. USSR-Sb, **25** (1975), 145-158.

[19] P.A. Raviart and J.M. Thomas, *Introduction à l'analyse numérique des equations aux dérivées partielles, Masson Paris*, 1983.

[20] E. Vitillaro, *Global existence for the wave equation with nonlinear boundary damping and the source terms*, Journal of Differential Equations, **186** (2002), 259-298.

[21] Y. Yamada, *Some nonlinear degenerate wave equations*, Nonlinear Analysis Vol. **10** (1987), pp. 1155-1168.

International Journal of Innovation Engineering and Science Research

Open Access

An Assessment of Commercial Real Estate Performance as an Investment Option in Nnewi, Anambra State, Nigeria

Aniagolu Celestine Obinna (PhD)
Dept of Estate Management, ESUT, Enugu,
Enugu State, Nigeria

Obodo Mercy Chika
Dept of Estate Management, ESUT, Enugu,
Enugu State, Nigeria

Ewurum Nonso Izuchukwu
Dept of Estate Management, IMT, Enugu,
Enugu State, Nigeria

ABSTRACT

Nnewi in the past two decades has grown considerably not only in size and infrastructural development but also as a commercial town to reckon with in Anambra State South-East Nigeria. This work therefore tries to assess the performance of commercial real estate development as an investment option in Nnewi using shops, offices and warehouses. This study is also delimited to old Nnewi-Onitsha road, Edo-Ezemewi Road and Nwagbara Road which are important commercial roads (CBD) in Nnewi. The study tries to determine the performance of the selected commercial uses in the selected roads from 2006 – 2010 and 2011 – 2015. Thereafter a comparison of the two periods was made. The survey research method was adopted. Data was collected through questionnaires distributed to Landlords of commercial properties in the study area, Estate Surveyors and Valuer, property developers in Nnewi and other secondary sources. The hypothesis developed was tested using ANOVA. The study shows a significant difference in the performance of shops offices and warehouses in Nnewi. The study recommended among other things that real estate investors in Nnewi and indeed in Nigeria should seek the help of professionals (Estate Surveyors and Valuers) who will carry out market and consumer preferences research/analysis before they venture into commercial real estate development.

Keywords: *Assessment, Performance, Investment options, Real Estate, Commercial Estate.*

I. Introduction:

Nnewi, a town in Anambra State South-East Nigeria is well known because of the scale of commercial and industrial activities going on there. Infact from time immemorial indigenes of Nnewi are known for their prowess in automobile parts trading. However, before the Biafran civil war in Nigeria which took place between 1966 and 1970, Nnewi was a rural town with very little commercial activities going on at Nkwo market roundabout (Okafor, 2016). With the undeclared Biafran civil war in 1966 and the

pogrom in the North, the incidence of returnees, escapees and refugees gave rise to the urbanization of Nnewi as a town.

Today the town has become a centre for commercial and industrial activities and is recognized as the second largest city in Anambra state, Nigeria. It experiences high level financial activities and thus hosts the branches of major banks, other financial institutions, and communication companies to mention but a few (Okafor 2016). According to Onwutalobi (2016) the major products of the town are in the areas of palm oil products, cosmetics, motor and motorcycle parts, books and stationeries, textile material, electric cables etc. The economy of the town is currently positively affecting neighbouring towns and villages (Onwutalobi 2015).

The high level of commercial and industrial activities in the town soon started attracting migrants from other states, towns and villages (Obichere, 1982). This led to continuous increase in the population of the town, leading to serious investments in real estate development to meet with demand for residential, commercial and industrial development. It is against this background that this study decided to assess the performance of commercial real estate development in Nnewi as an investment option.

II. Statement of the Problem:

Commercial real estate investment in Nigeria is quite diverse and is influenced by conditions existing in the places where they are located (Okafor 2016). Since Nnewi started developing as a major industrial and commercial hub in Anambra State traders, industrialists and merchant see it as a safe haven. Thus, Nnewi started experiencing sharp increase in population. This is followed with corresponding demand for shops, offices, warehouses and other commercial properties needed to accommodate the expansion of the town and the ever increasing demand for products of business units in the town.

Hence real estate developers in Nnewi have little or no option than to go into massive development of commercial properties. Besides commercial uses are taking over residential uses in quick succession. The most favoured types of commercial developments are shops, offices and warehouses. Thus this paper is interested in assessing the performance of commercial real estate development as an investment option in Nnewi.

III. Aim and Objectives of the study:

The aim of this study is to determine the performance of commercial real estate as an investment option in Nnewi town, Anambra state Nigeria. In order to achieve the above stated aim the paper intends to pursue the following line of objectives:

a. To assess the performance of shops, offices and warehouses in Nnewi between 2006 and 2010
b. To determine the performance of shops, offices and warehouses in Nnewi between 2011 and 2015.
c. To compare the performance of shops, offices and warehouses in Nnewi between 2006 and 2010 and between 2011 and 2015.

IV. Research Questions

The following research questions were put forward:

a. What are the performances of shops, offices and warehouses in Nnewi between 2006 and 2010
b. What are the performances of shops, office and warehouses in Nnewi between 2011 and 2015.
c. How could the performances of shops, offices and warehouses in Nnewi between 2006 and 2010 and 2011 and 2015 be compared.

V. Scope of the Study

In view of the broad nature of commercial investments, this study covers only shops, offices and warehouses. Also the study is delimited to old Nnewi-Onitsha road, Edo-Ezemewi road and Nwagbara road in Nnewi town.

VI. Hypothesis Formulation:

To investigate the research questions, the following hypothesis was put forward:

H_0: There is no significant difference in the performance of shops, offices, and warehouses in Nnewi town, Anambra state Nigeria.

H_1: there is a significant difference in the performance of shops, offices and warehouses in Nnewi town Anambra state Nigeria.

VII. Literature Review:

7.1 Concept of Investment

According to Okofor (1983) investment can simply be defined as expenditure in cash or its equivalence done during one or more time periods in anticipation of enjoying a net inflow of cash or its equivalence in some future time period. Investment according to Hemuka (2014) can also be seen as tying down or sacrificing the liquidity of capital with expectation of returns. Emoh (2004) concluded by asserting that the essential nature of any investment is the foregoing of a capital sum in return for a regular income over a period of time.

7.2 Classification of Investment

Ogbuefi (2002) classified investment into financial assets and non-financial assets. According to him, financial assets are made up of (a) direct ownership (equity) securities (such as common and preferred stocks (b) indirect ownership securities (shares of close-ended and open ended investment companies) (c) Monetary claims (such as government bonds, corporate bonds and savings / fixed deposit accounts) and (d) contingent claims (such as warrantees, options and convertibles). However, Non financial assets include (a) real estate (in the form of residential, commercial, industrial, recreational agricultural, etc) (b) collectibles (such as art, antiques, coins and stamps) and (c) precious metals and stones.

Kalu (2001) however classified investment into shares, bank deposits, stock & bonds and property. Finally, Udechukwu (2009) made his classification into gilt-edged securities (such as treasury bills, treasury certificates, and government stocks), company stocks (such as shares and debentures and property investment.

7.3 Real Estate Investment

Thorncroft (1965) opined that investment in real property can be seen as the employment and application of a capital sum in real property in expectation of a return either in the form of a reoccurring income or in the form of a gain due to appreciation in value or both.

Udobi (2014) quoting Millington (1992) noted the distinguishing characteristics of real estate investment as follows: heterogeneity, proof of ownership, imperfect market, adaptation, durability, capital requirement, transfer of ownership, source of income, limited supply of land and demand for land. Kalu (2001) equally stated the features of real estate investment as follows: high cost of transfer, indivisibility, income and capital growth, perpetuity, imperfect knowledge, risk, liquidity and heterogeneity. Finally, Udobi (2014) enumerates the qualities of property investment which distinguishes them from other types of investment as indivisibility, cost of ownership transfer, taxation, ease of marketability, capital appreciation, capital growth, form of security (collateral), turnover, provision of savings, management problems, direct control, liquidity of income and profitability index, etc.

Ifediora (2009) classified real estate for valuation purposes into (a) investment properties such as block of flats, office blocks, tenement buildings, shopping centers, leasehold interests, residential houses, commercial properties, hotels, industrial, patent, copyrights, royalties, stock, shares, etc (b) marketable non-investment, properties such as owner-occupied houses, staff housing estates, goodwill, furniture & fittings, equipment, antiques, paintings and artworks, gems and jewellery (c) service properties (non marketable non investment) such as churches, town halls, government houses, government schools, government hospitals, road networks and bridges.

7.4 Commercial Real Estate Investments

Udechukwu (2009) pointed out that commercial properties include the various types of income-producing properties that are basically used for trading (buying & selling). Olusegun (2011) classified these into stalls, shops, purpose built shopping mall, supermarkets, banking halls, offices and warehouses. Also included are chain stores, departmental stores, mobile shops, etc. Johnson, Davis and Shapiro (2000) in their own opinion identified four common categories of commercial properties as follows retail (properties where goods are sold to public), industrial warehouses and offices.

7.5 Real Estate Performance Measurement Tool

Kalu (2001) opined that the need for property portfolio performance measurement arises due to four important reasons namely, communication, actual performance against goals, accountability and basis for future action. He further enumerated the property portfolio performance measurement methods as follows:

a. Measurement of Past Return (Holding Period Return (HPR)
b. Arithmetic Mean Rate of Return (AMRR)
c. Geometric Mean Rate of Return (GMRR) and
d. Money – Weighted Rate of Return (MWRR)

Udobi, Ugonabo and kalu (2013) adopted the Holding Period Return (HPR) method to analyze the performance of Real Estate Investment in Onitsha Metropolis and Investment in Bank Shares in Nigeria

VIII. Research Methodology:

8.1 Research Design:

The research design adopted in this work is the Survey Research Method. According to Nwabuokei (1986), survey research method studies large and small populations or universe by selecting and studying samples chosen from population to discover the relative incidence, distribution and inter-relationships of sociological variables.

8.2 Brief Description of the study Area:

The study area is Nnewi which is the second largest town in Anambra state after Onitsha the commercial nerve of the state. According to Onwutalobi (2015), Nnewi covers two Local Government Areas (county councils) namely Nnewi North and Nnewi South. Nnewi can be located on the globe with the following co-ordinates: 6^0 1′N, 6^0 55′E. The town forms part of the tropical rain forest region of Nigeria and is located about 22 kilometers South-East of Onitsha. According to NPC (2006), Nnewi has a population of 391,227 (as at 2006 population figure which happens to be the last population census in Nigeria).

Nnewi City
Motto(s): Leading Innovations

Location in Nigeria

Coordinates: 6°1′N 6°55′E

The main occupation of Nnewi indigenes is trading and they stand tall in any trading business across National and International boundaries. They are also well known in the area of farming, arts and craft, music etc. Notable festivals in the town include new yam festival, (Ifejioku) and other masquerade festivals. Nnewi is the industrial hub of south-East, Nigeria and arguably the largest automobile spare part market in Africa. It is the home of the late Biafran war Lord Dim Chukwuemeka Odumegwu Ojukwu.

8.3 Sources of Data:

Data for this work were collected from both primary and secondary sources as follows:

a. Primary sources:

The primary sources of data include reconnaissance survey of the three roads that were used in the study, distribution of questionnaires, personal observations, oral interview etc. The questionnaire helped in the collection of data on rental values and capital values of properties within the study area.

b. Secondary Data:

The secondary data came from the internet, journals, text books, published and some unpublished materials. This was useful in the review of related literature.

IX. Data Presentation:

9.1 Presentation of data on performance of shops, offices and warehouses in Nnewi between 2006 and 2010:

To determine the performance of shops, offices and warehouses in the study area the rent passing on such properties in the study areas within the period in view was collected and analyzed for old Nnewi-Onitsha road, Edo-Ezemewi road and Nwagbara road. The results are presented in figure 1, 2 and 3 respecively.

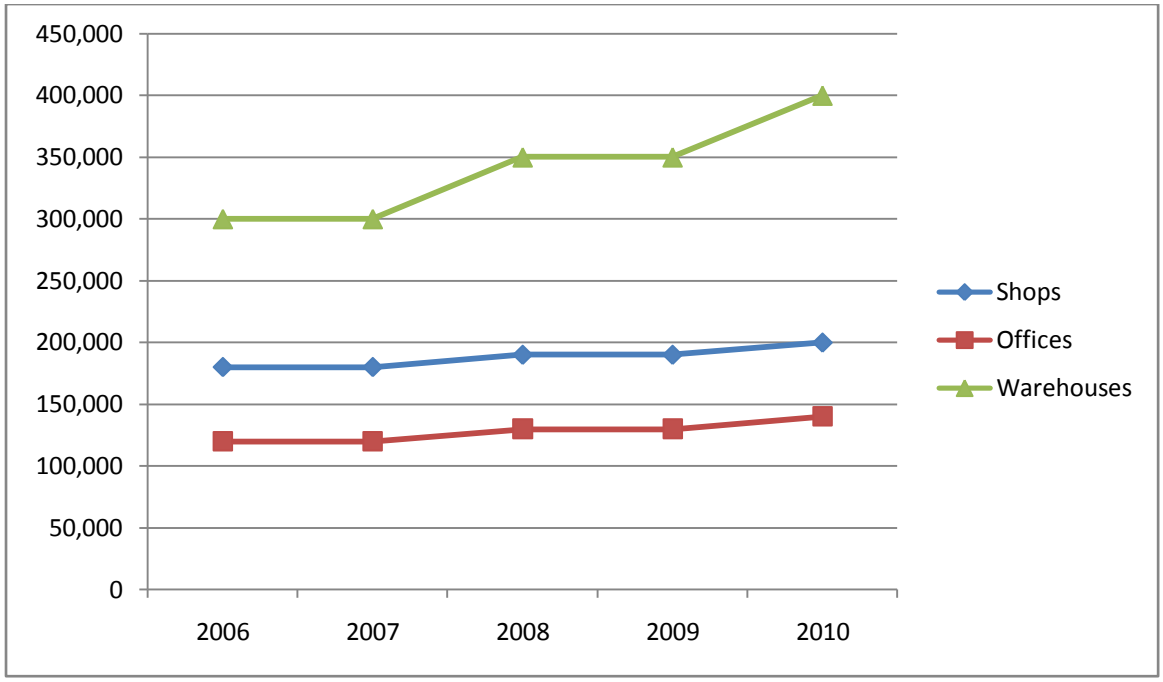


Fig. 1: Graph showing Rental Trend in Old Nnewi – Onitsha Road between 2006 – 2010 for Shops, Offices and Warehouses

Source: Field Survey, 2016

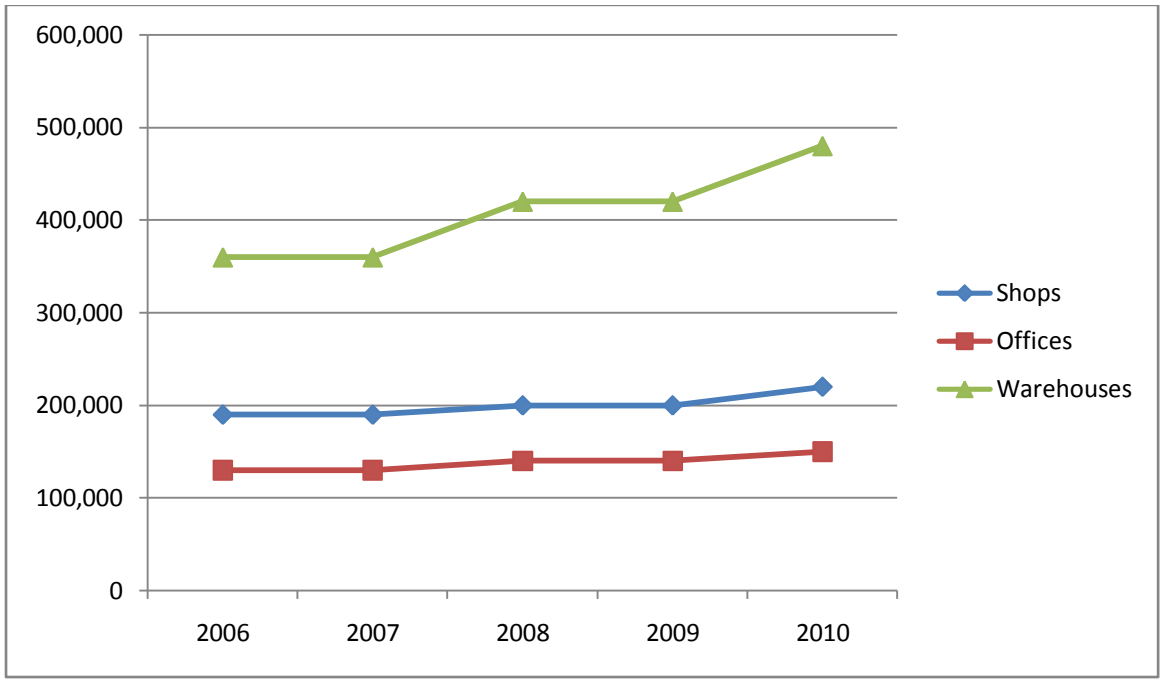


Fig. 2: Graph showing Rental Trend in Edo Ezemewi Road between 2006 – 2010 for Shops, Offices and Warehouses

Source: Field Survey, 2016

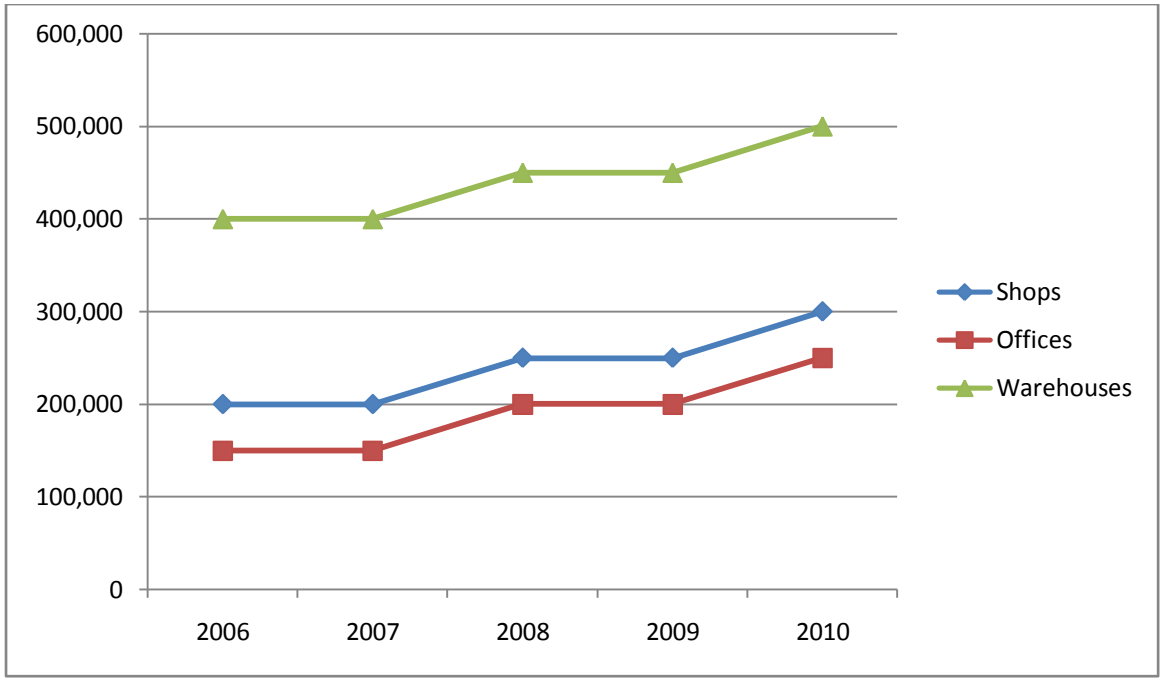


Fig. 3: Graph showing Rental Trend in Nwagbara Road between 2006 – 2010 for Shops, Offices and Warehouses

Source: Field Survey, 2016

The rate of return on investment was then determined by comparing the average annual value of each type of commercial property by either the capital sum invested by the owner or the estimated value of the property. The result of the computation in the three roads studied as presented in table 1.

Table1:

Presentation of data on the Rate of Return on investment for shops, offices and warehouses in the study area (2006 - 2010)

Categories of properties	Rate of Returns on investment		
	Old Nnewi-Onitsha road	Edo-Ezemewi road	Nwagbara road
Shops	17%	19%	24.3%
Offices	11%	11.5%	15.8%
warehouses	8.5%	10.2%	11%

Source: Field Survey 2016

From the above it could be seen that between 2006 and 2010 for shops, Nwagbara road shows the highest rate of return, followed by Edo-Ezemewi road and old Nnewi-Onitsha road respectively. The trend was also maintained for offices and warehouses.

9.2 PRESENTATION OF DATA ON PERFORMANCE OF SHOPS, OFFICES AND WAREHOUSES IN NNEWI BETWEEN 2011 AND 2015:

Similarly, rental data was collected from old Nnewi-Onitsha road, Edo-Ezemewi road, and Nwagbara road for shops, offices and warehouses for 2011 – 2015. The rent was equally analyzed and is presented in figure 4, 5 and 6.

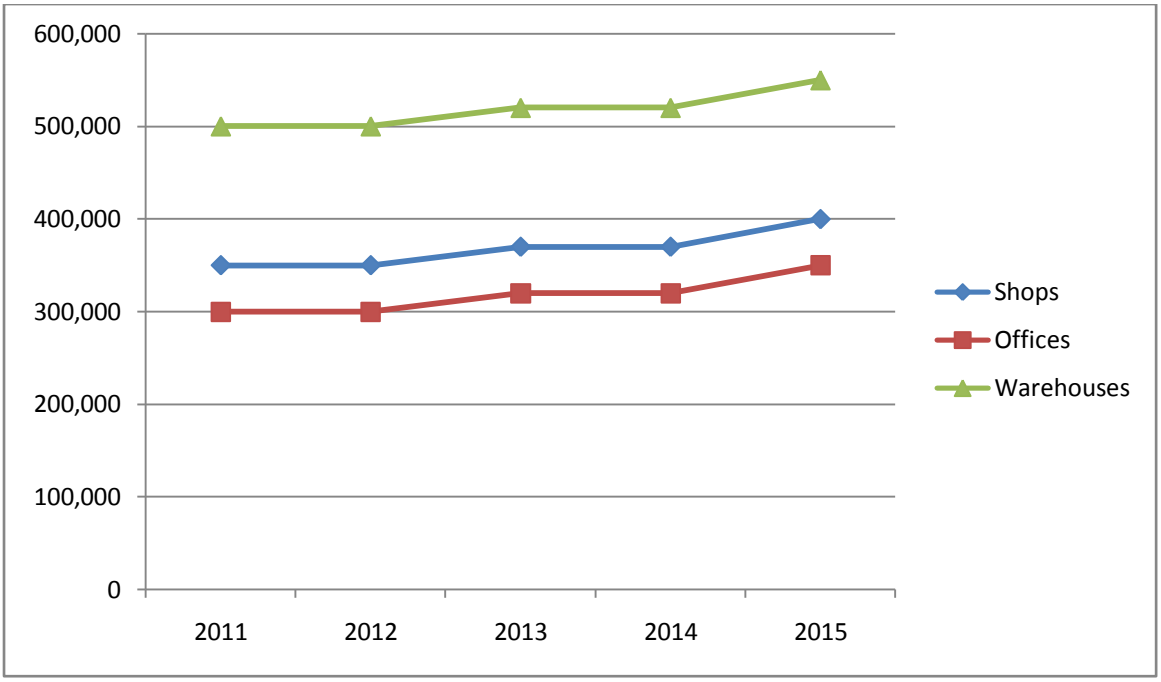


Fig. 4: ***Graph showing Rental Trend in Old Nnewi – Onitsha Road between 2011 – 2015 for Shops, Offices and Warehouses***

Source: Field Survey, 2016

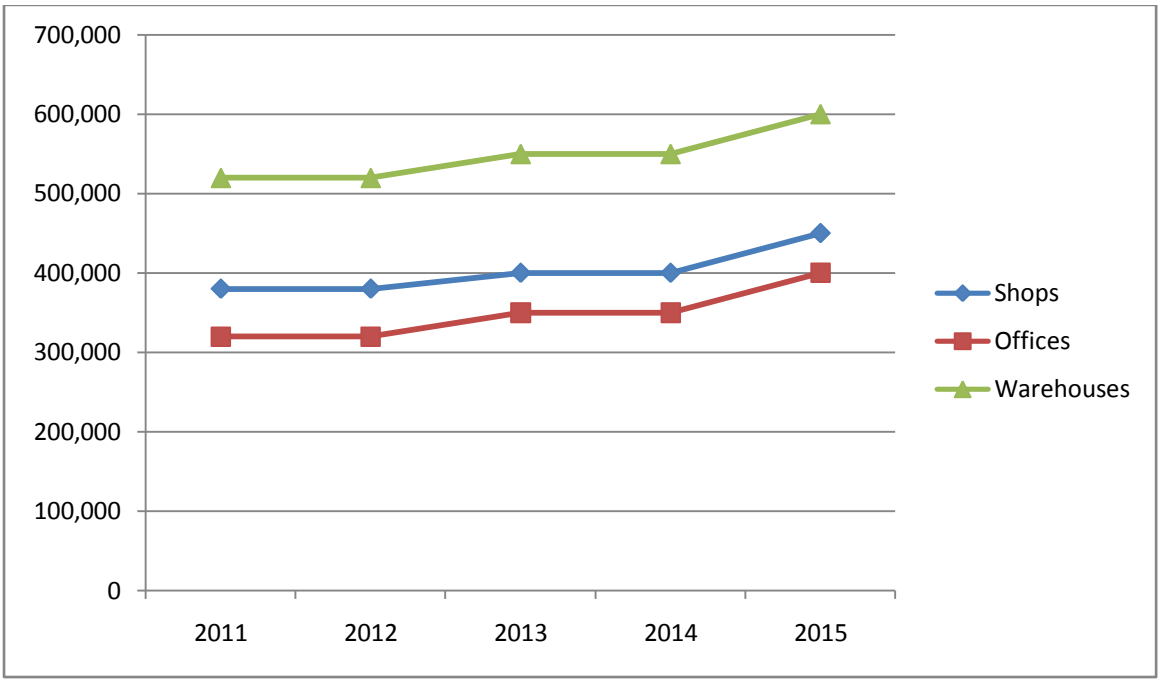


Fig. 5: ***Graph showing Rental Edo Ezemewi Road between 2011 – 2015 for Shops, Offices and Warehouses***

Source: Field Survey, 2016

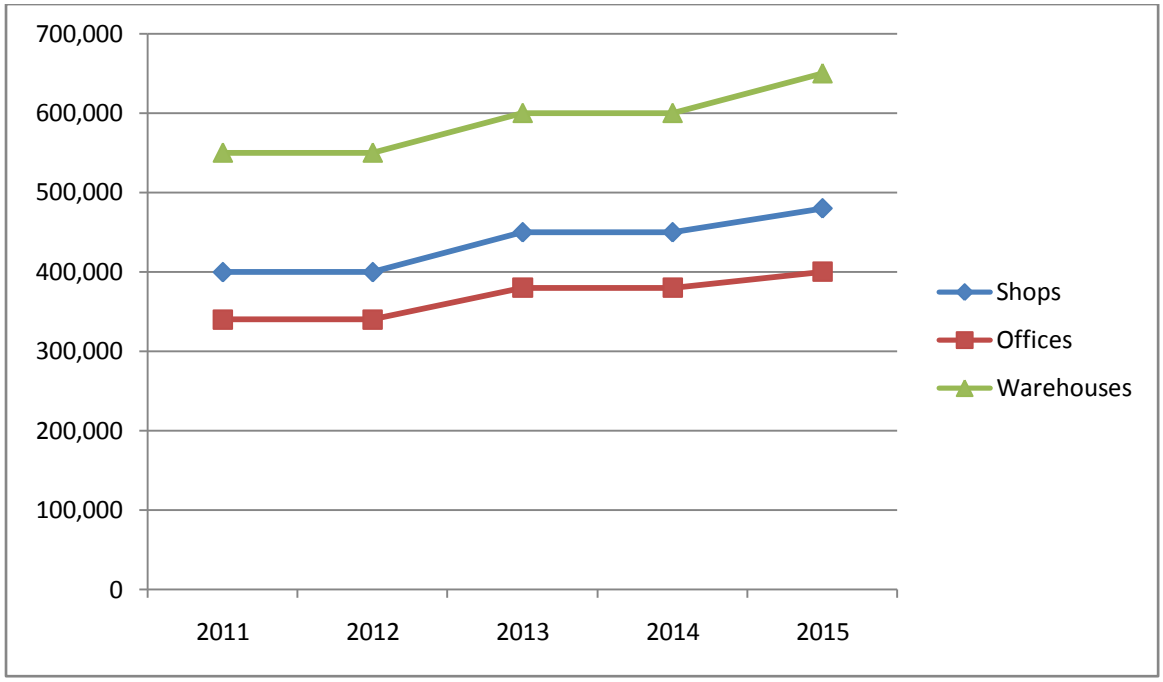


Fig. 6: Graph showing Rental Trend in Nwagbara Road between 2011 – 2015 for Shops, Offices and Warehouses

Source: Field Survey, 2016

Again, the rate of return on investment was determined by comparing the results in figure 4, 5 and 6 with the capital value of the properties or cost of the owner's investment. The result is equally presented in table 2.

Table 2:
Presentation of data on the Rate of Return on Investment for shops, offices and warehouses in the study area for 2011 – 2015:

Categories of properties	Rate of Return on investment		
	Old Nnewi-Onitsha road	Edo-Ezemewi road	Nwagbara road
Shops	16.8%	20.2%	23.6%
Offices	14.6%	26.8%	28.3%
warehouses	11.5%	12.2%	13.1%

Source: Field survey 2016.

As seen in table 2, Nwagbara road shows a superior rate of return than that of Edo-Ezemewi and old Nnewi-Onitsha roads respectively.

9.3 PRESENTATION OF DATA ON THE PERFORMANCE OF SHOPS, OFFICES AND WAREHOUSES IN NNEWI BETWEEN 2006 AND 2015:

The study then considered the performance of shops, offices and warehouses in the study area from 2006 – 2015. Data on rental annual values of the commercial properties under consideration was again used for the analysis and the result is presented in table 3.

Table 3:
Range and Mean of Rental Value of Commercial properties in Nnewi from 2006 - 2015

Descriptives								
Amount	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
shop	30	305666.67	104243.86	19032.237	266741.37	344591.96	180000	480000
offices	30	249000	104694.96	19114.597	209906.26	288093.74	120000	400000
warehouses	30	474000	94453.053	17244.689	438730.65	509269.35	300000	650000
Total	90	342888.89	138752.42	14625.79	313827.76	371950.02	120000	650000

Source: Field survey 2016.

X. Test of Hypothesis

The hypothesis formulated for this reason work still remains:

Ho: There is no significant difference in the performance of shops, offices and warehouses in Nnewi town Anambra State, Nigeria.

HI: There is a significant difference in the performance of shops, offices and warehouses in Nnewi town, Anambra State, Nigeria.

An analysis of variance (ANOVA) was conducted to discover if there is a significant difference in the performance of shops, offices and warehouses in Nnewi town, Anambra State, Nigeria. The result of SPSS analysis is presented in tables 4 – 7.

Table 4:
Descriptive

Descriptives

Amount	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
shop	30	305666.67	104243.86	19032.237	266741.37	344591.96	180000	480000
offices	30	249000	104694.96	19114.597	209906.26	288093.74	120000	400000
warehouses	30	474000	94453.053	17244.689	438730.65	509269.35	300000	650000
Total	90	342888.89	138752.42	14625.79	313827.76	371950.02	120000	650000

Source: Field survey 2016.

Table 5:
Analysis of Variance

ANOVA

Amount					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.217E11	2	4.109E11	40.085	.000
Within Groups	8.917E11	87	1.025E10		
Total	1.713E12	89			

We can see that the significance value is 0.000 (p=.000), which is below 0.05 and therefore there is a statistically significant difference in the performance of shops, offices and warehouses in Nnewi town.

Table 6:
Post Hoc Tests

Multiple Comparisons

Tukey HSD

(I) Property	(J) Property	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Shops	offices	56666.667	2.614E4	.083	-5664.35	118997.69
	warehouses	-168333.333*	2.614E4	.000	-230664.35	-106002.31
Offices	Shops	-56666.667	2.614E4	.083	-118997.69	5664.35
	warehouses	-225000.000*	2.614E4	.000	-287331.02	-162668.98
warehouses	shops	168333.333*	2.614E4	.000	106002.31	230664.35
	offices	225000.000*	2.614E4	.000	162668.98	287331.02

*. The mean difference is significant at the 0.05 level.

The table above shows which groups differed from each other. From the table, there is a statistically significant difference in the rental values between the shops and warehouses (p=0.000) as well as between the offices and warehouses (p=0.000). However, there was no statistically significant difference in the rental values between the shops and offices (p=0.083).

Table 7:
Homogeneous Subsets (Shops, Offices and Warehouses)

Amount

Tukey HSD

Property	N	Subset for alpha = 0.05	
		1	2
offices	30	249000	
shop	30	306000	
warehouses	30		474000
Sig.		.083	1.000

Means for groups in homogeneous subsets are displayed.

There was a statistically significant difference between groups as determined by one-way ANOVA [F(2,89) = 40.085, p=0.000]. A Tukey Post Hoc test revealed that the rental values were statistically significant for offices (₦249, 000 ±₦104, 694.96, p= .000) and warehouses (₦474,000 ±₦94,453.05, p= .000) compared to the shops (₦305,666.67 ±₦104243.86). There was no statistically significant difference between the rental values for shops and offices (p= .083).

Finally, this shows that there is a significant difference in the performance of shops, offices and warehouses in Nnewi town, Anambra State.

XI. RECOMMENDATIONS

The study therefore recommends that firstly, the government at all levels (local, state and federal) in Nigeria should work had to provide the enabling environment for investment (especially in the area of real estate development) to thrive. Secondly, investors in Nigeria should seek help from investment and/or real estate development analysts before embarking on real estate development. This can equally be done by employing such analysts in their firms for assured performance. Thirdly, Real Estate practitioner should equally endeavour to acquire the requisite skills in real estate performance analysis so that they can be in the best position to handle briefs as they come. Fourthly, firms of Estate Surveying and Valuation and other players in the real estate industry should work hard to create, operate and maintain a roburst data bank that can supply the required information at all times. Finally, the government, professionals and other stakeholders should partner to provide a very active market for building materials which is currently responsible for over 70% of cost of construction in Nigeria.

XII. CONCLUSION

This study has assessed the performance of commercial real estate development as an investment option in Nnewi, Anambra State, Nigeria. The study discovered that the rate of return on shops and offices out shined that of warehouses in Nnewi. Investors in Nnewi are therefore advised to concentrate more in the development of shops and offices since this would ensure better returns on their investment.

Reference

[1.] Emoh, F. I. (2004); *"Real property investment and management"*. Christen International Co. Ltd, Awka, Nigeria.

[2.] Hemuka, N. N. (2014); Feasibility and Viability Studies. Unpublished lecture series, Department of Estate Management, ESUT, Enugu.

[3.] Ifediora, G.S.A (2009); *"Appraisal framework"* SNAPP Press Limited, Enugu, Nigeria.

[4.] Johnson, T., Davies, K. and Shapiro, E. (2000); *Modern Methods of Valuation of Land, Houses and Buildings*: Estate Gazette London.

[5.] Kalu, I.U (2001); *Property valuation and appraisal*. Bon Publications Owerri, Nigeria.

[6.] Millington, A. F. (1982); "*An introduction to property valuation"* The Estate Gazette, London.

[7.] Obichere, B. I. (1982); *Studies in Southern Nigerian History:* A Festschrift for Joseph Christopher Okwudili Anene. Ttps://books.google.com/books?id=MFXE8-usa4c) retrieved 2016 – 06 – 02.

[8.] Ogbuefi, J. U. (2002) *"Aspects of feasibility and viability studies*" Institution of Development Studies, University of Nigeria, Enugu Campus.

[9.] Okafor, E. C. (2016); Commercial Real Estate Performance in Nnewi, Anambra State, Nigeria. An unpublished B.Sc. Project.

[10.] Okafor, F.O. (1983); "Investment Decisions. Evaluation of Projects and Securities. (ASSEl Ltd) London.

[11.] Olusegun, K. G. (2011); "Property valuation", Principles and Practice in Nigeria. Olusegun Kuye and Associates Lagos, Nigeria.

[12.] Olusegun, K. G. (2011); Introduction to Property Valuation (Second Edition). Adro Dailar Heritage Company Limited, Lagos, Nigeria.

[13.] Onwutalobi, A. C. (2016); "History – The Official Nnewi City Portal" (http://www.nnewi.info/nnewi-history) Retrieved 2016 – 07 – 14.

[14.] Udechukwu, C. E (2009), Principles of Valuation: (Second Edition) Iveom Nigeria Limited Palmgrorve, Lagos, Nigeria.

[15.] Udobi, A. N. (2014); Analysis of the Performance of Residential Property Investment and Bank Shares in Anambra State. The Estate Surveyor and Valuer, Vol. 39 No. 1, 2014

[16.] Udobi, A. N., Ugonabo, C. U. and Kalu, I. U. (2013); An Analysis of Performance of Real Estate in Onitisha metropolis and Investment in Bank Shares in Nigeria. Journal of Civil and Environmental Research. www.iiste.org, vol.3 No.8, 2013.

[17.] Thorncroft, M. (1965); "Principles of Estate Management". Estate Gazette Limited London.