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EDITORIAL

It is my proud privilege to welcome you all to the Researchfora International Conference at Berlin, Germany in association with The IIER. I am happy to see the papers from all part of the world and some of the best paper published in this proceedings. This proceeding brings out the various Research papers from diverse areas of Science, Engineering, Technology and Management. This platform is intended to provide a platform for researchers, educators and professionals to present their discoveries and innovative practice and to explore future trends and applications in the field Science and Engineering. However, this conference will also provide a forum for dissemination of knowledge on both theoretical and applied research on the above said area with an ultimate aim to bridge the gap between these coherent disciplines of knowledge. Thus the forum accelerates the trend of development of technology for next generation. Our goal is to make the Conference proceedings useful and interesting to audiences involved in research in these areas, as well as to those involved in design, implementation and operation, to achieve the goal.

I once again give thanks to the Institute of Research and Journals, Researchfora, TheIIER for organizing this event in Berlin, Germany. I am sure the contributions by the authors shall add value to the research community. I also thank all the International Advisory members and Reviewers for making this event a Successful one.

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ANALYSIS OF THE RELATIONSHIP BETWEEN BUILT-UP AREA AND ARTIFICIAL LIGHT AT NIGHT (ALAN) IN BALI PROVINCE 2015-2018: A REMOTE SENSING PRESPECTIVE

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Abstract - The development of remote sensing technology has increasingly provided easy access to understanding various spatial phenomena, one of them is the Visible Infrared Imaging Radiometer Suite (VIIRS) DNB that provides information about distribution of artificial nighttime light (ANTL) on the earth's surface as an indicator of socio-economic activity and anthropogenic existence in a region. Apart from using light illumination as an indicator, this phenomenon can be observed by looking at the built-up area of land cover through the Normalized Difference Built Up Index (NDBI). However, the NDVI data has an identification error between the constructed land and the empty land. Therefore, the relationship between these two variables needs to be tested. Multi-temporal analysis using the VIIRS-NDB2015 and 2018 data was carried out to see the development of a built-up area with light illumination and land cover. The results of this observations show that the increase in the DN VIIRS value which represents artificial light illumination is followed by the DN NDBI value which represents the density of the built-up land in the study area in 2018. The interpretation of the data explains that the development of the area is followed by the expansion of the area indicated by artificial night lights. Remote sensing method that can effectively assist in monitoring and policing control an area. Correlation analysis using the one-tailed Spearman's Rank has strong results with 0.65 in 2015 and 0.63 in 2018 and having a monotonous correlation pattern. These two values are considered very high scores.

Keyword - VIIRS, NDBI, Built-up Area, Artificial Light, Spearman's Rank

I. INTRODUCTION

Along with the times, global population dynamics become something that cannot be avoided. An increasing number of the world's population until 2018 to reach 7.7 billion people over the last 10 years and this number continues to rise 1-1.2% per year. The increase in population is accompanied by an increase in the need for space, even creating competition for land use that ignores the environmental balance as a social good and a development instrument [1]. The space in question is land that is used to support life in various aspects, such as social, cultural and economic. Population growth dynamics affect global environmental changes[2]. Changes in land cover are currently occurring very rapidly in a relatively short period of time, so that natural or semi-natural land cover has turned into built-up land which is dominated by residential areas [3]. Cities will always grow and develop in line with the social and economic life in them. Developed land dynamics can produce spatial patterns that can be analyzed spatially through remote sensing.

One of the phenomena of land cover change that has become developed land and areas of socio-economic activity. Socio-economic activities is characterized by the presence of artificial nighttime lights (ANTL)[4]. This is due to human activity not only in the morning but also at night. This phenomenon occurs especially in urban areas due to high productivity and activity[5]. Currently, development of remote sensing technology can provide artificial night light data with a Visible-Infrared sensor, Suomi NPP-VIIRS

DNB[6]. Compared to DMSP-OLS, VIIRS has a significant increase, especially in increasing spatial resolution and dynamic range [7]. VIIRS has been widely used in various studies to determine anthropogenic activities, for example on resources, energy consumption and greenhouse gases [8] and the impact of humans on ecosystems over large geographic areas [9].

Although widely used in Europe and China, VIIRS requires retesting to represent artificial night lights in Indonesia. This is due to the geography of Indonesia is in the middle latitudes with a high level of cloud formation. [10]. In addition, there is considerable interference with cloud cover and aerosols in the recording process [11]. In addition, the disadvantage of NTL is that there is interference in the form of pixels that cause biased bright effects, which can reduce the accuracy of the application of NTL brightness to estimate human activities. therefore it is necessary to compare the data in seeing the capabilities of VIIRS [12].

Remote sensing can also be used to directly identify areas where land cover is built. There are various ways in the extraction of developed areas, such as OBIA[13][14] multispectral classification [15] and index transformation[16][17] However, each method in the extraction of built-in land has limitations, among them OBIA which only works well with little noise interference and high accuracy at high to medium resolutions[18] or multispectral classification which requires a lot of training data [19].

Index transformation such as NDBI can be an alternative method of automatic, representative, and objective data extraction[20]. In addition, the use of

VIIRS data combined with other spatial data such as Landsat 8 OLI can be used in the extraction of building areas for urban areas [21]. High accuracy values can be obtained using ALAN data for data extraction[5]. Although there are still limitations by cloudiness, which is a challenge when applying our methods globally, especially in tropical areas [6]. Therefore, there is a need for research on the correlation between NDBI-VIIRS in the tropics. The focus of this research is to analyze the relationship between the built-up area and ANTL through statistical tests of remote sensing images from the phenomena that occurred in 2015 and 2018 in Bali Province, Indonesia.

II. METHODOLOGY

2.1 Research Area

The research area for this research taken place on Bali Province, Indonesia (08°03'40" "LS - 08°50'48"

South Latitude and 114°25'53" "East Longitude - 115°42'40" East Longitude). The area of Bali Island is 5,780.06 km²[22] covering Buleleng, Badung, Bangli, Gianyar, Jembrana, Karangasem, Klungkung, and Tabanan. Bali Province is a province with a fairly high population density, which is 753,37 people / km² with a population in 2018 of 4.247 million people[22]. Land cover in Bali is very diverse and varies with the area consists of two groups of major islands, Bali and Nusa Penida Island. Central part of Bali Island is dominated by barren land, vegetation and a small part used by humans. It is because the area is hilly to mountainous, while the relatively flat area is located around the coast and is widely used as a cultural and economic center area. The rate of population growth, regional complexity, and rapid land cover change were considered in the selection of Bali Province as a research location. Map of the study area can be seen at **Fig. 1**.

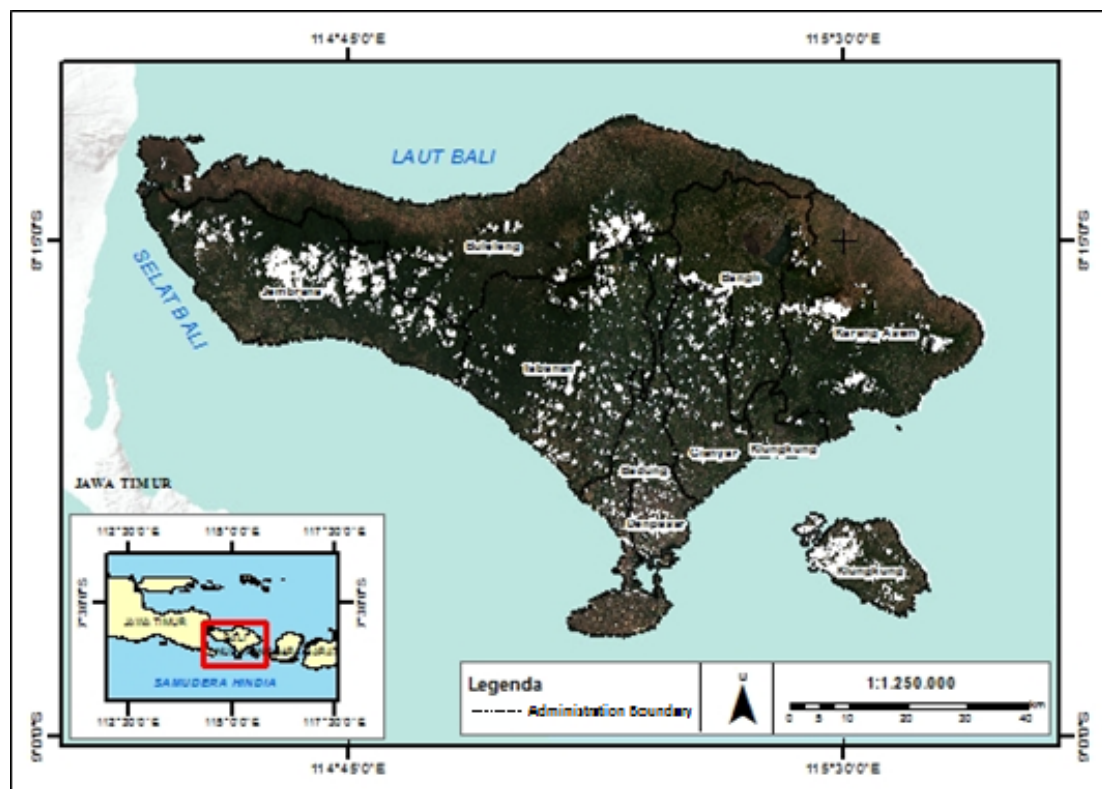


Fig. 1. Study Area in Bali Province on Landsat 8-OLI composite 4,3,2 perspective

2.2 Data Source

The data used in this study include NDBI data obtained from Landsat 8 OLI and VIIRS Day / Night Band data. The NDBI data represents a build-up area, while the VIIRS-DNB represents an area illuminated by artificial light at night. Landsat 8 OLI data is obtained from earthexplorer.usgs.gov, while VIIRS can be downloaded for free from ngdc.noaa.gov[23]. The data used is the average value in one month, these are October 2015 and 2018. The selection of recording time is made by considering the minimum cloud cover in 1 year. Data pre-processing was

performed for Landsat 8-OLI data including radiometric correction to BOA level and data mosaic before index transformation. The NDBI index transformation uses the formula $((\text{SWIR} - \text{NIR}) / (\text{SWIR} + \text{NIR}))$ [24]. VIIRS data is not processed first because the system has performed calibration and automatic filtering so that it can eliminate atmospheric disturbances, stray light, and inconsistent light such as gasflare and reflections by snow Both data are closed with administrative boundary data of Bali Province to obtain the study area.

2.2 Method

This study examines 2 things, the first thing is conditions of build-up area that occurred in 2015 and 2018 and the second thing is testing the correlation between artificial light (VIIRS) and built-up land (NDBI) through statistic test. Previously, data resample for NDBI was conducted to $742 \times 742 \text{ m}^2$ referring to the VIIRS scale to obtain pixel size is equal and each pixel can be registered with each other perfectly. This is very important later in determining the sample distribution. If resample is not done, it is possible that the correlation value will be very low.

The number of samples used was 33 sample points and scattered throughout the Province of Bali. The distribution of sample locations was determined by purposive sampling with the Landsat 8 OLI composite (4,3,2) to avoid sample points on cloud cover objects, and adjust the samples so that the samples are in pixels with the same NDBI and ANTL.

The statistical test in this study used the Spearman rank correlation method. Relationship analysis was

carried out of 33 data samples from the extraction of the VIIRS and NDBI values which were assumed to represent the entire value of artificial lighting and built-up land in Bali Province in 2015 and 2018. The spearman correlation test was carried out at the 95% confidence level or significance level. 0.05 (level of significance). The test carried out is a one-sided test. In this study, it was determined that H_0 (zero hypothesis) is that VIIRS and NDBI have no relationship and H_a (alternative hypothesis) is that VIIRS and NDBI have a strong positive relationship. Interpretation of the results of the correlation test is carried out by understanding the form of a scatter plot, the correlation value formed, the direction of the relationship, and the t-table. This relationship is positive if the two correlated variables move in parallel or in one direction, in other words, if VIIRS increases, NDBI will also increase. The patterns that are formed can then be used to help understand the direction, value fluctuation, and shape of the relationship. Sample distribution can be seen at **Fig. 2**.

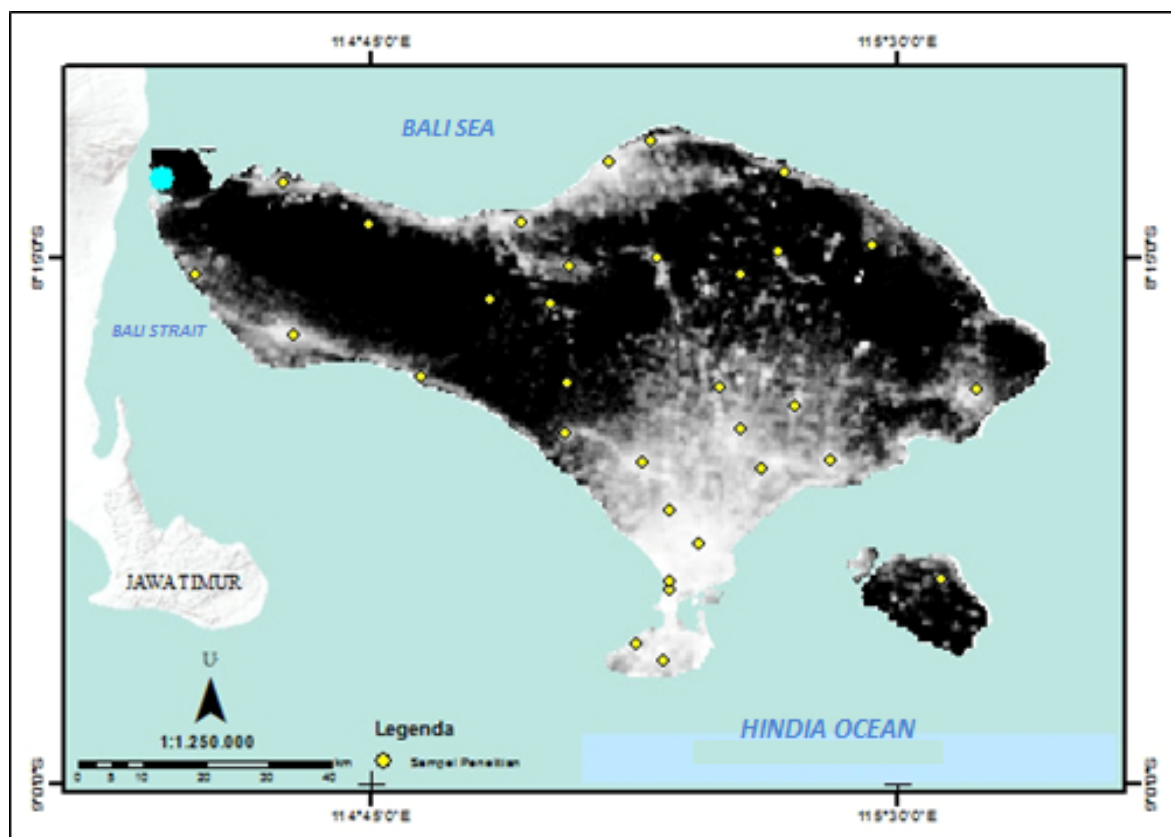


Fig. 2. Sample points distribution

III. RESULTS AND DISCUSSION

The results of DNB VIIRS data extraction show that in 2015 and 2018 Bali Province experienced a fairly high increase in the range of artificial light illumination values. In 2015, values ranged from $-0.07 \text{ nW} / \text{cm}^2 \cdot \text{sr}^{-1}$ to $55.72 \text{ nW} / \text{cm}^2 \cdot \text{sr}^{-1}$. Pixel values are $\leq 0 \text{ nW} / \text{cm}^2 \cdot \text{sr}^{-1}$ range indicate that the

object does not emit artificial light at night [5] or because there are restrictions from other objects, such as vegetation, high walls, or open ground without lighting [25]. Meanwhile, the spatial distribution also changes where the area with the illumination of light expands and continues to increase even though it is not obvious because the pattern is not much different (**Fig.3**). The increase in light illumination can be

caused because artificial light has now become a necessity in supporting various activities, especially in the socio-economy so that it can continue, real evidence can be found of an increase in foreign investment, land use patterns, and GDP which increases linearly with artificial light [26]. It is known that in **Fig. 4.**, the red symbol shows the 2015 data and the wider orange symbol represents the addition of the area illuminated by artificial light in 2018. This increase occurred in 3 main urban centers on the

island of Bali, namely in the southern part, the coast, north, and a little to the east of the island. The increase in light illumination mainly occurs in the core-urban area [27] as it can be seen that this increase does not occur drastically but rather gradually. This phenomenon is in accordance with the dynamics that occurred globally in 1992 - 2017 in research conducted by Hu et al (2019)[28]. The total area increased is described in **Table 1.**

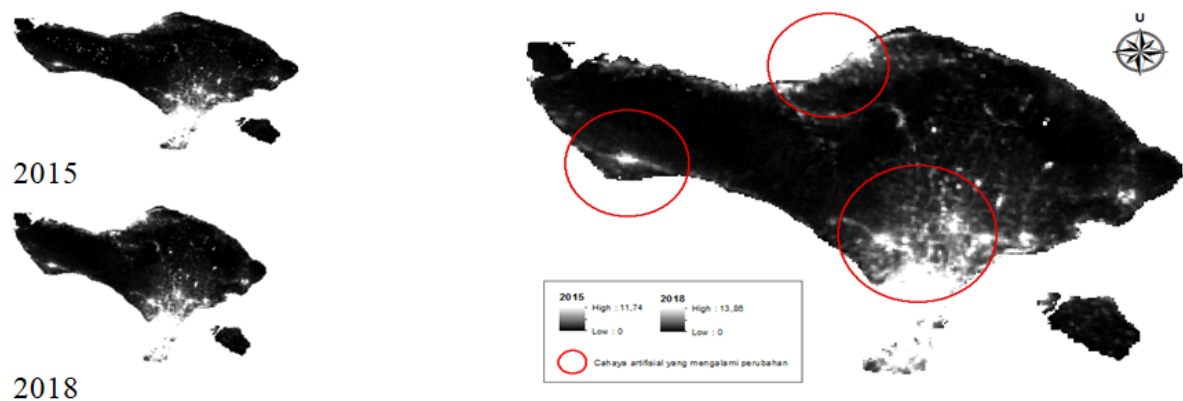


Fig. 3. Changes in artificial light illumination conditions in 2015 and 2018

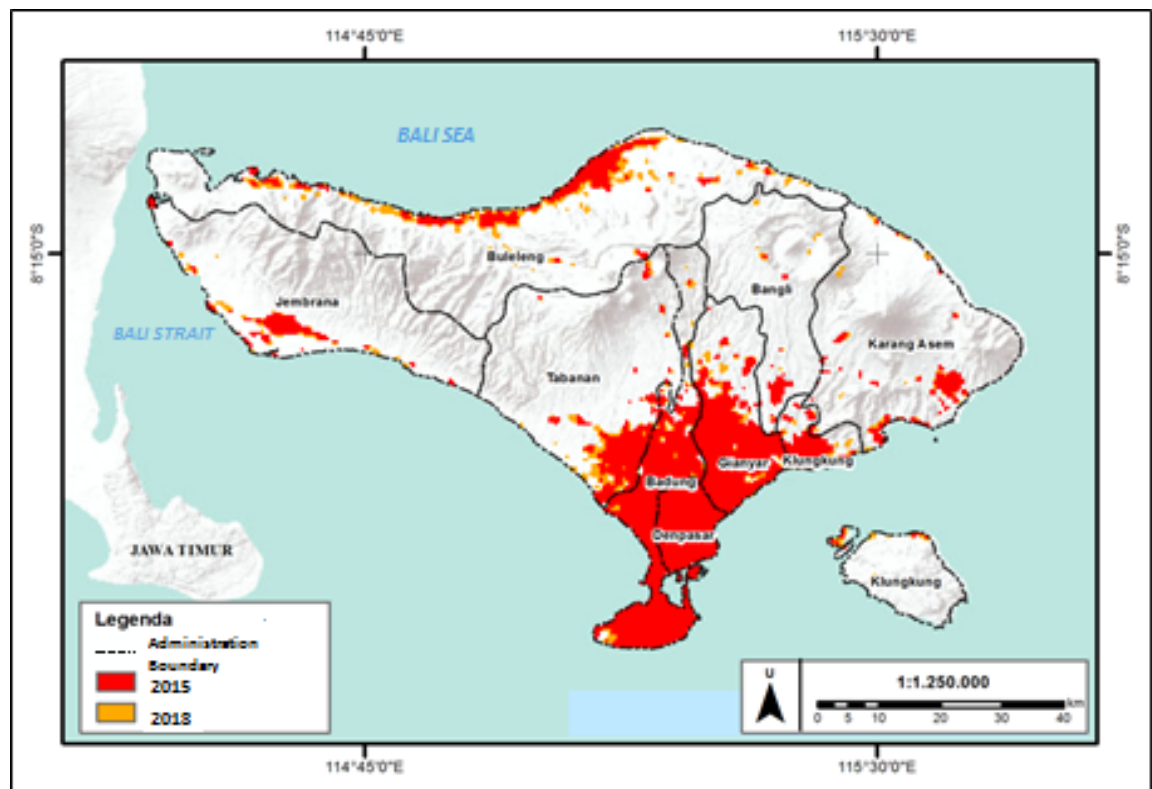


Fig.4. Map of area growth with artificial night light illumination, 2015 - 2018 in Bali Province

The increase in the built-up area also increased in 2015-2018 in the NDBI data as described in **Table 1.** Spatially the increase in the area of built-up land (**Fig. 5**) has occurred in the northern part of Bali Island which is marked with a yellow symbol. The spatial distribution of the constructed land differs from the distribution of artificial night lights. This can happen

because NDBI is not good at distinguishing built-up land from empty land. Although it can be said that the two regions have increased in size, this change is not shown by the same areas by VIIRS-NDBI. Therefore, a statistical correlation test with Spearman's Rho was carried out to test the strength of the relationship between VIIRS-NDBI and the formed pattern.

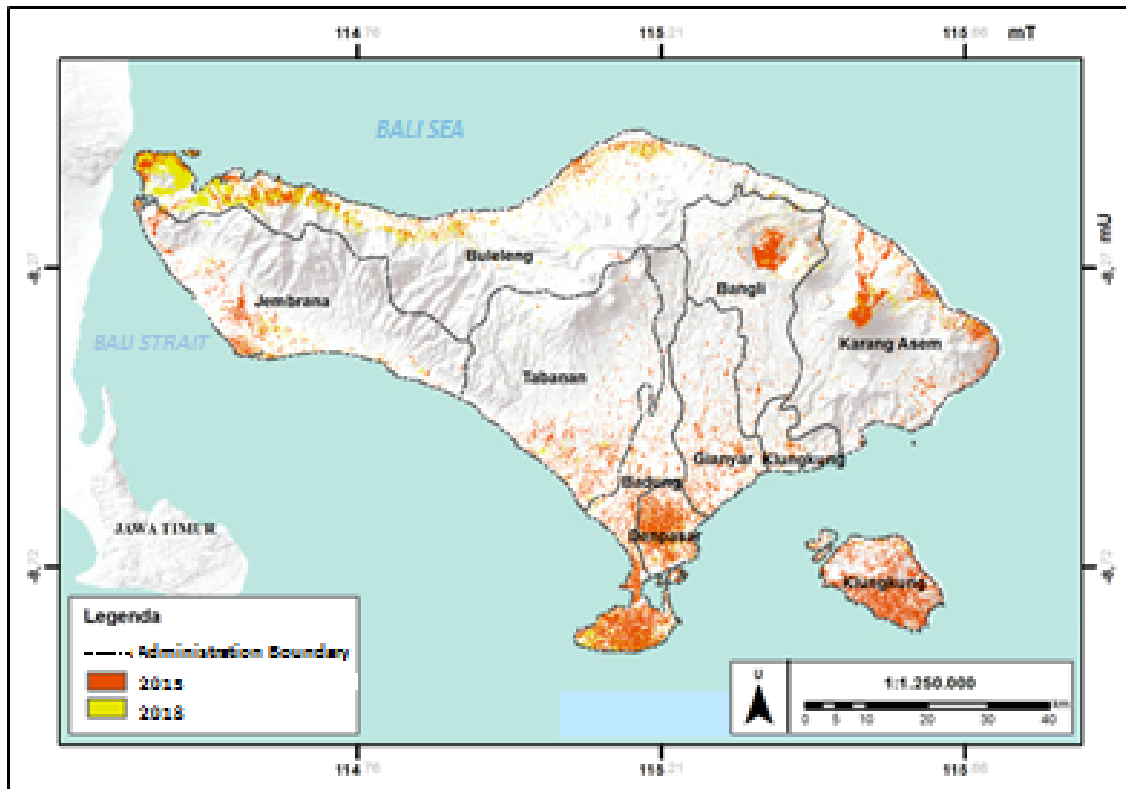


Fig. 5. Land growth map developed in 2015 - 2018 in Bali Province

Data Type	2015	2018	Conclusion
NDBI	985,15	1.164	Increase
VIIRS	750,17	857,12	Increase

Table 1. The results of geometric calculations for the total area of NDBI-VIIRS 2015 - 2018

The correlation test was performed using Spearman's rho (ρ) and was carried out on 33 test samples with a confidence level of 95% or alpha 0.05. Based on the one-tailed spearman rho correlation test, the VIIRS-NDBI correlation value in 2015 was 0.652 while in 2018 the correlation was 0.624. Both of them show a positive relationship value, which means that they are both unidirectional (changing direction). As the NDBI value increases, the VIIRS value also increases. The table of correlation test results for the two variables can be seen in **Table 2**. When the value of the relationship between the two variables increases, it indicates a stronger relationship, and vice versa. Based on changes in the conditions of VIIRS and NDBI, the two of them increasingly show the development of an established area accompanied by the growth of an area illuminated by artificial light, but the relationship between the two is getting weaker. This is because the growth of a built area is not always in the form of building objects, or public infrastructure that only operates during the day. The accumulation of various objects like this causes the illumination of artificial light to not increase and creates gaps. In addition, there was an error in object identification by NDBI. Based on the results of the Spearman correlation test at **Table 2**, it is known that in testing the VIIRS-NDBI data for 2015 and 2018, the critical point for both data is 1.64. The t-test for

the 2015 VIIRS-NDBI was 3.69 while the VIIRS-NDBI for 2018 was 3.54. Both show that the results of $t\text{-test} > t\text{-table} / \text{critical point}$, so it can be concluded that the alternative hypothesis (H_a) is accepted and it is stated that there is a relationship between VIIRS and NDBI both in 2015 and 2018. These results show a correlation between VIIRS-NDBI at the location but tested at different recording times and conditions resulted in a correlation that is not too far away.

Parameter	2015	2018
Sample	33	33
Rho	0,65	0,62
t-Test	3,69	3,53
Alpha	0,05	0,05
Class-limit	1,64	1,64
Conclusion	Ha Accepted	Ha Accepted

Table 2. Results of Spearman's rho (ρ) Correlation Test

Scatter plots can be used in visualizing the form of the relationship that occurs between VIIRS-NDBI. The scatter plot graph in **Fig. 6**.represents the VIIRS-NDBI relationship in 2015, while **Fig. 7**.represents VIIRS-NDBI in 2018. The X axis represents the NDBI value and is treated as an independent variable, while the Y axis represents the VIIRS value and is treated as the dependent variable. They both form a

one-tailed monotonic function. It is said that because **Fig. 6.** shows that when one variable increases, the other variables also increase and move in the same direction (positive relationship) but don't show a constant change in value. This is known as a non-linear relationship.

The VIIRS-NDBI scatter plot in 2015 shows a pattern that forms 2 curves, namely the NDBI value: -0.3, VIIRS: 3 and NDBI: -0.5, VIIRS: 3. Overall it can be seen that there are 2 patterns, namely: The increase in land density value is built up quickly and is accompanied by a relatively slow increase in artificial light illumination, so that a line tends to form sideways. This pattern occurs in the range of NDBI

values -0.35 to -0.5 and VIIRS at 1 to 3. Furthermore, there is an exponential increase and forms an inverted curve where there is a curvature and an upward trend. This indicates a slow increase in the density of built-up area and a rapid increase in artificial light illumination, and occurs at NDBI values > 0 and $VIIRS \geq 3$. The NDBI value identified as built-up land is vulnerable to 0 - 1, while the VIIRS value identified as illumination of artificial light is on value > 0 . The maximum value in the 2015 sample was obtained for VIIRS of 28.74 and the minimum value of 0.43. Whereas for NDBI, the maximum sample value was 0.156 and the minimum value was -0.374.

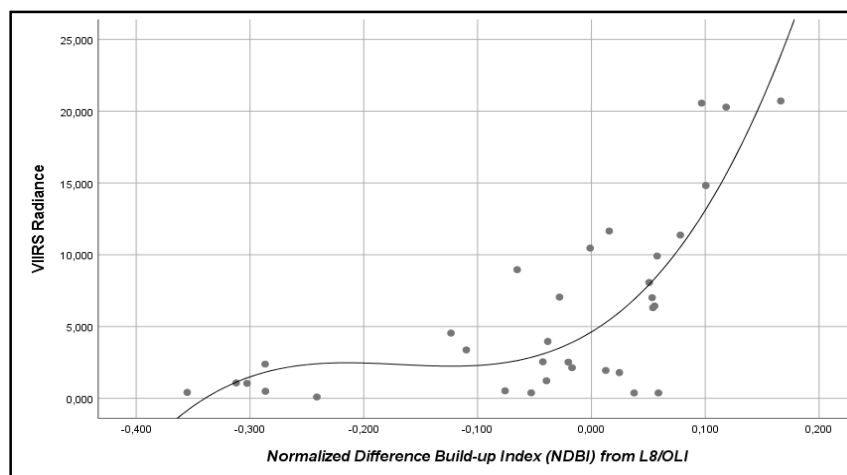


Fig. 6. Scatter plot VIIRS-NDBI 2015

The VIIRS-NDBI scatter plot in 2018 shows a pattern similar to that of the 2015 scatter plot data, namely the formation of a non-linear one-tailed monotonic function. The difference is that in 2018, there was only one curve in the NDBI value range of around -0.5 to 0, and there was no increase in the artificial light value in the built-up land index value in the range -0.4 to -0.3. The increase in value is also exponential. In addition, if the VIIRS-NDBI scatter plot in 2015 it is known that the distribution of samples is mostly found in the NDBI value range of -

0.1 to 0.1 with VIIRS in the value range of 0 to 10, then in 2018 VIIRS-NDBI it is known that the distribution more samples are in the NDBI range from -0.3 to 0 with VIIRS in the value range 0 to 10. Based on the distribution, the 2015 VIIRS-NDBI scatter plot forms a more random pattern than in 2018. The maximum value in the 2018 sample is obtained for VIIRS is 20.71 and the minimum value is 0.09. Whereas for NDBI, the maximum sample value was 0.166 and the minimum was -0.355.

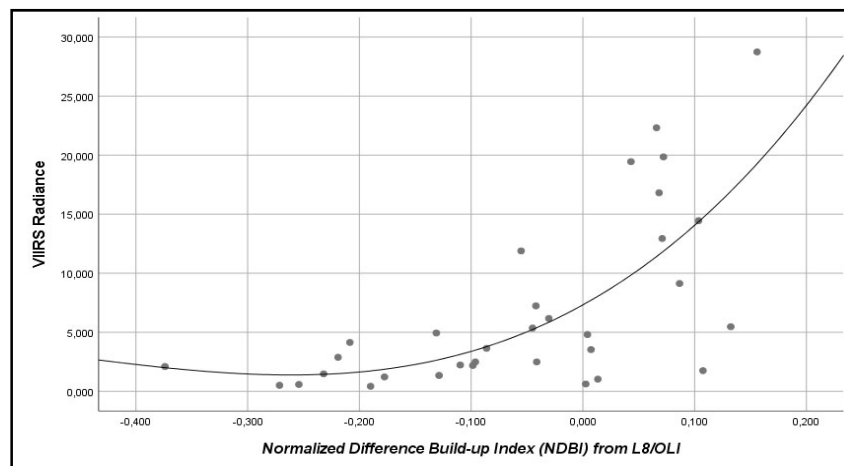


Fig. 7. Scatter Plot VIIRS-NDBI 2018

Based on the correlation test of NDBI and ANTL, it shows non-linear and monotonic correlations. The built-up area as an independent variable affects the increase of artificial light illumination as the dependent variable. It has been known previously that based on spatial observations, artificial light and built-in areas show a similar development pattern where if the land is built wider, artificial light is also wider in an area because there is a strong relationship between the two variables in showing the level of human activity and the development area.

Artificial light was associated with built up area, but the correlation that emerged was only at a strong level and not at a very strong level. There are several factors that cause this to happen, especially in analyzes using remote sensing data. First, there is a misidentification of empty land objects with built-up areas, resulting in built-up area objects where there is no artificial light at all. This results in a sizable value gap at some sample points. Second, in the VIIRS data, there is the possibility of aerosol interference which causes a decrease in the value of the recording process at night because the VIIRS sensor is very sensitive to aerosols. Third, the value represented by VIIRS cannot fully represent the true value measured directly at the earth's surface because the VIIRS sensor recording objects at an apogee as far as 833.7 km will cause a decrease in the magnitude of light.

IV. CONCLUSION

In 2015 - 2018 the trend of land growth developed in Bali Province was accompanied by the growth of artificial light, both in terms of the area that continued to grow and the intensity of both. DNB VIIRS can best explain the dynamics of developed land through artificial light as an indicator. Even so, there are some areas that have developed in NDBI that do not show any progress in VIIRS, this is due to the bare land that was identified as built up land by NDBI. In terms of value, the Spearman's Rho one-way correlation test shows a strong correlation between VIIRS-NDBI in Bali Province in 2015 and 2018. The relationship formed shows a positive value at alpha of 0.05, indicating an increase in NDBI value will be accompanied by an increase in VIIRS value. The graph plot with a scatter plot shows a monotonic (non-linear) value growth pattern. It is known that conversion of natural land to build-up area can trigger the potential for artificial light illumination.

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AYURVEDA MANAGEMENT OF OSTEOARTHRITIS OF THE KNEE JOINT

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Abstract -

Osteoarthritis of the knee joint is commonly occurring in modern India as well as the whole world. Aging, obesity, sedentary life style are common precipitating factors of Osteoarthritis of the knee joint. Signs and symptoms like pain and tenderness of the knee joint, restriction of joint movement and swelling are commonly seen in these patients. Genu valgus and Genu valgus are the common complications seen in this disease. Difficulty in walking is a prominent symptom. Ayurveda medicine is having a positive role in the management of osteoarthritis of the knee joint. Ayurveda includes use of vyadhipratyanikaushadhis (disease specific medicines), panchakarma including patrapindasweda, valukasweda, snigdhasweda, matrabasti, janubasti, use of pathyapathya and diet therapy in this disease. The drugs and formulations used in the treatment include vatahara, vedanasthapaka, rasayana, immunomodulator, virechana, snehana and swedana actions.

The present paper highlights the role of Ayurveda in the management of osteoarthritis of the knee joint.

Keywords - Osteoarthritis, Ayurveda, Rasayana, Panchakarma

I. INTRODUCTION

Osteoarthritis of the knee joint is a degenerative joint disease. It is characterized by pain and swelling of the knee joint with restriction of movement and joint tenderness. X Ray findings are decreased joint space between the bones sclerosis of the articular surface of cartilages and presence of osteophytes at the periphery of the joint. There will be a loose body at the popliteal fossa. Complications like genu vera and Genu valgus are seen often in these patients. Difficulty in walking is a usual symptom in this disease.

Single herbs used in osteoarthritis.

1. Guggulu (Commiferamukul)
2. Shallaki (Boswelliaserrata)
3. Ashwagandha (Witheniasomnifera)
4. Bala (Sida cordifolia)
5. Rasna (Vanda roxburgiana)
6. Eranda (Ricinus communis)
7. Vishatinduka (Strychnos nuxvomica)
8. Gandhaprasarini (Pedaria foetida)
9. Nirgundi (Vitex negundo)
10. Dhatura (Dhaturametel)
11. Arka (Calotropis gigansia)
12. Lashuna (Aliumsativam)

Formulations used in osteoarthritis

1. Yogarajaguggulu
2. Mahayogarajaguggulu
3. Maharasnadikashaya
4. Balarishta
5. Ashwagandha Ishtar
6. Rasnadikashaya
7. Rasnaguggulu

8. Kaishoraguggulu
9. Punarnavadiuggulu
10. Punarnavadi mandoora
11. Kaseesabhasma
12. Mandorabhasma
13. Mahanarayanataila
14. Ksheera Balataila
15. Prabhanjanavimardanataila
16. Panchagunataila
17. Nirgunditaila
18. Gokshuradiuggulu
19. Trayodashangaguggulu
20. Amritadiuggulu
21. Shadangaguggulu
22. Murivenkataila
23. Shuddha Balataila

Ayurveda drugs and formulations used in the management of osteoarthritis of the knee joint are having the ingredients with following actions.

1. Vatahara
2. Vedanasthapaka
3. Anti-inflammatory
4. Analgesic
5. Snigdha
6. Balya
7. Brimhana
8. Poshaka
9. Calcium supplement
10. Rasayana
11. Ojaskara
12. Immunomodulator
13. Jivaniya
14. Virechana
15. Malavatanulomana
16. Matrabasti

17. Abhyanga	Immunomodulator
18. Swedana	1. Guduchikashaya
19. Nutritive	2. Amritadiguggulu
20. Vayasthapana	3. Kaishoraguggulu
21. Haematinic	4. Godugdha
22. Mootrala	Jivaniya
	1. Ashtavargaksheera
Vatahara	2. Godugdha
1. Yogarajaguggulu	3. Ashtavargakashaya
2. KsheeraBalataila	Virechana
3. Maharasnadikashaya	1. Triphala tablets
4. Chaturvidhasneha	2. Trivritleha
Vedanasthapaka	3. Abhayarishta
1. Shallaki tablets	Malavatanulomana
2. Yogarajaguggulu	1. Erandataila
3. Trayodashangaguggulu	2. Erandabijaksheerapaka
4. Kaishoraguggulu	3. Triphala tablets
5. Vishatindukavati	4. Shatsakarachorna
Anti-inflammatory	Immunosuppressant
1. Mahayogaraja y	1. Yashtimadhuchorna
2. Kaishoraguggulu	2. Chitrakasava
3. Amritadiguggulu	3. Bhallatakavati
4. Yogarajaguggulu	Nutritive
Analgesic	1. Godugdha
1. Mahayogarajaguggulu	2. Ksheerapakataila
2. Yogarajaguggulu	3. Masha nirmitaaharakalpana
3. Shadangaguggulu	4. Godhumanirmitaaharakalpana
4. Shallaki tablets	5. Mamsa Rasa
5. Rasnadiguggulu	6. Kukkutanda (eggs)
Snigdha	Vayasthapana
1. KsheeraBalataila	1. Amalakiswarasa
2. Goghrita	2. Amalakirasayana
3. Majja	3. Chyavanaprashavaleha
4. Vasa	Haematinic
Balya	1. Navayasalo
1. Kukkutanda	2. Punarnavadiandoora
2. Kukkutandamamsa	3. Mandooravataka
3. Aja mamsa Rasa	4. Mandoorabhasma
4. Aja mamsarasayana	5. Kaseesandoora
5. Masha nirmitaaharakalpana	6. Kaseesabhasma
6. Vidari Kanda choorna	Mootrala
7. Varahi Kanda choorna	1. Suraksharakaseesa
Brimhana – do	2. Punarnavadiandoora
Poshaka – do	3. Gokshuradibijachorna
Calcium supplement	4. Punarnavasava
1. Mrigashrungabhasma	5. Swetaparpatl
2. Godantibhasma	
3. Pravalapanchamrita rasa	
4. Muktapanchamrita rasa	
5. Kamadugha rasa	
Rasayana	
1. Guggululalpana	
2. Balarishta	
3. Ashwagandha Ishtar	
4. Ashwagandha Alexa	
Ojaskara	
1. Ashtavargakashaya	
2. Godugdha	
3. Goghrita	
4. Guduchikashaya	

II. DISCUSSION

Osteoarthritis of the knee joint is a degenerative joint disorder seen commonly in 50 – 60 year age group. Pain, tenderness, swelling of the knee joint along with restriction of movement is seen in this disease. Ayurveda has a positive role in this disease. Osteoarthritis of the knee joint with recent onset can be easily treated by Ayurveda medicine. Old cases respond for prolonged treatment. Abhyanga, swedana, Janubasti, matrabasti, anuvasanabasti, vyadhipratyanikaushadhis, use of pathyapathya, diet and yoga practice usually beneficial in this disease. In

Ayurveda, rasayanavedanasthapaka, balya, brimhana, mootrala, ojaskara and haematinics are used. In old age, patients are usually associated with iron deficiency anaemia. In such conditions, along with main drugs, haematinics are also preferred. These will correct the Hb 0/0 and reduce the intensity of signs and symptoms of the disease. Some cases which are advised knee replacement therapy are also relieved by Ayurveda treatment. However prolonged treatment is necessary in the management of this disease.

III. CONCLUSION

1. Osteoarthritis of the knee joint usually occurring above the age of 45 years. Especially persons with increased exercise and lack of nourishing diet will suffer from this disease.
2. Obesity is also a precipitating factor in the occurrence of this disease.

3. Ayurveda treatment has positive role in the management of osteoarthritis of the knee joint.
4. There will be relief in pain tenderness swelling and restriction of movement by Ayurveda medicine. However there will be less recovery from structural defects from Ayurveda treatment.
5. Some cases who are advised knee replacement therapy are also responded well for Ayurveda treatment.

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CRISIS MANAGEMENT AND LOGISTICS OF INTERNATIONAL SECURITY SYSTEM IN REGIONAL ORGANIZATIONS

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Abstract - Regional organisations are becoming increasingly active in the humanitarian sphere. Despite this optimism, regional organisations do not necessarily fit into any one model or possess any across-the-board benefits. Furthermore, this paper aims to provide an overview of the current system of crisis management for UN, EU, NATO, OSCE and AU. It describes the institutional framework, main missions, and the decision-making processes. Due to the complex of crisis management sector around the world, this paper adopted a combination of historical and descriptive literature, the historical method allowed the researcher to determine what led to existing mechanism for crisis management by all organizations. While the descriptive method made it possible to determine the nature of existing mechanisms. Finally, the paper recommends that the cooperation among the international organizations in this area will be as a precedent.

Keywords – Crisis Management, Regional Organizations, UN, EU, NATO, OSCE, AU

I. INTRODUCTION

There is no doubt that the expansion of crises around the world has given more importance for emerging the regional organizations, they began to emerge following the Second World War with the League of Arab States (1945) and Organization of American States (1948). Regional organizations transformed themselves into growing players in the humanitarian sphere, their activities have steadily expanded to a

wide array of issues including aid provision, disaster risk reduction, conflict management, peacekeeping and the protection of civilians [1]. As shown in figure 1, there is significant increasing in the number of regional organization around the world which reached to 30 by 2015. In today's globalizing world, almost all regions have some sort of regional organization, in many cases there are also sub-regional divisions of organizations in order to concentrate on more specific issues.

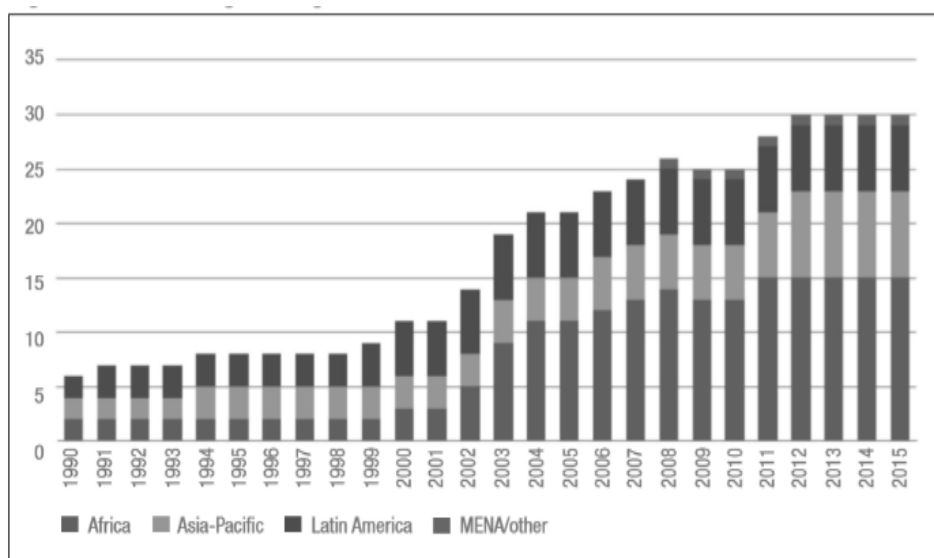


Figure 1: Growth of regional organizations' humanitarian institutions [2]

Regional organizations come in many various forms and were established to manage different purposes. Some were intended to coordinate political positions on broad issues of peace and security, others aim to enhance free trade, and still others were intended to enhance cooperation on very specific scientific or logistical issues. There have been a number of prominent examples of such regional organization contributing to humanitarian outcomes; The

Organization for Security and Co-operation in Europe (OSCE) which works for stability, peace and democracy for its members, broader institutions like African Union (AU) which is manage both political and administrative issues in Africa, European Union (EU) which include political and economic pacts to coordinate the relation between the European countries, and The North Atlantic Treaty Organization (NATO) which is primarily focused on

collective defence and war fighting. As well as, disaster reduction become one of the main key component in The United Nations Development Programme (UNDP).

II. UNITED NATION (UN) AND CRISIS MANAGEMENT

The United Nations (UN) is an international organization, made up of its member states, and founded in 1945 as a replacement for the League of Nations after World War II. The main objectives of the UN are to maintain international peace and security and achieve the international cooperation in solving international problems of political, economic, social, cultural, human rights, and humanitarian issues [3]. It has been involved in crisis management in a comprehensive range of fields and at multiple stages in disaster responses through its principal organizations and subsidiary entities. Due to the exigency, multiplicity and complexity of humanitarian crisis, crisis management cannot be defined by a single dimension or by a single UN agency's activities. It effects on health, safety, and well-being of a community or a country [4]. It is clear that the geographical coverage of humanitarian crisis could be local, national, and international. Furthermore, the time required to cope with each disaster varies, ranging from weeks, to months, to years, and to decades.

1. UN approach for crisis management
According to UNOCHA, 2015 the approach of UN to deal with crisis management was shifted from "disaster management" to "disaster risk management" which means that UN's purpose is not limited to provide disaster relief services during post-disaster situations, but it includes assessing the risks of crises, reducing the probability and size of losses, and preparing for them coping with their effects [5].

2. UN system for crisis management
The Office for Coordination of Humanitarian Affairs (OCHA) is the most comprehensive humanitarian relief and emergency responses of the UN system. While the UN Security Council is mainly responsible for maintaining international peace and security. Additionally, there are many UN subsidiary bodies and specialized agencies that are in charge of addressing crises related to their specialized areas or sub-population groups [6].

A. Office for Coordination of Humanitarian Affairs (OCHA)

The OCHA is considered the main office for humanitarian relief and emergency responses, his responsibility represented in being sure that all humanitarian efforts by various actors are coordinated in a coherent and unified platform. As well as, the primary objectives of OCHA are; 1) mobilizing and coordinating humanitarian actions in response to

disasters and emergencies in collaboration with multi-level actors, including national and international ones, 2) advocating the rights of needy people, 3) preparing for and preventing emergency situations, and 4) developing and implementing sustainable solutions [5].

B. Organizational arrangement and responsibilities

1. The Under-Secretary-General and Emergency Relief Coordinator (ERC)

It is responsible on assisting the oversight of humanitarian by the United Nations. It serves as the central focal point for governmental, intergovernmental and nongovernmental relief activities.

2. The Inter-Agency Standing Committee (IASC)

IASC aims to coordinate and develop policies, and make decisions on humanitarian assistance in collaboration with the United Nations and Non-United Nations actors. It works under the umbrella of the Emergency Relief Coordinator (ERC). It has a lot of objectives such as; developing system-wide humanitarian policies, allocating responsibilities amongst agencies in humanitarian programmes, developing a common ethical framework, identifying lack of operational capacity in disaster management; and resolving disputes or disagreements about and amongst humanitarian agencies [5].

C. UN Security Council

The Security Council is the organizational body in the UN system that takes actions when a threat to peace exists. Main functions and powers of the Security Council include maintaining international peace and security in accordance with the principles and purposes of the United Nations. The UN Security Council investigates disputes and situations that lead to international friction and determine the existence of a threat to peace or acts of aggression and to recommend actions. The UN Security Council has the authority to take military action to prevent or stop aggression. Additionally, it collaborates with regional and sub-regional organizations in maintaining international peace and security [6].

D. UN ECOSOC

The UN Economic and Social Council adopted a resolution (E/RES/2012/3) that reaffirms the principles of neutrality, humanity, impartiality and independence for the provision of humanitarian assistance [6]. This resolution reaffirms the significance of ensuring a smooth transition from relief to rehabilitation, reconstruction and development.

E. UN Subsidiary Bodies and Specialized Agencies

The International Organization for Migration (IOM): is committed to assisting in meeting the growing operational challenges of migration management and upholding the human dignity and well-being of migrants

The United Nations High Commissioner for Refugees (UNHCR): aims to protect refugees who have fled

their homes due to violence, conflicts and persecution. UNHCR provides shelter, food, water, medical care, and other life-saving assistance to refugees.

The United Nations Development Programme (UNDP): has the Emergency Response Division as its operational responsibility for this task. UNDP utilizes its extensive country office network, including offices in all crisis countries.

United Nations Environmental Programme (UNEP): has been working on emergency preparedness and response. It has also focused on facilitating the transfer of knowledge for sustainable development. UNEP undertakes environmental causes and consequences of natural hazards and environmental emergencies and attempts to reduce their impacts on vulnerable communities and countries.

World Health Organization (WHO): is the principal actor that helps member states in their emergency responses with regards to public health issues. It also serves as the Health Cluster Lead Agency in the Inter-Agency Standing Committee (IASC).

United Nations International Children's Emergency Fund (UNICEF): is in charge of humanitarian and developmental assistance to children and mothers in developing countries. UNICEF was originally created as the focal point to provide humanitarian assistance to children living in war-torn countries after the Second World War.

UN Food and Agricultural Organization (FAO): focuses on reducing people's vulnerability to hazards by incorporating risk assessment, risk reduction, emergency response and rehabilitation. It focuses on establishing food security and developing sustainable food and agriculture systems.

The World Food Programme (WFP): has one of the most comprehensive Early Warning Systems, collecting and analysing information on natural and human-caused hazards. WFP aims to feed more than 90 million people annually.

3. UN international coordination Mechanisms
Effective disaster response requires careful coordination at global, regional and national levels. As explained above, the UN has established a number of interdependent coordination mechanisms designed to guide relations among humanitarian actors and between humanitarian actors. Figure 2 shows the structure of UN coordination framework, and clarify how the coordination mechanisms work. The coordination mechanisms can be clarified in three levels; the first one is global level mechanism including the Emergency Relief Coordinator (ERC) and Inter-Agency Standing Committee (IASC). Second level is country mechanism with focusing on the Resident and Humanitarian Coordinators (RC/HC) and Humanitarian Country Team (HCT). Last level related to Bridging Mechanism including Cluster Approach and Office for the Coordination of Humanitarian Affairs (OCHA).

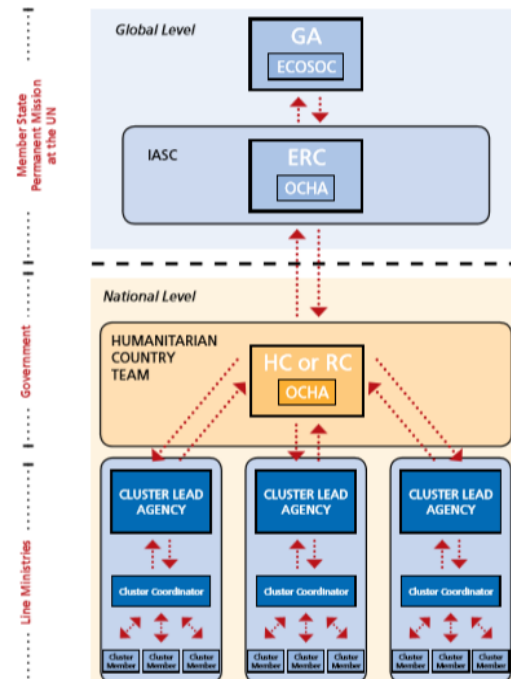


Figure 2: UN humanitarian coordination architecture [6]

III. CRISIS MANAGEMENT AT EUROPEAN UNION (EU)

Any single EU member-state can be easily overwhelmed by serious and complex security threats such as; armed attacks and terrorism, natural disasters and cyber-attacks. These threats need to be improved with an emphasis on better EU-level crisis response and risk management of all potential hazards. Strikingly, the EU has no uniform definition of the word crisis. Despite the ambiguity of the meaning of this word, the Understanding ranges from internal crises (e.g. a financial crisis), perceived threats to justice and home affairs (e.g. uncontrolled migration influxes), or external crises (e.g. international conflict) [7]. Because of EU crisis response is a policy area under constant revision and improvement, there are many recent and ongoing initiatives which aimed revise and adapt EU policies to shifting security contexts. The European Commission and the High Representative/Vice President (HRVP) have recently developed a comprehensive approach to external conflicts and crises' that implies a broader analysis, set of instruments and capabilities [8, 9].

1. EU approach for crisis management
After the end of the Cold War, new threats and risks were identified. They were too complex to be solved by single institution or unit such as the engagement in Bosnia, Iraq and Afghanistan. This engagement appeared that EU need to be much coordinated in crisis management. The EU started with introducing the European Security Strategy (ESS) which plays an important role in linking between the internal and external aspects as well as between security and

development [10]. As well as, the EU spent a significant time and energy on regulating its approach and improving internal coordination; starting with adapting the Lisbon Treaty in 2009, including the establishment of the External Action Service in 2011, and the adoption of a comprehensive approach to crisis management in 2013. The last development has been accompanied by reflection on the most appropriate instruments for providing added value in EU crisis management [11]. The HR/VP and the European Commission have introduced the following eight measures to enhance the coherence and effectiveness of EU external policy and action in conflict or crisis situations [12]:

- Develop a shared analysis
- Define a common strategic vision
- Focus on prevention
- Mobilize the different strengths and capacities of the EU
- Commit to the long term
- Linking policies and internal and external action
- Make better use of EU Delegations
- Work in partnership.

2. The EU crisis cycle: Institutions, decision-making structures

The EU believes that managing crises require balanced manner and swift responses. In order to alleviate human suffering, to prevent further escalation and strive to promote dialogue, reconciliation and reconstruction, and also to protect EU citizens. Crises seldom follow a predictable pattern, but when they erupt, immediate attention and coordination within the EU structures are required. According to reference [13], EU comprehensive approach include the following three phases in a crisis cycle:

A. Pre-crisis phase: despite crisis does not start in a specific moment, the motivation and origins elements can always be traced back through the following four elements: early identification of risk of violent conflict and starting the process for early action; improved understanding of the conflict situations (root causes, actors and dynamics); enhanced identification of the range of options for EU action; and finally, conflict-sensitive programming for external assistance [12]. From this point of view, the EU approach is taking all the necessary precautions and preparations where the pre-crisis response is mainly taken care of by the EEAS and the Commission, in line with their focus on early warning and conflict prevention.

B. Crisis phase: This phase is the most complicated one where the member-states have retained most decision-making powers, they must reach unanimity before a response can be launched. The Commission and the European Parliament

therefore have a very limited role, except in areas such as; development aid, humanitarian aid and civil protection while many EU institutions acting as a leaders. As shown in figure 3, the structure of Common Foreign and Security Policy (CFSP)/ Common Security and Defence Policy (CSDP) in order to understand how the decision to undertake a crisis response is made. The main decision-making bodies of the EU are; the European Council as ‘the most politically authoritative institution’, the Council of Ministers, the Foreign Affairs Council (FAC) which chaired by the High Representative of the Union for Foreign Affairs and Security Policy (HR). As well as, the Committee of Permanent Representatives (COREPER) which relies on the Working Party of Foreign Relations Counsellors (RELEX). The Political and Security Committee (PSC) that can be considered as a key institution in the CFSP/CSDP decision-making structure, assisted by the EU Military Committee (EUMC), the Politico-Military Group (PMG), and the Committee for Civilian Aspects of Crisis Management (CIVCOM) which offer advice concerning a military or a civilian response. Finally, the European External Action Service (EEAS) which plays an essential role in crisis response, in particular the Situation Room as it includes various cooperated institutions [14].



Figure 3: The structure of CFSP/CSDP [14].

C. Post-crisis phase: the main objective of this phase is not only to respond to the crisis but it extends to implement the stabilization and state-building efforts for peace, human security and preventing expected crisis [15]. The EU has been involved in various negotiations of peace agreements and extended ceasefires (e.g. Aceh, South Sudan, Mindanao) as well as various kinds of reconciliation processes (e.g. Belgrade-Pristina).

3. EU functions and tasks

The functions and tasks provided for in Title V of the Treaty on the European Union (General Provisions on the Union's External Action and Specific Provisions on the Common Foreign and Security Policy), in particular Article 21 TEU, Article 27(2) TEU and

Article 43(1) TEU. According to reference [16], the EU has acted as crisis manager across the spectrum:

- As a conflict preventer or security guarantor during elections (e.g. DR Congo)
- As a counter-terrorism agent (e.g. Niger)
- As a combatant against organized crime and illegal migration (e.g. Southern Mediterranean)
- As a combat force in crisis management against piracy (e.g. Horn of Africa)
- As an agent for humanitarian relief and rescue (e.g. DR Congo)
- As an honest broker of peace between the parties to a conflict (e.g. Aceh)
- As a facilitator for mediation between adversaries (e.g. Serbia-Kosovo, and Iran)
- As a peacekeeper on the invitation of a host country (e.g. FYROM)
- As a regional arrangement operating under a mandate by the UN Security Council to Assist peacekeeping operations conducted by other international organizations (e.g. Darfur)
- As a post-conflict stabilizer, a component of an international transitional administration (e.g. Pillar IV in the UN Mission in Kosovo)
- As an Assistant to border management (e.g. Moldova/Ukraine)
- As an adviser in justice reform (e.g. Georgia)
- As a trainer of police and prison staff (e.g. Iraq)
- As a military adviser and Assistant (e.g. Guinea-Bissau)
- As a civilian security sector reformer (e.g. Ukraine).

IV. NORTH ATLANTIC TREATY ORGANIZATION (NATO) CRISIS MANAGEMENT

The North Atlantic Treaty Organization has changed dramatically since the end of the Cold War. Today, it plays a significant role as a global security provider, is a concrete embodiment of the transatlantic relationship, and is still the most important defence related organization in Europe. NATO increased its roster of members three separate times during the Cold War and has continued to take in new members, most recently in 2004. In addition to this, the organization has created a network of partners that has successfully expanded NATO's influence beyond its members and increased stability and cooperation between states that previously had not cooperated in security issues. The Alliance has also expanded its operational remit and added crisis management, along with partnership, to collective defence as a core alliance task [17].

1. NATO's tasks and Missions

The North Atlantic Treaty Organization has taken on a number of new tasks and missions since the end of the Cold War. The Alliance's fundamental purpose remains "to safeguard the freedom and security of its member countries by political and military means". In 1990, NATO's members has agreed to five fundamental security tasks: (1) Security, (2) Consultation, (3) Deterrence and Defence, (4) Crisis Management, and (5) Partnership [17]. To achieve this, NATO has made a very commendable effort to advance and set legal and ethical standards that facilitate consensus among member nations in the always difficult decision to intervene in a Crisis Response Operation. The new tasks have been extended to include; the contribution to the effective conflicts prevention, the application of an effective crisis management to prevent their escalation into conflicts, the ensuring of the readiness of civilian and military capabilities, Control and prevention of escalation and discouraging the aggressor from violence in the military actions, and crisis de-escalation after stopping violence or end of disaster.

2. NATO Crisis Response System (NCRS)

The evolution of NATO crisis response system went through many stages, beginning with the NATO alert system during the cold war period. While in the 1990s crises were managed through NATO precautionary system, military response options and inventory of preventive measures. In 2001, the requirement for a new system represented in NCRS development. Recently, the new strategic concept of NATO is a comprehensive crisis and operations management centre. The following range of measures are applied in crisis management to make the Alliance ready to resolve the crisis [18]:

A. Integrated System: including the Early Warning System, NATO Precautionary and Preventive Measures catalogue of potential Military Response Options, and Integration of prevention and reaction measures.

B. Combination of political-military and emergency measures: represented in NATO's Intelligence & Warning System, NATO's Operations Planning process, Civil / military & Civil Emergency Planning (CEP) Crisis Management Arrangements, and NATO's contribution to Comprehensive Approach with international organizations.

C. Comprehensive: the operation of Article 5¹ and non-Article 5² is embraced by NATO.

¹ Article 5 Collective Defense: NATO members participate fully within the Alliance and are equally committed to the terms of the Treaty. The Article 5 is namely to consider an armed attack from an enemy against one or more of them as an attack upon them all. It is a formal obligation for NATO to take action against armed attack.

² Non-Article 5 Crisis Response Operations: it includes multifunctional operations, falling outside the scope of Article 5, which contribute to conflict prevention and resolution or serve humanitarian purposes, and crisis management in the pursuit of

Additionally, the defence against terrorism, counter proliferation and cyber.

D. Flexibility: NATO's principles can be changed in order to adapt the varied crisis situations.

E. Prevention and precautionary: NATO has preventive options in order to prevent crisis escalation and conflict. As well as, they enhance the Alliance preparedness through Crisis Response Measures.

3. Key NATO Crisis Response System's bodies

As shown in figure 4, the structure of NATO with the principal political decision-making body North Atlantic Council (NAC) which exchanges intelligence, information and other data, compares different perceptions and approaches, harmonises its views and takes decisions by consensus, as do all NATO committees. It is the NAC that decides on a case-by-case basis and by consensus whether to engage in a crisis response operation. The Council is supported by the Operations Policy Committee, the Political Committee, the Military Committee and the Civil Emergency Planning Committee. The operations policy committee which aim to collaborate between the political and military sides. The political and partnerships committee responsible for all NATO programs with non-member countries and relations with international organizations while military committee provides military advice to NATO's decision-making bodies. The Civil Emergency Planning Committee also plays a significant role in making decisions, it can be considered as an advisory body for the protection of civilian populations and the use of civil resource. It is responsible for civil emergency planning providing oversight and guidance to four planning area; civil protection, communication and industrial planning, public health and food, and transport [19]. In the field of crisis management, NATO communication systems, including a "Situation Centre" (SITCEN), receive, exchange and disseminate political, economic and military intelligence and information around the clock, every single day of the year. NATO periodically exercises procedures through scheduled Crisis Management Exercises (CMX) in which the Headquarters (civilian and military) and capitals participate, including partners and other bodies who may be involved in a real-life crisis. As well as, Euro-Atlantic Disaster Response Coordination Centre (EADRCC) with 24/7 duty officer system. Its main role is to coordinate of Euro-Atlantic Partnership Council (EAPC) nations' assistance to each other in case of disaster [19].

declared Alliance objectives. There is no formal obligation for NATO nations to take part in a NA5CRO.

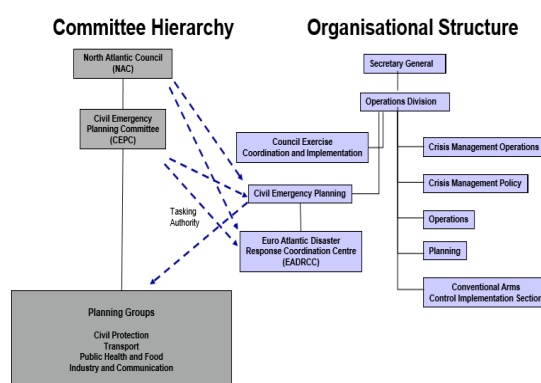


Figure 4: NATO Crisis Response System's structure [19]

Regarding the previous structure, it is clear that NATO provides the framework within which members can work and train together in order to plan and conduct multinational crisis management operations, often at short notice. The comprehensive approach of NATO Crisis Response System (NCRS) is a process within which a number of elements are geared to addressing different aspects of NATO's response to crises in a complementary manner. These include: the NATO Crisis Management Process (NCMP), the NATO Intelligence and Warning System (NIWS), NATO's Operational Planning Process and NATO Civil Emergency Planning Crisis Management Arrangements, which together underpin NATO's crisis management role and its ability to respond to crises.

V. ORGANIZATION FOR SECURITY AND CO-OPERATION IN EUROPE (OSCE) IN CRISIS MANAGEMENT

Because of the enlargement in 2004, the EU doesn't represent all participating states. When one includes those non-EU members states that consistently coordinate their position in The Organization for Security and Co-operation in Europe (OSCE) with the EU, the union has acquired unprecedented weight inside the organization. Furthermore, the OSCE has assumed many responsibilities, it became a vital forum for EU foreign policy and an important plank of member states vision of Europe's security architecture [20]. The approach of OSCE remains the normative foundation for much EU member state thinking. As well as, the Union and member states have attached great value to the unique range of activities and missions undertaken by the OSCE. It is considered as a forum for political dialogue on a wide range of security issues and a platform for joint action to improve the lives of individuals and communities [21].

1. **OSCE Mechanisms for Crisis Management**
Through its comprehensive approach to security that encompasses the politico-military, economic and environmental, and human dimensions and its

inclusive membership, the OSCE helps bridge differences and build trust between states by co-operating on conflict prevention, crisis management and post-conflict rehabilitation. According to reference [21] the approach is focused on three dimensions; the politico-military, the economic and environmental, and the human. In military matters, it seeks to create greater openness, transparency and co-operation and has developed the world's most advanced regime of arms control and confidence building measures. While in economic and environmental issues are also key factors in building security through promoting good governance, tackling corruption, environmental awareness,

sharing natural resources and sound management of environmental waste. Finally, Human rights and fundamental freedoms are the bedrock of stable societies. The OSCE helps its participating States build democratic institutions; hold genuine and transparent democratic elections; ensure respect for human rights, media freedom, the rights of national minorities and the rule of law, and promote tolerance and non-discrimination. Figure 5 shows the other challenges that pose a threat across borders, such as climate change, terrorism, radicalization and violent extremism, organized crime, cybercrime and trafficking in drugs, gender equality and migration.



Figure5: Security Branches of OSCE [21]

1. **Decision making bodies in OSCE**
Each week ambassadors meet at the Permanent Council, the OSCE's regular decision making body, and the **Forum for Security Co-operation**, where decisions are taken regarding military aspects of security. A **Ministerial Council** is held annually to review OSCE activities and provide overall direction. **Summits of Heads of State or Government of OSCE** participating States take place periodically to set priorities at the highest political level. In addition to the **Chairmanship**: a different participating State holds the OSCE Chairmanship each year with that country's foreign minister as Chairperson in-Office, working alongside the previous and succeeding Chairmanships, who together form the OSCE Troika. **Secretariat**: the Secretary General heads the Secretariat based in Vienna, and directly supports the Chairmanship. The Secretariat comprises the Conflict Prevention Centre and departments and units focusing on economic and environmental activities, cooperation with Partner countries and organizations,

gender equality, anti-trafficking, as well as transnational threats including anti-terrorism, border management and policing reform. They monitor trends, provide expert analysis and implement projects in the field [20]. **Institutions**: the OSCE also includes institutions such as the Warsaw-based Office for Democratic Institutions and Human Rights (ODIHR), which promotes democratic development and human rights. Areas of its work include election observation, the rule of law, promoting tolerance and non-discrimination and improving the situation of Roma and Sinti. ODIHR hosts the annual Human Dimension Implementation Meeting, the largest annual human rights conference in the OSCE region. **Representative on Freedom of the Media**: follows the Vienna-based which observes media developments and provides early warning on violations of freedom of expression and media freedom, promoting full compliance with OSCE media freedom commitments. **High Commissioner on National Minorities**: as a tool of conflict

prevention based in The Hague, uses quiet diplomacy and early action to seek resolution of ethnic tensions that might endanger peace, security and stability. **The Parliamentary Assembly:** brings together more than 300 lawmakers from the parliaments of OSCE participating States to facilitate dialogue and co-operation and to promote accountability. OSCE parliamentarians also play a leading role in the Organization's election observation activities, conduct field visits, and drive organizational reform [20].

VI. AFRICAN UNION CRISIS MANAGEMENT

The African Union (AU) was officially launched in July 2002 in Durban, South Africa. Its predecessor was the Organization for African Unity (OAU) established in 1963. The organisation has been charged with the responsibility of preventing, managing and resolving violent conflicts ranging from political violence, terrorism, insurgency, and so on [22]. In the African region, AU's interventions in African states have generated academic debates especially in the Mali and Nigerian crisis. While some scholars consider AU's intervention as being effective, others consider it ineffective. One of the main objectives of the AU is to defend the sovereignty, territorial integrity and independence of its Member States [23], but the AU is currently having difficulty to achieve this objective.

1. Objectives and Missions of AU

It is clear that AU'S norms, values, objectives and principles have been unevenly applied to states that have fallen in to conflict. These objectives are written in a consistent manner without the effective implementation. According to article 3 of the Constitutive Act of the African Union (2000) and the Protocol to the Act (2003), the Union's objectives are to [23]:

- Achieve greater unity and solidarity between African countries and the peoples of Africa
- Defend the sovereignty, territorial integrity and independence of its Member States
- Accelerate the political and socio-economic integration of the continent
- Promote and defend African common positions on issues of interest to the continent and its peoples
- Encourage international cooperation, taking due account of the United Nations Charter and the Universal Declaration of Human Rights
- Promote peace, security and stability on the continent
- Promote democratic principles and institutions, popular participation and good governance
- Promote and protect human and peoples'

rights in accordance with the African Charter on Human and Peoples' Rights and other relevant human rights instruments

- Ensure the effective participation of women in decision-making, particularly in the political, economic and socio-cultural areas
- Establish the necessary conditions that enable the continent to play its rightful role in the global economy and in international negotiations
- Promote sustainable development at the economic, social and cultural levels as well as the integration of African economies
- Promote cooperation in all fields of human activity to raise the living standards of African peoples
- Coordinate and harmonise policies between the existing and future Regional Economic Communities for the gradual attainment of the objectives of the Union
- Advance the development of the continent by promoting research in all fields, in particular, in science and technology
- Work with relevant international partners in the eradication of preventable diseases and the promotion of good health on the continent
- Develop and promote common policies on trade, defence and foreign relations to ensure the defence of the continent and the strengthening of its negotiating positions
- Invite and encourage the full participation of the African Diaspora, as an important part of the continent, in the building of the Union.

2. Legal and institutional framework of AU

The establishment of the African Union heralded a new trend to deal with issues of peace and security in the continent. It came up with the **African Peace and Security Architecture (APSA)** aimed at prevention, management and resolution of crises or conflicts and post crisis reconstruction. The main pillar of the APSA is the **Peace and Security Council (PSC)**, its component and responsibilities were outlined in the PSC protocol which was adopted in Durban 2002. The PSC is a collective security arrangement to facilitate timely and efficient response to conflicts and crisis situations in Africa; anticipate and prevent conflicts; promote and implement peace building and post-conflict reconstruction activities; and coordinate and harmonize efforts in the prevention and combating of terrorism [22]. PSC is supported, in the discharge of its mandate, by various structures, namely: **the Commission, the Panel of the Wise, the Continental Early Warning System (CEWS), the African Standby Force (ASF) and the Peace Fund** [24]. Furthermore, it is also expected to promote close harmonization, coordination, and cooperation between regional mechanisms and the Union in the promotion and maintenance of peace, stability, and

security in Africa. Accordingly the **Peace and Security Council Secretariat** provides the operational and administrative support required by the PSC, to enable it and its subsidiary bodies to perform their functions effectively. The Secretariat acts as the storehouse of the institutional memory on the work of the PSC and facilitates its interaction with other organizations and institutions on issues of peace and security [23]. The **Defense and Security Division (DSD)**, within the PSC addresses long-term, cross-cutting defense and security issues. The DSD is in charge of issues relating to arms control and disarmament, counter terrorism, nuclear non-proliferation, maritime safety and security and other strategic security issues, including **Security Sector Reform and Disarmament Demobilization and Reintegration (DDR)** processes. The DSD conducts research, and produces policy documents and other publications and implements related projects in consultation with Member States, Regional Economic Communities (RECs), and the International Community, Partners, Civil Society Organizations and other stakeholders. The Division also plays a key role in the implementation of the African Peace and Security Architecture. Regionally, the APSA relies on the continent's **Regional Economic Communities (RECs)**. The relationship between the AU and the RECs is supposed to be hierarchical but mutually reinforcing. AU harmonizes and coordinates the activities of the RECs in the peace and security realm, in part through the contact of officers from the RECs serving within the AU Commission in Addis Ababa. At the continental level, a variety of institutions coordinated by the AU's Peace and Security Council comprise the APSA [23].

Since the establishment of African Union in general and the African Peace and Security Council in particular is promoting the idea of "African Solution for African problem". But the achievement on the ground is far from significant where the African Union was short of capacity to deal with the crisis on timely basis. Additionally, the AU is facing some challenges related to the balance between the aspirations of different actors, involved in the crisis management. Ironically most of the problems specifically related with peace and security are being addressed by the former colonial powers that are sometimes part of the problem themselves.

VII. CONCLUSION

There are many organizations that seek to manage the crisis, including those who respond quickly and appropriately based on their experience, abilities and learning from previous lessons. On the other hand, there are those who do not respond very effectively according to their capabilities. As a consequence, it is building closer partnerships with civilian actors – including non-governmental organisations and local

authorities – and is focusing on several key areas of work including cooperation with external actors; planning and conduct of operations; lessons learned, training, education and exercises; and public messaging. Such techniques could move the world forward in the future through early warning, conflict prevention, and crisis management. The importance of local and regional support should be highlighted. Indeed, it was observed that local and regional emergency response capacity was vital for dealing with national emergencies and for contributing to international relief efforts. So networking among practitioners and among the relevant organizations is vital. It was concluded that cooperation and preparedness are a prerequisite for the implementation of an effective response to crisis and disaster. In this context, the record of NATO's sustained cooperation with the UN, the Organization for Security and Co-operation in Europe, African Union, and the European Union (EU) stands as a precedent.

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LATENT PATTERN IN THE CONSUMPTION OF JAPANESE LOCAL CULTURAL THINGS

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Abstract - It is often argued that modern consumer society is becoming more uniform with globalization. On the other hand, it has been reported that the consumption of local cultural things has become one of the basic trends in Japan in recent years. Furthermore, it has been argued that the consumption of local cultural things may be related to exclusionary nationalism. In this paper, the latent class analysis estimates the patterns of acceptance of local cultural objects in Japan. Furthermore, a multinomial logistic regression analysis was conducted to examine the determinants of the individual's alienation from foreigners as a determinant of the acceptance pattern. As a result, the effect of exclusionary nationalism on the preference for local cultural objects was found to be very limited.

Keywords - Consumer culture, Consumer society, Latent Class, Local culture

I. INTRODUCTION

The purpose of this paper is to analyze the patterns of acceptance of Japanese local culture in today's globalized consumer society, and what factors determine these patterns of acceptance.

One of the consequences of the globalization of consumer culture is the Ritzer's (1993) "McDonaldization" theory, in which he argues that an American-based rationality-based consumer culture is increasingly leading to uniformity and destroying local consumer culture. In the first place, the globalization of consumer culture itself presupposes a cultural system that transcends spatial and linguistic differences to communicate and share information globally, and the tendency toward uniformity, such as the "McDonaldization" that is a consequence of the efficiency and computability demanded by today's economy and society, can be further enhanced by information technology.

On the other hand, a long-term trend in Japanese consumption since the 2000s has been a preference for *wa-fuu* (Japanese-style) products. This can be reinterpreted as a research question as to why, in a globalized consumer society, Japanese local culture's preference for "Japanese style" has become a trend in consumption. In this study, this question is further analyzed and reinterpreted as a question of "how and by what factors is Japanese culture, as a local culture, being accepted in the globalized consumer society. In other words, by positioning the consumption of Japanese things as "acceptance of local culture," the patterns of acceptance are categorized using a latent class model, and the determinants of these patterns of acceptance are analyzed.

Since the 2010s, journalism has reported on the growth of exclusionary nationalism, such as hate speech. Some argue that the acceptance of Japan's indigenous culture is in danger of converging with exclusionary nationalism (Kayama 2002). This paper

focuses on exclusionary attitudes as a manifestation of exclusionary nationalism and develops a working hypothesis that "exclusionary attitudes toward foreign residents has a significant effect on the acceptance of local culture" and statistically tests this hypothesis.

II. METHODOLOGY

A. Overview of the Survey

This study is based on data from the survey research conducted in the Tokyo metropolitan area in 2016. An overview of the survey is given below.

Survey title: *Survey on Consumption and Lifestyles in the 21st Century*

Population: male and female individuals between the ages of 15 and 69 (as of the end of August 2016) living in a 40 km radius around Shinjuku Station.

Sampling method: stratified two-stage random sampling (probability proportional sampling)

Survey mode: mail survey

Survey period: September-October 2016

Sample size: 4,000

Number of valid responses: 1,609 (41.3%)

Details of the survey and sample design, as well as the results of the sampling and the age distribution of the validated ballots are shown in Hatayama and Hirose (2017).

B. Variables

The concept of "acceptance of local culture in Japan" was operationalized as follows.

First, the concept of "local culture in Japan" is operationalized as "Japanese things" that are the objects of Japanese consumption of goods and services. The questionnaire lists the following items: *washoku* (Japanese food), *yukata* and *kimono* (Japanese clothes), Japanese house, *ryokan* (Japanese inn), *mingei-hin* (Japanese folk crafts), old Kyoto townscape, *onsen* (hot springs), and *enka* (traditional

Japanese music), *sumo* (sumo wrestling), temples, and shrines.

Next, the concept of "acceptance" of local culture was measured using a four-item scale, with respondents' preferences for these 11 items being "like", "somewhat like", "somewhat dislike" and "dislike".

This study also operationalizes xenophobic attitudes that are used as explanatory factors regarding the acceptance of local culture. The questionnaire contains two items to explain the exclusion of foreigners from the local community: "Hiring foreigners as local officials under the same conditions as Japanese" (Exclusion-A) and "Allowing foreigners to vote in local elections" (Exclusion-B), and the questionnaire asks respondents whether they agree or disagree with these two items using a four-item method. The higher the value of these variables, the stronger the oppositional attitudes, and consequently express exclusionary attitudes. Basic statistics are shown in Table 1.

Item	<i>N</i>	<i>Mean</i>	<i>S.D.</i>
Age	1,529	47.29	13.99
Sex (female=1)	1,529	.54	.50
Years of education	1,518	14.45	1.98
<i>washoku</i>	1,517	3.73	.49
<i>yukata</i> and <i>kimono</i>	1,512	2.93	.87
Japanese house	1,516	3.05	.78
<i>ryokan</i>	1,517	3.25	.76
<i>mingei-hin</i>	1,514	2.89	.77
old Kyoto town	1,515	3.45	.68
<i>onsen</i>	1,517	3.63	.64
<i>enka</i>	1,516	2.10	.92
<i>sumo</i>	1,516	2.38	.94
Temple	1,517	3.15	.80
Shrine	1,517	3.19	.79
Exclusion-A	1,518	2.53	.90
Exclusion-B	1,518	2.51	.94

Table 1

C. Latent Class Analysis

This study applies latent class analysis to categorize the patterns of acceptance of 11 survey items related to local culture for Japan. The reasons for using latent class analysis in this study are briefly summarized as follows. Compared to cluster analysis, which is often used for pattern classification, latent class analysis allows us to calculate the probability of each individual belonging to each class and the degree of fit of the classification results to the data as a whole. Since the classification of each class is never uniquely determined, it is probabilistically determined which class each respondents belongs to, and the probability of its belonging can be calculated (Hagenaars and McCutcheon 2002).

Latent class analysis is also a method for analyzing latent structure as well as factor analysis. However, while general factor analysis assumes continuous

latent variables, latent class analysis assumes categorical latent variables, and each of these categories is called a "class". Furthermore, with regard to observables, quantitative data are input into general factor analysis, but latent classes can also be input with binary data, ordinal scale variables, and nominal scale variables. This is also an advantage because many of the data measured in social surveys are categorical variables.

Latent class analysis allows for multiple classifications, such as 2-class and 3-class models and allows for comparisons between models by calculating a goodness of fit index for each model.

D. Policy of the analysis

Patterns of acceptance of local culture were extracted from the positive and negative reactions to 11 survey items that were designed to represent the local culture in Japan, and a factor analysis was conducted to determine which of these patterns people belonged to, using a number of explanatory variables. The procedure of the statistical analysis can be divided into three steps. (1) determining the number of classes through latent class analysis, (2) assigning each individual in the study to the class with the highest probability of belonging, and (3) exploring the determinants of the differentiation of patterns of local cultural acceptance through multinomial logistic regression analysis using the class of affiliation as the dependent variable.

In conducting the latent class analysis, first, teenagers were excluded from the analysis of this study because they were not yet determined to have an intention to accept local culture. Second, the eleven questions on "preference for Japanese things" that were used to categorize the patterns of acceptance of local culture were recoded into a binomial variable (merger of response categories). The reason for this recoding was that if the 11 items were used as the four responses in the questionnaire, the number of combinations would be 411, which is quite large, and it would be difficult to summarize the local cultural acceptance into a simplified pattern, and the estimation results would be somewhat unstable in some cases.

Third, the latent class model was unconstrained as much as possible, and the latent class model was simply estimated by using only the age group (age) of the respondents as a covariate, which is a basic demographic attribute. A multinomial logistic regression analysis was then conducted using social stratification and other explanatory variables to explore the factors that contribute to individual membership in each class.

III. RESULT

A. Estimation of latent class models

A latent class analysis was conducted based on the positive and negative responses of each item of local culture in Japan. Once all the items were included in

the estimation of latent classes, the response rates for washoku (Japanese food) and onsen (hot spring) were high in all classes, so these two items were excluded to make the discrimination between the classes clearer, and nine items were estimated again. In addition, the age of each case was used as a covariate in the estimation of the classes.

When the model in which the classes to which each case belonged were estimated under the assumption that there were two latent classes is described as a "2-class model", Table 2 shows the results of the latent class analysis in which classes were estimated under the assumption of a 2-class model to a 6-class model. As a procedure for determining the number of classes in the pattern classification, we adopted an exploratory approach by comparing the goodness of fit indices among multiple models with different numbers of classes that were not rejected at the 5% level. The results are presented in Table 2. Here, the 5-class model was adopted with the lowest value using the BIC as the goodness of fit index.

Model	BIC	L^2	df	p
2-class model	12442.78	2260.63	1481	.000
3-class model	12090.47	1805.89	1467	.000
4-class model	11815.43	1428.43	1453	.670
5-class model	11638.07	1148.65	1439	1.000
6-class model	11660.19	1068.34	1425	1.000

Table 2
* L^2 : log-likelihood chi-square value

For each of the classes identified in this section, line graphs of response probabilities to the 11 items are shown in Figure 1.

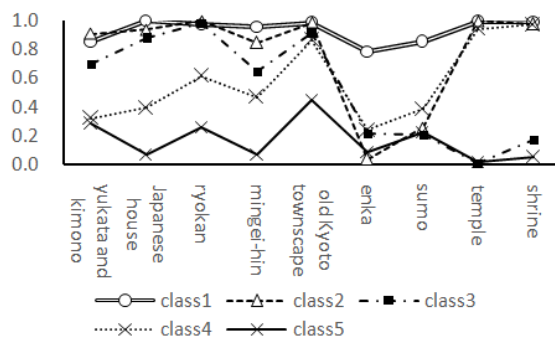


Figure 1

The following is a brief description of how the five estimated classes show the pattern of preference toward Japanese things: Class 1 can be read as a pattern in which respondents respond favorably to all items, Class 2 responded favorably to most of the items, but only the *enka* and *sumo* items showed low favorability, Class 3 as a pattern similar to Class 2, but does not respond to "places" such as visiting temples and shrines, Class 4 as a pattern in which they respond

to "places" such as *ryokan*, old Kyoto townscape, and temples and shrines, and Class 5 as a pattern in which they respond less favorably to all items.

B. Determinants of Local Cultural Acceptance Patterns

Having estimated latent classes of local cultural acceptance patterns, the determinants of these latent class affiliations were explored through multinomial logistic regression analysis. Since multinomial logistic regression analysis requires a reference category for the explained variable, we designated it as class 5.

Table 3 shows the results of the multinomial logistic regression analysis using two variables that operationalized the exclusionary attitudes toward foreign residents, "exclusion-A" and "exclusion-B". The results of this analysis show that the Nagelkerke R^2 is .238, which is significant for the model. Looking at the effects of each explanatory variables, exclusion-A does not have a significant effect on either class. The parameter estimates of the effect of exclusion-B on Class 1, which has a high preference for all Japanese things, was .391, which is not very high, but is significant. The results were significant even after controlling for the age effect, as we did here. Nevertheless, there was virtually no significant effect of Exclusion-A and Exclusion-B on other class affiliations, and the analysis suggests that exclusionary attitudes in local politics had little effect on the acceptance of local culture.

	Class 1	Class 2	Class 3	Class 4
Intercept	-1.439	-0.603	1.085	-2.698*
Sex	0.334	1.014**	0.644*	0.329
Age	0.054**	-0.028**	-0.018	0.030**
Yr. of Educ.	-0.027	0.145*	-0.061	0.088
Exclusion-A	-0.189	0.024	0.028	-0.068
Exclusion-B	0.391*	0.310	0.281	0.405

Table 3
Reference category: Class 5.
N=1485, Nagelkerke R^2 =.238 * $p<0.05$, ** $p<0.01$

IV. CONCLUSION

In this study, five patterns of local cultural acceptance were identified through latent class analysis. Next, the individuals were classified into classes with the highest probability of belonging, and a multinomial logistic regression analysis was applied to determine the mechanism of belonging to any of the classes, controlling for attributes such as gender and age, and exclusionary attitudes toward foreign residents as explanatory variables. As a result, it can be concluded that although some of the variables of exclusionary attitudes had a significant effect, they did not have a significant effect overall. It can be concluded that Kayama's (2002) nationalism hypothesis, which argues that orientation to local culture "converges with exclusionary nationalism," does not fit the data.

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SIMULATIONS OF FRW MODELS WITH VARIABLE EQUATION OF STATE

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Abstract - We explore the dynamics of FRW models by postulating two separate equations of state with dependence on the scale factor. This analysis amounts to studying the new form of the Friedmann equations and analyzing the evolution of the different universe based on the new terms introduced by the changes in the equation of state. Connections and deviations from the classical FRW solutions are referred to throughout the analysis.

Keywords - Cosmology, FRW, Equation of State

I. INTRODUCTION

The goal of this contribution is to study FRW cosmology models by relaxing the condition that the stress energy tensor takes the form of a perfect fluid. This area of research is quite rich, and there have been many suggestions on how to improve the classical models. In particular, Tiwari (2011) explored the classical perfect fluid model under the assumption that the cosmological constant behaves as some negative power of the Ricci scalar. Tiwari is able to explore the dynamics of a variable G (Newton's constant) and Λ with this formalism. C.P Singh and V. Singh (2011) studied these perfect fluid models by postulating a coupling of a scalar field to the stress-energy tensor. In this way, the authors explore the dynamics of this cosmology by assuming the scalar factor and a self-interacting scalar potential are a function of this scalar field. Finally, Alvarenga F.G et al (2001) stipulated a quantum cosmological perfect fluid model using Schutz's variational formalism. Under a certain interpretation, the authors predict both an initial and final singularity.

Before exploring various simulations of different cosmologies; we will first review the key equations of FRW (Friedmann-Robertson-Walker) spacetimes. FRW spacetime models are cosmological solutions to Einstein's equations for the evolution of the spacetime manifold under certain assumptions. These spacetimes make use of the 'Copernican principle', which postulates that there are no special observers in the universe [James Schombert (2019)]. Mathematically, this corresponds to the assumption that the universe is isotropic (looks the same in every direction) and homogeneous (looks the same at every point on average). FRW models assume there is expansion with regards to spacetime at an earlier time. To incorporate this fact, we use comoving coordinates; in which we measure distances $r(t) = r_0 a(t)$ in terms of the scale factor, $a(t)$. Notice, the scale factor is completely responsible for the spatial expansion of spacetime. The Friedmann equations

with non-zero cosmological constant, Λ , can be separated into the spatial (2) and time (1) components of the Einstein equation $G_{\mu\nu} = 8\pi G T_{\mu\nu}$. The equations take the form:

$$3\left(\frac{\dot{a}^2}{a^2} + \frac{k}{a^2}\right) = 8\pi G\rho + \Lambda \quad (1)$$

$$-2\frac{\ddot{a}}{a} - \frac{\dot{a}^2}{a^2} - \frac{k}{a^2} = 8\pi Gp - \Lambda. \quad (2)$$

Where k is the scalar curvature of the spacetime manifold, p is the pressure of an ideal fluid and ρ is the energy density of the fluid. In classical FRW model, in order to explore the dynamics of different universes with matter we must postulate an equation of state. The simplest equation of state is that of a perfect fluid, the equation of state takes the form:

$$p(t) = w\rho(t). \quad (3)$$

With a suitable choice of the constant w we can find a solution for the scale factor in terms of our physical constants and our one parameter (either p or ρ). It should be noted that particular choices of w correspond to the dynamics of different forms of matter. In particular, $w = 0$ corresponds to the dynamics of pure dust, $w = -1$ corresponds to dark energy (the solution in which the cosmological constant dominates) and $w = -\frac{1}{3}$ corresponds to the solution for a radiation dominated universe.

In this contribution we explore the dynamics of changing the equation of state so that it takes a different form or depends on a given dynamical variable. By making this change we are effectively studying the dynamics of different universes, the goal being that by studying these universes, we might further our understanding of the dynamics of our own universe more concretely. A review of the Friedmann equations and FRW cosmologies can be found in [Islam (1992)].

II. SCALE FACTOR DEPENDENT EQUATION OF STATE

It can be shown that (1) and (2) reduce to the single equation:

$$\frac{d}{da}(a^3 \rho(a)) = -3p(a)a^2. \quad (4)$$

Hence, through a choice of w from (3) (and suitable initial condition) we can solve (4) for the function $\rho(a)$ (or $p(a)$, the choice we made is taken due to its obvious physical interpretation) which describes how the matter density of the universe varies with the scale factor $a(t)$; the solution describes how the density of the universe changes as the universe expands. Early FRW models showed that there are two ultimate fates to the universe. a) The matter density of the universe goes to zero asymptotically – this is known as the ‘big freeze’ model. All the matter in the universe is so far apart, and so there is hardly any interaction. Stars cannot be reformed, and the universe slowly dies out (note: here we are not considering a ‘big rip’ scenario in which the expansion of the universe is so fast as to cause a ‘rip’ in spacetime). b) The matter of the universe becomes infinite asymptotically, the so called ‘big crunch’ scenario in which our universe tends towards a singularity (the state of the universe prior to the big bang).

To explore different dynamics of the FRW cosmologies, we changed to equation of state to be given by:

$$p(t) = w(a)\rho(t). \quad (5)$$

Where $p(t)$ is the time dependent pressure, $\rho(t)$ is the time dependent energy density of a perfect fluid

and the variable $w(a) = w(a(t))$ is dynamical through its dependence on the scale factor, $a(t)$. It is clear that we have introduced time dependence into the equation of state by allowing the $w(a)$ to depend on the scale factor. Then, we simulated for different universe by choosing different functions $w(a)$ and solving (4) under the initial condition $\rho(t_0) = \rho_0$. The solutions are plotted in Fig. 1 and Fig. 2. Note that Fig.1 involves “Big Crunch” simulations, and so all the plots are concave up; while in fig.2 the plots are concave down (again, this is due to the fact that the density goes to zero in Big freeze universe, while $\rho(t)$ asymptotically tends to infinity in the “Big Crunch” case). Note that we simplify the plots by using natural units such that $G = c = 1$; and thus, the difference in scales between the graphs is what is relevant to discuss.

We now discuss the quantitative behavior of the plots in Fig.1 and Fig.2. Looking at Fig. 1 we can see that the universe with equation of state $w(a) = -\ln(a)$ evolves on a much longer time period compared to universes with equations of state $w(a) = -a^2$ and $w(a) = -\sqrt{a}$ (can be seen by the difference in scales on the time axis). Likewise, we can say the universe with equation of state $w(a) = -a^2$ has a much larger initial density as compared with the universe with equation of state $w(a) = -\sqrt{a}$ (the universe with equation of state $w(a) = -\ln(a)$ has a truly small initial density and yet a surprisingly long lifetime compared to the other universes). The universe with equation of state $w(a) = -a^2$ is also different from the other two universes due to the fact that it has a poorly defined critical point (this universe remains at a critical density close to zero for most of its evolution).

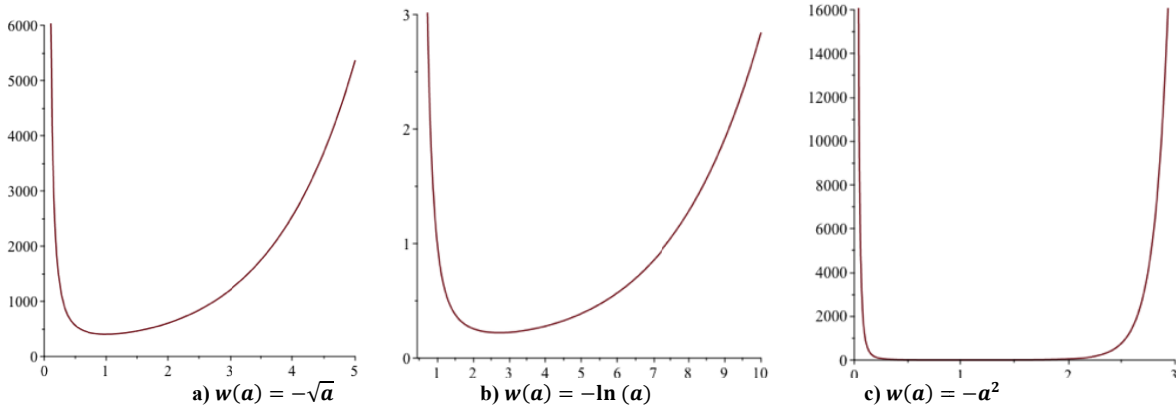
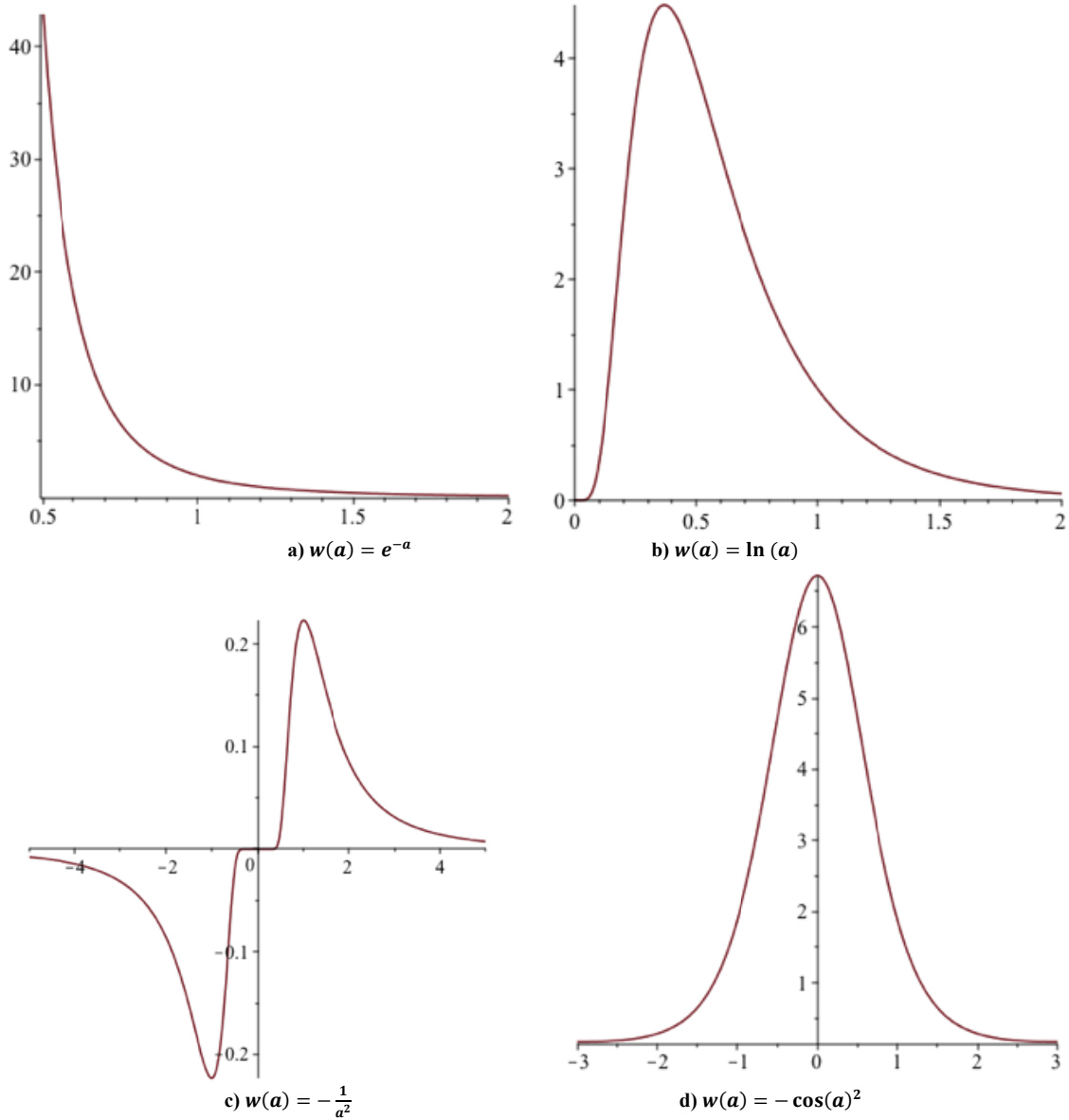


Fig.1 Big Crunch Simulations $\rho(a)$ vs. $a(t)$

Similarly, for the big freeze simulations in Fig. 2 we can see that the universe with equation of state $w(a) = e^{-a}$ is a very dense universe, while the universe with equation of state $w(a) = -\frac{1}{a^2}$ has a comparatively small initial density. The universes with equations of state $w(a) = -\frac{1}{a^2}$ and $w(a) = e^{-a}$

represent the extremal dynamics compared to the universes with equations of state $w(a) = \ln(a)$ and $w(a) = -\cos(a)^2$. Interestingly, all the simulations of the Big Freeze scenario seem to evolve on similar time scales (it's clear that all four graphs tend to zero at more or less the same time) even though the functions describing $w(a)$ all have distinct behavior.


 Fig.2 Big Freeze Simulations $\rho(a)$ v.s $a(t)$

The authors would like to note that the idea for the simulations are partially motivated due to Khandai(2008); who solved the Friedmann equations for an equation of state of the form $p = w(t)\rho$.

III. VAN DER WAALS EQUATION OF STATE

We also considered a model in which we ignore the equation of state of a perfect fluid and instead study a different equation of state. In particular, the leading correction to the equation of state of a perfect fluid would be given by the Van der Waals equation of state. This equation of state attempts to introduce the spacing between atoms in the fluid to achieve a more realistic model. To this end, we considered an equation of state of the form:

$$p(t) = w\rho(t) - \frac{a}{9}\rho^2(t). \quad (6)$$

The key point of this equation is to postulate the dependence of the pressure on the square of the density. The aim of this is to simulate more complex dynamics of the universe (i.e., similar to allowing higher order terms in perturbation theory). In the classical equation of state for the Van der Waals fluid we have set $b = 0$ which is valid for large volumes. Also, we have set $T = 3 \text{ K}$ to be the temperature of the CMB (cosmic microwave background). Thus, our new ODE to solve is given by (the analog of (4)):

$$\frac{d}{da}(a^3 \rho(a)) = -3a^2(w\rho(a) - \frac{a}{9}\rho(a)^2). \quad (7)$$

Which has a general solution (where $\rho(t_0) = \rho_0$):

$$\rho(a) = \frac{9w+6}{6\rho_0 a^3(1+w)+9\rho_0 w a^3(1+w)+a}. \quad (8)$$

We compare this solution to the classical solutions by choosing w to be 1, 0 or $1/3$; corresponding to the classical solutions for dark energy, pure dust and pure radiation. The solutions are plotted in fig. 3.

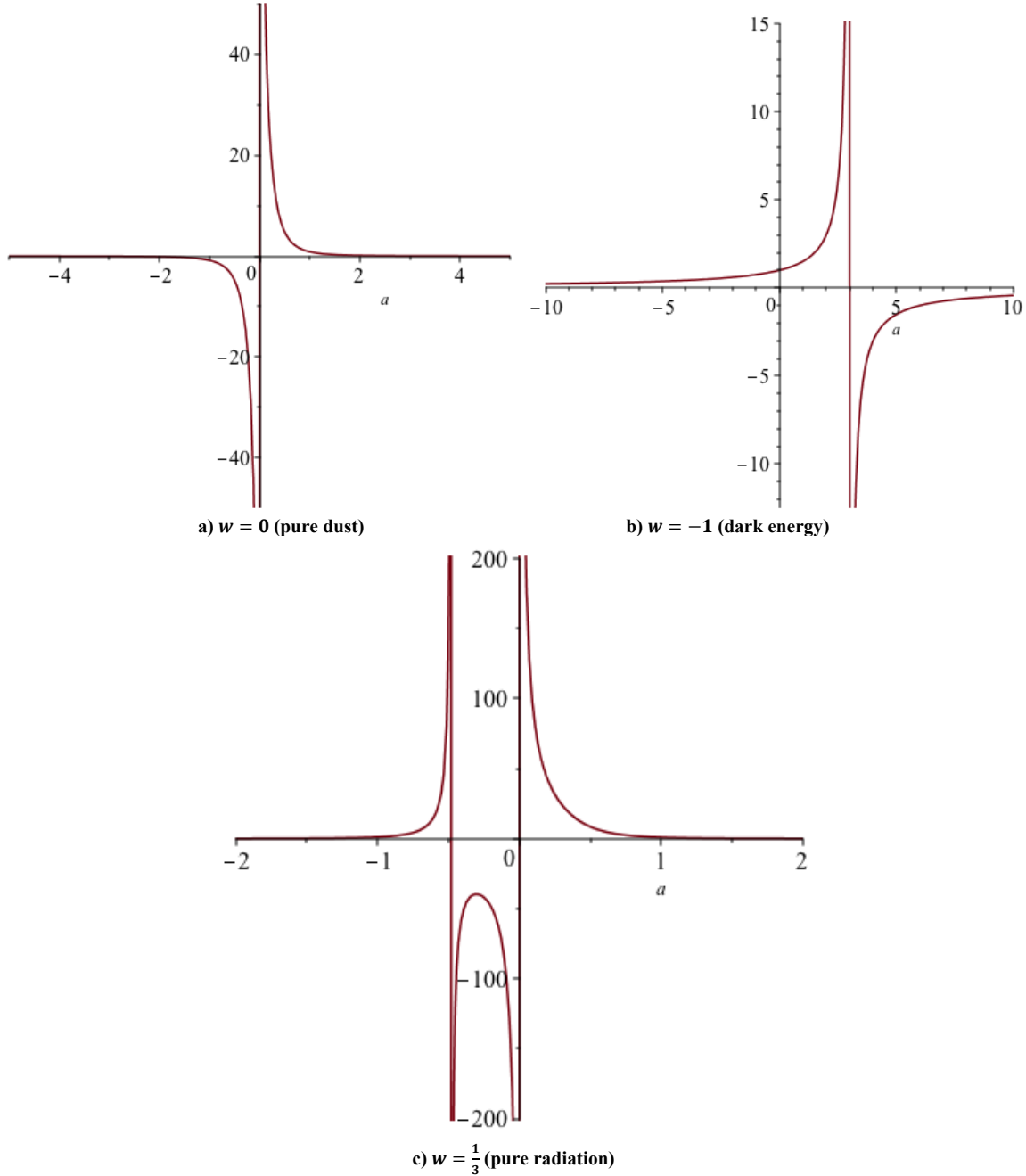


Fig.3 Solutions of FRW spacetimes for the Van der Waals equation of state

Analyzing the above plots above we see that for the plot of pure dust the dynamics do not change noticeably as expected (classically, the solution tends as $\rho \sim a^{-3}$). However, the other graphs display very different properties. For the pure radiation case the

plot the symmetry about $a(t) = 0$ has been removed in this new model. The dynamics now allow for $\rho(a)$ to be negative if the scale factor is negative (i.e deceleration instead of expansion). The plot for dark energy can resemble the case of pure dust under a

suitable transformation (shifted to the left, reflected and a suitable scaling). We observe that $\rho(a)$ is positive until it hits a large discontinuity, before continuing to grow from a negative energy density. A model of negative energy density has been explored by Neimiroff & al (2015) for example. We also note that each universe predicts a “Big Freeze” scenario in which the density tends towards zero asymptotically. If the current rate of expansion of the universe (attributed largely to dark energy) does not decelerate, then a “Big Freeze” scenario will likely describe the end of our universe.

IV. CONCLUSION

We have simulated the dynamics of FRW universes by varying the equation of state of a perfect fluid as a function of time (implicit dependence on time through the scale factor) to capture more complex evolution. Concretely, we have solved the Friedmann equations of these new models and analyzed how these universes behaved when compared to the classical solutions that are seen in the literature (i.e where the equation of state is chosen to be that of a perfect fluid $p = w\rho$ with w being a constant). The

two models we considered were: 1) A scale factor dependent equation of state and 2) a Van der Waals equation of state. In future research we will make further attempts to generalize FRW perfect fluid models.

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THE IMPACT OF ORGANIZATIONAL RISKS ON PROJECT CONSTRUCTION DELAYS IN DUBAI

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Abstract - The objective of this research is mainly to identify the different organizational risks that cause delays in construction projects in Dubai by using the mixed qualitative and quantitative research method.

A survey was generated based on identification of different risk factors from literature review. The survey was distributed to people who work in the same field. After all data collected from the respondents, all data were analyzed using descriptive statistics and to establish the relationship between organizational risks factors and delays of construction projects. Reliability and correlation analysis were applied to inspect the significance of risk factors towards construction project delay.

The results of the study show that there are various organizational risks, which affect the delays of construction projects in Dubai. The findings indicated that strategic risks factors, reporting risks, operations risk, compliance risks and regulatory risks have positive correlation with the factors of constructing project delays. However, the degree of strength and reliability of the correlations between these risks and the construction project delays vary, with all risks, excluding compliance risks; have weak to moderate positive or linear correlation with project delay. Compliance risks have moderate to strong positive correlation with construction project delay

The research reveals that the delays of construction projects in Dubai can still be addressed and resolved through implementation of effective strategies and initiatives by top management of local entities and companies. Furthermore, the different risk factors identified can be mitigated through various strategies.

Keywords - Business Management, Construction, Project Management, Risk Management.

I. INTRODUCTION

This section of the research presents a discussion about the topic being explored by the research study – Organizational Risks causing Construction Project Delays in Dubai, UAE.

A. Background

The increasing expenditure for infrastructure that drives the construction market in the country is in line with the upcoming Dubai Expo 2020. The Expo 2020 is expected to increase visitor arrivals in the country, specifically in Dubai. The Expo's scope as well as the nation's pursuit towards their economic diversification objectives in key areas has resulted to infrastructure a main priority of the country. Although the country's construction industry has experienced some considerable pressure for the past year resulting from the continued fluctuations in the oil prices, the sector remained to be resilient. Investments continued to pour into the country, particularly major emirates such as Dubai and Abu Dhabi.

With the construction industry becoming a major player in the achievement of development goals in the country, construction companies and consulting firms can agree to the fact that the industry itself is exposed to a wide range of risks, whether these be from the internal environment of the organization or external environment. These risks may emerge during the course of the project progress, which could have varying degree of implications to the overall success

of the construction project.

B. Research Gap and Rationale

This research's rationale is to create the close relationship between Construction Project Delays and Organizational Risks.

C. Problem Statement

By its definition, Construction Delays can be referred to as the time overrun that is either past the deadline set in the contract or beyond the agreed complete date of the delivery.

Existing literature on construction delays had provided some evidences on the different risk factor that caused the delay, and the subsequent impacts to the overall construction project. For instance, in a systematic review conducted by Motaleb and Kishk (2015), there have been several risks identified influencing project delays in construction. For instance, one of the findings pointed to the organizational risk involving the project designer and contractor, which reflected the human errors occurring in project management, which caused time overruns. In addition, project managers and organizational resources were also considered to be recurring organizational risks factors in public transportation infrastructure constructions, especially road and highway constructions, which in turn had contributed to the time and cost overruns. Financing system used to fund for the construction projects such as

commercial construction projects in the United States and public works projects in Nigeria was also found to have links with construction delays, further causing major time overruns (Motaleb & Kishk, 2015). These factors, therefore, should be taken into consideration during the planning, where project managers have to establish effective risk mitigation plans and contingency plans in order to guarantee project success through elimination of construction delays.

Existing literature on project management, in general, offered a wide range of strategies that could help in mitigating risk factors, including organization-based or external environment factors. One of which is the design contingency, in which it should be developed to handle any changes during the design phase of the construction project. This might address factors including inconsistent and inadequate project scope definition or erroneous estimation methodologies in scheduling and other design planning activities. Another strategy is establishing a comprehensive construction contingency, which will address the varying changes during the construction execution (Abd El-Karim, et al., 2017). Adopting these strategies or tools could be of great help in addressing the problem of construction delays. Although the literature on construction delays are extensive, there is limited number of studies that only focus on the organizational risks, and specifically to the case of the Dubai in general; hence the need for exploring the issue within Dubai's case.

D. Aims and Objectives

The objectives of this study are:

- 1) To use the qualitative method through the literature review to identify the organizational risk factors influencing construction project delays in Dubai.
- 2) To test and confirm the data gathered in qualitative by applying a quantitative method using survey questionnaires, reliability test and correlation analysis.

E. Research Scope and Questions

This study utilizes certain research questions, which will be of great help in narrowing the focus of the research, especially when it comes to the research methods adopted in the study such as data collection procedures used in the study. This descriptive quantitative research survey will answer its only research question – “What are the organizational risks that have significant impact on construction project delays in Dubai?”

The findings will be based on the views and perceptions of people working in the industry, basing solely on their previous experiences in construction projects.

II. LITERATURE REVIEW

This section of the research presents a review on the existing literature on construction delays as well as on the risk factors associated with the issue. A review on the construction market of the United Arab Emirates is presented, followed by a discussion on the concept of construction delays and its implications or effects. A conceptual framework to guide the research study is also included. The gathered studies are collected articles from peer-reviewed journals published from 2013 to 2018.

A. UAE's Construction Market

UAE is one of the fastest growing economies in the world, with apparent growth and development in both oil and non-oil sectors. Based on the latest economy report published by the country's Ministry of Economy (2016), manufacturing industries, construction and building, transport and telecommunications and hospitality (real estate and business services) has contributed a total of around 53 per cent of the total GDP of the country. Specifically, construction sector will continue to propel forward in the approach to the Dubai Expo 2020. Alongside other non-oil sector, the construction sector will help in offsetting the projected oil production cuts in the next years (Al-Fakir & Kanafani, 2017).

Majority of the construction projects in the UAE are infrastructural works including roads, airports and ports, metro and others. On the other hand, the federal government has also supported major residential construction projects across the country, especially in Abu Dhabi and Dubai. Office construction market in the country, as well as retail, hospitality and healthcare construction projects also continue to become major sub markets of the construction industry in the country. Table 1 below shows some of the construction projects across different submarkets.

Project	Value (USD mil.)	Completion Dates
Dubai Metro	14,352	2030
Etihad Railway Network	11,000	2018
Abu Dhabi Metro	7,000	2020
Airport Expansion Project	7,800	2018
Capital District-Abu Dhabi	40,000	2030
Al Reem Island	37,000	2023
Mohammed bin Rashid City	55,000	2023
Renaissance City Abu Dhabi	25,000	2020
Masdar City Abu Dhabi	22,000	2025

Yas Island Development	37,000	2025
Mall of the World	6,800	2022
Viceroy Dubai	1,000	2018
Mediclinic Parkview Hospital	--	2018

(Adapted from Driessche 2016, pp. 4-6)

Table 1: Construction Projects in UAE

B. Construction Project Delays: Types, Risk Factors and Implications

B.1 Types and Implications of Delays in Construction Projects

The construction industry worldwide is always facing issues concerning delays, which have varying implications on the overall success of construction projects (Torbaghan, et al., 2015; Alotaibi, et al., 2016; Adam, Josephson & Lindahl, 2017). By its

broad definition, delay pertains to the failure in meeting the scheduled time (Agyekum-Mensah & Knight 2017). In the construction industry, delays can take in various forms which results to changing the original plan. There can be various types of delays that can emerge in any construction project. According to Alias and Mydin (2013), there are six different types of project delays – (1) critical and non-critical, (2) excusable delays, (3) excusable compensable delays, (4) excusable non-compensable delays, (5) non-excusable delays, and (6) concurrent delays.

Srdić and Selih (2015) provided a different framework for categorizing the delays in relation to four aspects – timing, compensability, origin, and impact, as shown in Figure 1 below.

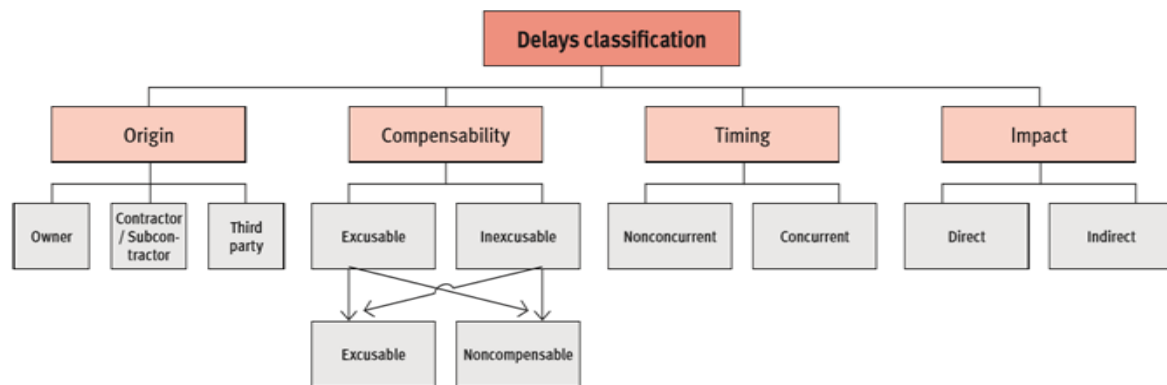


Figure 1: Classification of Delays (Adapted from Srdić and Selih 2015, p. 1384)

Construction delays could have varying implications. For instance, the study by Sani et al., (2014) attempted to identify the different consequences of the private housing construction project delays, alongside the different causal factors. The identified consequences included time overrun, cost overrun, differences in opinion, negotiation, legal action and total abandonment of the project (Sani, et al., 2014). Other studies indicated consequences including party damages and financial impacts, budget overspending, and others (Al-Gahtani, et al., 2016; Hussain, et al., 2017). In a similar vein, Sambasivan et al., (2017), examined the delay factors and causes in the construction projects in Tanzania and indicated that the major consequences of the Tanzanian construction project delays are cost overruns, disputes, litigation, arbitration and complete abandonment of the project.

B.2 Factors and Risks Affecting Construction Delays

Literature on construction delays presented evidences identifying several risk factors that cause the delays of construction.

The study by Aziz and Abdel-Hakam (2016) explored on the different cause of delays in road construction projects in Egypt. The study, which used mixed method approach, made use of questionnaires and

interview techniques to gather data from construction participants including consultants, contractors and others. Analysis of their data resulted to almost 300 different causes resulting to road construction projects in the country – with factors and risk associated with the financing, equipment, contractor, design, site aspects of the construction project. Specifically, the financing and equipment issues and factors were observed to be on top of the time delay causes of road constructions (Aziz & Abdel-Hakam, 2016). A similar study by Marzouk and El-Rasas (2014) on the analysis of the causes of delays in Egyptian construction projects indicated the different categories of delays causes include owner related, consultant related, contractor related, material related, labour and equipment related, project related and external related. Their findings indicated that the owner related causes represent a very high priority from the respondents when it comes project delays in Egypt's construction industry (Marzouk & El-Rasas, 2014).

Mydin et al., (2014) attempted on identifying and assessing the different key risk factors causing construction delays in Malaysia's private housing market. Through an online questionnaire survey that involved 76 survey participants, their findings

indicated that there were about 28 different causes that pertained to four major categories – client factors, consultant factors, contractor factors and external factors. Further analysis emphasized that contractor factors were perceived to be the major contributor to private housing construction project delays in the country (Mydin, et al., 2014). Kim and Chi (2015) explored on the different risk factors and issues associated with the schedule delays in the building projects in Vanuatu. Their findings indicated that majority of their respondents pointed labour, material, and managerial issues were the top group of issues causing building delays in the country. Other risk factors and issues included information-related issues, equipment, site characteristics and financial factors (Kim & Chi, 2015).

Tankkar and Wanjari (2015) attempted on exploring, identifying and discussing on the critical delay factors that emerge during the execution of the construction projects in India. Through a survey questionnaire, their findings indicated that the top three factors resulting to construction delays in the country included: (1) Lack of human resources- skilled, semi-skilled and unskilled, (2) poor site management, and (3) lack of coordination and control. In Vietnam, Pham and Hadikusumo (2014) explored the different risk factors resulting to the schedule delays of constructions in EPC projects in the petrochemical market in the country. Based on their findings, various risks and factors caused delays in the construction and engineering phases of EPC construction projects. Contractor related and external related factors such as poor communication and coordination, ineffective planning and scheduling, land acquisition, inadequate contractor experience were found to have the most effect on the schedule delays during the construction phase. On the other hand, owner and contractor related factors such as approval delays caused by the project owner, the lack of input data and change in the project scope were key risks and issues causing delays in the engineering phase of the project (Pham & Hadikusumo, 2014). The study by Sambasivan et al., (2017) attempted on exploring the factors causing the delays in the construction projects in Tanzania. Through a survey involving over 300 respondents, their findings indicated that the risk factors and issues associated with construction delays included stakeholder related (e.g. client, contractor and consultant related), material related, labour and contract related and external (Sambasivan, et al., 2017).

In the UAE, few studies explored the issue. For example, the study by Mpofu et al., (2017) attempted on identifying the causative factors that results to the construction project delays in the country. Through a survey involving key stakeholders of construction projects – clients, contractors and consultants, their findings stressed several key causes of delays of

construction projects in the country, which included unrealistic contract durations, poor labour productivity and others. The study further suggested that project stakeholders should modify their current practices to make sure that projects were delivered within the targeted completion time. In addition, the study found that delays can be caused from country-specific risks factors, including social, economic and cultural settings of the country (Mpofu, et al., 2017). Cultural assimilation and the difference between the cultures of UAE and overseas management teams were found to have significant effect on the construction delays of the project, as well as the entire success of the project (Khan, 2014). Organizational culture was also indicated as a major causal risk factors of construction delays (Arditi, et al., 2017).

C. Theoretical Underpinning

This section presents a summary of the theoretical underpinning identifying the different risk factors associated with construction project delays discussed in the previous review of literature.

Table 2 and 3 shows the factors associated with organizational risks and project construction delays, respectively.

Organizational Risks Factors	Authors (Supported Articles)
Strategic Risk	Assaf & Al-Hejii (2006); Al-Hazim, Abu Salem, & Ahmad (2017); Upadhyay, Gupta and Pandey (2016)
Reporting Risk	KPMG (2014)
Operation Risk	Doloi, et al. (2012); Akogbe, Feng, & Zhou (2013)
Regulatory Risk	Banaitiene & Banaitis (2012)
Compliance Risk	Muhwezi, Acai, & Otim (2014); Muhammed (2015)

Table 2: List of Organizational Risk Factors (Independent Variable)

Project Construction Delays Factors	Authors (Supported Articles)
Time and Cost Overrun	Divya & Ramya (2015)
Poor Quality of Completed Project	Meng (2012)
Bad Public Relation	Sambasivan (2007)
Disputes and Claims	Divya & Ramya (2015); Abedi, Fathi, & Mohammad (2011)

Table 3: List of Project Construction Delays Factors (Dependent Variable)

D. Conceptual Framework

Based on the literature, the conceptual framework to be adopted by this research is shown in the Figure below. The framework was devised drawing on the common findings of the studies reviewed. The studies in the past indicated several risk factors and issues related to the construction delays.

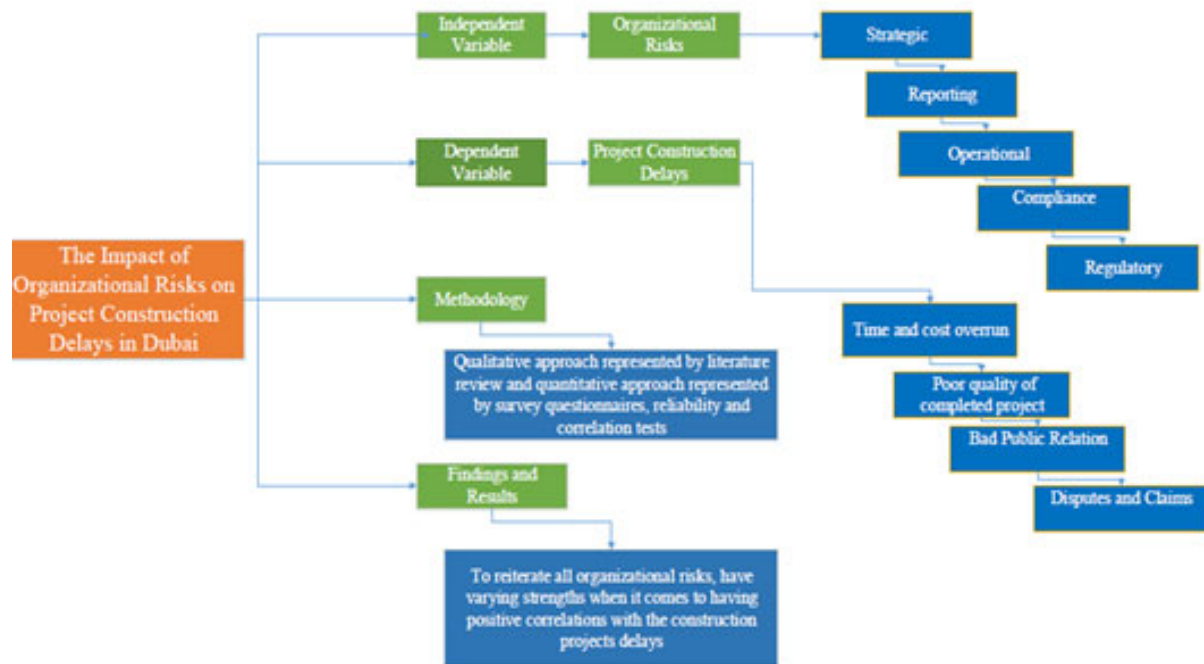


Figure 1: Conceptual Framework of the Research

The organizational risk is the independent variable for this current study, which encompasses five basic factors – strategic, reporting, operation, regulatory and compliance. On the other hand, the project construction delays is the dependent variable, which encompasses four factors – time and cost overrun, poor quality of completed project, bad public relation and disputes and claims. The conceptual framework denotes testing hypotheses involving the factors related to the independent and dependent variable through conducting correlation analysis.

E. Hypothesis

In the conceptual framework, there are five organizational risk factors (independent variable) and project construction delays (dependent variable). For the purpose of this research, the study limits its hypothesis to test to maximum of five hypotheses, including:

- H1: There is positive relationship between strategic risk and time and cost overrun.
- H2: There is positive relationship between reporting risk and time and cost overrun.
- H3: There is positive relationship between operational risk and poor quality of completed project.
- H4: There is positive relationship between compliance risk and bad public relations in project construction delays.
- H5: There is positive relationship between regulatory risk and disputes and claim factors.

III. METHODOLOGY

The methodology used in this research is the mixed method- qualitative represented by literature review based on trusted and cited resources, and quantitative represented by survey questionnaires, reliability and correlation tests.

A. Primary Data Collection

Primary data were collected through survey technique. The data collection process was conducted within a week time. Since the participants are in the working sector, the researchers conducted a survey facilitated through online channel.

B. Sampling Method

The participants of the study were employees in the Construction industry. They are all working in construction companies situated in Dubai since it is the purpose of the study to determine the various organizational risk factors that cause delays in the construction projects in the said Emirate. In that manner, they are classified to be most fitting to undertake the survey because they have sufficient knowledge in the activities involved in construction projects as well as the dilemmas that the construction industry encounters.

C. Research Instrument

A survey questionnaire was prepared and was distributed to the respondents. It was the objective of

the researcher to make the questionnaire brief and precise. The survey contains three main sections and ethical section. The first section contains the demographic of the respondents, the second section contains questions related to factors of independent variable (Organizational Risks) with number of 23 questions, and third section contains questions related to factors of dependent variable (Project Construction Delays) with number of 27 questions. Moreover, the survey was online based that was distributed to a number of 100 participants.

D. Data Analysis

To analyze the data, two quantitative analysis methods were used – descriptive statistics and correlation analysis. Correlation analysis, in specific, was used to test the global factors and five hypotheses identified early in this research. SPSS (Statistical Package for the Social Sciences) was used to provide outputs for the reliability, factor reduction analysis and correlation analysis, discussed as follows;

D.1 Reliability Test (Cronbach's Alpha)

Cronbach's Alpha tends to estimate and indicate the internal consistency reliability and shows homogeneity and how items are close to be in one group. However, the aim is to reach at least 0.7 as justified and reliable point.

In this research the independent variable organizational risks factors have 0.911 value, whereas the dependent variable project delays factors have .956 value. Therefore, these values show a high reliability and hence there is no requirement for factor enhancement or deletion.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.912	.911	23

Table 4: Cronbach's Alpha for Organizational Risk Factors

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.955	.956	27

Table 5: Cronbach's Alpha for Project Delay Factors

D.2 Factor Reduction Analysis

Factor reduction is needed for data reduction and scale enhancement where the desired value of KMO shall be more than 0.5 to have factorable factors for applicability of data analysis. However, the KMO for organizational risks factors was 0.720 and KMO for project delay was 0.799. Hence, both KMOs are above 0.5 and therefore the sample is factorable.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.720
Bartlett's Test of Sphericity	Approx. Chi-Square	721.788
	df	253
	Sig.	.000

Table 6: KMO for Organizational Risks Factors

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.799
Bartlett's Test of Sphericity	Approx. Chi-Square	1281.088
	df	351
	Sig.	.000

Table 7: KMO for Project Delay Factors

D.3 Correlation Analysis

The correlation aims to measure the strength, significance and direction of the relationship between offered variables, however in this research the correlation between the organizational risks and construction project delay was 0.843 (as shown in the below table) which shows positive, strong and high significance of the relationship between independent and dependent variables. However, correlation analysis for anticipated five hypotheses was done and will be discussed in hypotheses section.

		Strategic Risk	Time Cost Over run
Strategic Risk	Pearson Correlation	1	.331*
	Sig. (2-tailed)		.017
	N	52	52
Time Cost Over run	Pearson Correlation	.331*	1
	Sig. (2-tailed)	.017	
	N	52	52

Correlation is significant at the 0.05 level (2-tailed).

Table 8: Correlation between the Organizational Risks and Construction Project Delays

IV. RESULTS AND DISCUSSION

This section of this study consists of two subsections – results from descriptive statistics and hypothesis testing.

A. Descriptive Statistical Analysis

A.1 Organizational Risks Factors

Figure 3 below shows the average rating of the participants when it comes to the perceived effects of various organizational risk factors on construction project completion. Based on the data, seven factors

were indicated by the surveyed participants to have high impact on the success and completion of construction projects in Dubai. Topping the list of factor having high impact on project completion is a strategic risk factor, “Underestimation of time for completion of project by contractors”, which gained a mean rating score of 3.681. Another strategic risk factor, ‘Underestimation of project budget’ have high impact on project completion, as reflected on the average rating of 3.66. “Shortage of materials”, which is categorized as an operations risk, was also perceived to have high impact on project completion, with an average rating of 3.638. Three other strategic risks were also seen to have high impact on project completion, including ‘time overrun’, ‘ineffective feasibility study’, and ‘insufficient or lack of project management controls and strategies’, with average rating scores of 3.574 each. Last factor which was considered to have high impact on project completion is the ‘difficulty in obtaining government permits’, which gained an average rating score of 3.532.



Figure 2: Perceived degree of impact of organizational risks on project completion

Other factors indicated in blue in the Figure above have medium impact on project completion, as perceived by the surveyed participants. The factors that were perceived having the least impact of amongst all the factors are either categorized as reporting risks or operations risks. “The lack of project status reports”, as well as “delay in producing final status and financial report”, were reporting risks perceived by the surveyed participants being of low impact on project completion, with average rating scores of 2.936 and 2.723, respectively. Operations risks such as “Leaders display unethical behaviour” and “Poor IT

security” were least perceived to have impact on project completion, with average rating scores of 2.83 and 2.638, respectively. Nonetheless, the findings supported this current study’s hypothesis, H1, stating that organizational risks have impact on project completion delays. However, the findings indicated that the degree of impact on project completion varies across different categories of organizational risks.

A.2 Construction Project Delays

Figure 4 below shows the factors of the construction project delays, and several factors influencing its occurrence. These factors were categorized based on the types of effects, including time and cost overruns, poor quality of completion, bad public relations, and disputes and claims. Based on the Figure, there were eight factors that were perceived by the surveyed participants to have high impact on construction project delays, primarily its effect concerning time and cost overruns. For instance, the lack of communication between both parties was considered to have high impact on the occurrence of time and cost overruns, with an average rating score of 3.702. Poor project planning and control, as well as failure to make timely decisions and effective response plans, received high perceived impact by the surveyed participants with average rating scores of 3.66 and 3.617, respectively. Leadership and supervision as well as unrealistic project schedules were also noted to have high impact perceived by the survey participants, with average rating scores of 3.574 and 3.532, respectively.

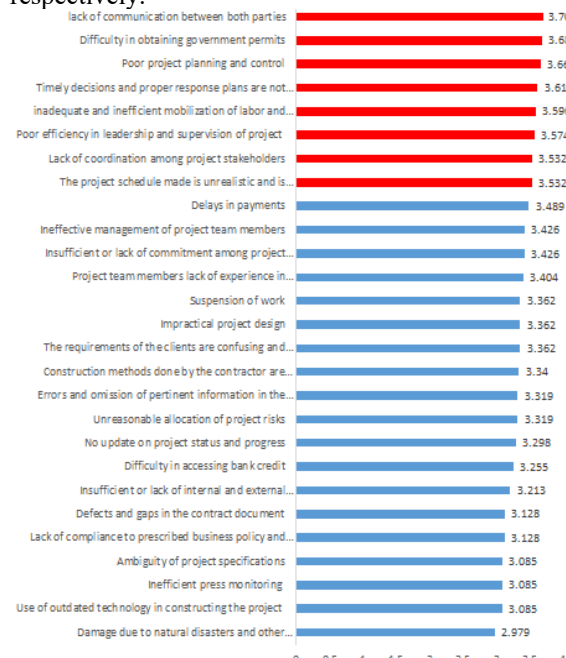


Figure 3: Perceived impact of factors on the effects of construction project delays

On the other hand, the surveyed participants indicated that public relations effect of project delays was perceived to have been highly impact by the difficulty in obtaining government permits, as reflected on the

average rating score of 3.681. Similarly, lack of coordination among project stakeholders were also seen to have high impact on the occurrence of public relations problems subsequent to the project delays. Construction project delays due to inadequate and inefficient mobilization of labour and materials have high impact on the occurrence of disputes and claims. Other factors influencing the effects of construction project delays have medium degree of effect, as shown in the figure.

B. Hypothesis Testing

In this section, the variables were computed in **SPSS Software** as factors to serve the testing of correlation which requires a factor to factor testing, the following are the five hypotheses anticipated at the beginning of the research along with their results:

H1: There is positive relationship between strategic risk factors and time and cost overrun factors.

This hypothesis assumes that there is positive relationship between the strategic risk factors and the time and cost overrun factor of project construction delay. The first factor of the time and cost overrun factor was chosen mainly because it was the top perceived factor by the surveyed participants when it comes to construction delay. Based on the correlation table below, the correlation between Strategic risks and time and cost overrun is 0.331, which is **weak to moderate** in significance. Hence, strategic risk factors and time and cost overrun factors have Pearson correlation r greater than 0.3. Finally, this hypothesis is accepted.

Table 09: Correlation between Strategic Risks and Time / Cost Overrun

		Strategic Risk	Time/Cost Over run
Strategic Risk	Pearson Correlation	1	.331*
	Sig. (2-tailed)		.017
	N	52	52
Time/Cost Over run	Pearson Correlation	.331*	1
	Sig. (2-tailed)	.017	
	N	52	52

*. Correlation is significant at the 0.05 level (2-tailed).

H2: There is positive relationship between reporting risk factors and time and cost overrun.

This hypothesis suggests that there is positive relationship between the reporting risks factors and the time and cost overrun. The correlation analysis indicated that all reporting risk factors all have **moderate positive** correlation with the time and cost overrun factor of construction project delays, as reflected on their Pearson correlation coefficient greater than 0.5. Overall, this hypothesis is accepted.

Table 10: Correlation between Reporting Risks and Time/Cost Overrun

		Time / Cost Over run	Reporting Risk
Time / Cost Over run	Pearson Correlation	1	.543**
	Sig. (2-tailed)		.000
	N	52	52
Reporting Risk	Pearson Correlation	.543**	1
	Sig. (2-tailed)	.000	
	N	52	52

** . Correlation is significant at the 0.01 level (2-tailed).

H3: There is positive relationship between operation risk factors and poor quality of completed project.

This hypothesis assumed that there is positive relationship between the operation risk factors and poor quality of completed project factor of construction delay. The first factor of poor quality of completed project was chosen 'impractical project design' due to its high ranking based on the perceptions of the surveyed participants about the different factors of construction delays. The hypothesis is accepted, as reflected with **moderate positive** correlation between the operation risks and the poor quality factor of construction delay with correlation of 0.520.

Table 11: Correlation between Operation Risk and Poor Quality

		Operational Risks	Poor Quality
Operational Risks	Pearson Correlation	1	.520**
	Sig. (2-tailed)		.000
	N	52	52
Poor Quality	Pearson Correlation	.520**	1
	Sig. (2-tailed)	.000	
	N	52	52

** . Correlation is significant at the 0.01 level (2-tailed).

H4: There is positive relationship between compliance risk factors and bad public relations.

Based on the correlation table below, there is a **strong significance and positive correlation** of 0.779 between the different compliance risks factors and bad public relations factor of construction project delay. The bad public relation factor, 'difficulty in attaining government permit' was chosen due to its high ranking by the surveyed participants. Overall, this hypothesis is accepted.

Table 12: Correlation between Compliance Risk and Bad Public Relations

		Compliance Risk	Public Relations
Compliance Risk	Pearson Correlation	1	.779**
	Sig. (2-tailed)		.000
	N	52	52
Public Relations	Pearson Correlation	.779**	1
	Sig. (2-tailed)	.000	
	N	52	52

** . Correlation is significant at the 0.01 level (2-tailed).

H5: There is positive relationship between regulatory risk factors and disputes and claim factors.

Based on the correlation table below, there is a **strong and positive correlation** between the regulatory risk factors and the dispute and claim factor of construction delay. This is shown on the Pearson correlation coefficient of 0.809. Hence this hypothesis is accepted.

Table 13: Correlation between Regulatory Risk Factors and Disputes and Claim factors

		Regulatory Risk	Disputes and Claims
Regulatory Risk	Pearson Correlation	1	.809**
	Sig. (2-tailed)		.000
	N	52	52
Disputes and Claims	Pearson Correlation	.809**	1
	Sig. (2-tailed)	.000	
	N	52	52

** . Correlation is significant at the 0.01 level (2-tailed).

V. INTERPRETATION OF FINDINGS

Construction projects heavily rely on effective strategic planning, considering its importance in achieving better decisions, competitiveness and smooth execution of the overall progress of the project. Such importance in the construction project management reflected the findings of this study, almost all strategic risk factors were perceived by the surveyed participants to have high impact on construction project completion and delays. This was also highlighted in the hypothesis testing, wherein strategic risks have weak to moderate positive correlation with time and cost overrun. This means that as the strategic risks arises, there is the increase likelihood that the project team can experience time and cost overruns. Specifically, failure to accurately estimate the budget and project time can have significant impact the potential occurrence of project delays. This corroborated with past findings by Aziz (2013) within the Egyptian construction context, where both underestimation of project costs and time for completion of projects by contractors were perceived as two of the top ten influencing factors that cause delays. Similar findings were observed and supported by past studies (e.g. Assaf & Al-Hejii, 2006; Al-Hazim, Abu Salem, & Ahmad, 2017). In addition, Aziz's study (2013), as well as other studies such as Upadhyay, Gupta and Pandey (2016), identified wrong feasibility study of project as a major influencing factor causing project delays in the construction industry, further supporting this current study's findings. In a nutshell, the findings of this study notably emphasized the importance of carrying effective strategic planning by the contractors and project team in order to avoid delays in the

construction project progress and completion.

This study also indicated that people behind the project management should need to address compliance and regulatory risks associated with construction project. This current study's findings have stressed on the high impact of some of the factors associated with compliance and regulation on construction project delays. For instance, there was high degree of impact on the difficulty of gaining government permit in Dubai on construction project delays, as perceived by the survey participants. This was corroborated by the findings from past studies (e.g. Muhwezi, Acai, & Otim, 2014; Muhammed, 2015). More so, such external-related factor of government permit does not only affect the project's completion, but its effects can go beyond on an economic scale. This is because of the fact that improving the process of building permitting in Dubai can be of great help in achieving opportunities for increasing development activity in the emirate. Besides the compliance and regulatory-related risk factors causing delays in construction projects, there were other forms of risks that have impact on delays, as perceived by the surveyed participants. Though having medium impact, reporting risks reported in this current study have implications on the need to have efficient and effective process for reporting in project management in order to avoid delays in projects. It is suggested that main actors of the construction project management should implement an effective project reporting system that emphasizes the need to have coordinated information and project phase integration (KPMG, 2014).

This current study also reported on time and cost overruns as the major effect of construction delays perceived by the surveyed participants. As a matter of fact, time and cost overruns are common effects of delays evidenced in past studies. For instance, the study by Divya and Ramya (2015) explored on the causes and effects of delays in construction projects in the District of Deviyakurichi, India, in which their findings have indicated that the top effects of delays were time overrun and cost overrun. It can be suggested that both time and cost overrun are two of the most prevalent and significant challenges that the global construction industry is facing, in which serious attention should be exhibited in order to achieve higher success rates of project completions that are within the budget and time constraints. Besides time and cost overruns, this study also found out disputes and claims as effects of construction delays to have high impact on Dubai's construction industry, as supported by past findings from studies (e.g. Divya & Ramya, 2015; Abedi, Fathi, & Mohammad, 2011). To reiterate, organizational risks have significant effect on project completion, as reflected on the acceptance of this research study's hypothesis. Not all organizational risks, however, identified in this study have high degree of impact, in which some of which

only have moderate impact. Regardless, it is critical that proper strategic planning and risk management and contingency plans should be effectively in place in order to guarantee success project completion and to avoid any delays across all phases of the construction project.

VI. CONCLUSIONS AND RECOMMENDATIONS

The delays of construction projects in Dubai can still be resolved through the implementation of the right strategies. To reiterate, all organizational risks – strategic, regulatory, compliance, reporting and operations risks – have varying strengths when it comes to having positive correlations with the construction projects delays. This study, therefore, recommends that:

- 1) The Moderate positive correlations between strategic risk factors and time and cost overruns suggests that there should be an effective strategic planning set for the project in order to minimize the effects associated with time and cost overruns.
- 2) The proper strategic and project planning should include effective communication plans, with focus on mitigating compliance and regulatory risks. As these risks emerge, the more likelihood that the project can be delayed, especially related to the public relation factors of construction delays.
- 3) Due to the high significance of the correlation related to the regulatory risk by changing the specifications and the regulations in continues manner during the course of project execution which will impacting the project by extending some claims and overall delay the project, however, the recommendation is to identify and fix all projects' specifications and regulations from the beginning of the project to ensure no dispute and delay in the project.
- 4) Due to unsafe practice and non-employing the best practice in all aspects of project construction will led to deliver poor quality project, and since operational risk have positive good correlation with poor quality, the recommendation for contractors, consultants and other entities is to have a recognized standards for all their processes in every task they do to limit the poor quality outcomes.

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THE EFFECT OF MAGNESIUM STEARATE ON TEA WASTE CELLULOSE NANOFIBER-REINFORCED FOAM

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Abstract - This work developed foam from starch blended with polyvinyl alcohol, cellulose nanofibers, and magnesium stearate. Cellulose nanofibers and polyvinyl alcohol was mixed with starch. Magnesium stearate at 2, 4, and 6% (w/w starch) was added into starch/fiber batter. Hot mold baking was used to develop the starch-based foam. Results showed that foam produced from starch with 4% magnesium stearate had properties closest to polystyrene foam. Density and tensile strength increased, while degradability, moisture content, and water absorption decreased as the concentration of MgS increase as well.

Keywords - Cellulose Nanofiber, Foam, Magnesium Stearate, Styrofoam

I. INTRODUCTION

Nowadays, petroleum-based plastic packaging is used heavily. Example of these plastic packaging is polymer foam. Polymer foams are a group of lightweight, very porous, and low-density material [1]. Generally, foams can be classified as flexible or rigid, closed- or open-cell foam [2]. The majority of commercial polymeric foams are petrochemical-based [3]. The most commercially used kind of polymer foam is expanded polystyrene (EPS).

EPS is widely used in food packaging food containers, disposable cups, plates, cutlery [4], with styrofoam as its commercial name. thus commonly found as litter on soil, coastlines, or oceans. Especially in the marine biosphere, polystyrene foam litters greatly threatens marine life [5].

EPS harm in two key ways: chemically, when monomers, plasticisers and other hazardous EPS additives leach from EPS objects when poorly manufactured; physically, when EPS breaks down into microplastics in the environment [6].

To combat this, numerous researchers have gathered a number of studies exploring the possibilities of substituting EPS with biomass for bio-based polymer foams (foam). Many of these studies found a strong possibilities of starch as matrix [7] – [8] for foam, with various additive such as fiber [3] or nano-sized fiber [9], polyvinyl alcohol [7], and magnesium stearat [8] to increase the capability of the foam created.

Many types of cellulose have been used as fillers in polymer products [10]. Among these types of cellulose, nanocellulose is expected to have great potential because cellulose materials are the most abundant biological raw materials and can self-assemble into well-defined architectures at multiple scales, from nano to micro size. Furthermore, cellulose is not only renewable but also a multifunctional raw material and is expected to be able to replace many non-renewable materials [11]. It is worth noting that there are two major structures of nanocellulose, namely cellulose nanofibers (CNFs)

and cellulose nanocrystals (CNCs). They have essentially different extraction procedures as well as different morphologies. CNFs can be isolated using mechanical processes such as high pressure homogenization, grinding and refining [12], whereas CNCs have been extensively isolated by using acid hydrolysis treatments [13] – [14].

Previously, the common purpose adding magnesium stearate (MgS) on the mixture of foam only as demolding agent [2] – [3] and lubricant additive on tablets [15]. However, as more researches conducted, it is found that there is correlation between the addition of magnesium stearate and the properties of foam produced. Examples of these results are on tensile strength, density, and moisture interaction with the foam.

Although there are some researches about the effect of MgS on foam, there are almost few to none reports detailing the effect of MgS on CNF-reinforced foam. This works reports foam prepared from starch and CNF for the replacement of polystyrene foam, with MgS and polyvinyl alcohol (PVA) act as additive.

II. MATERIALS AND METHOD

A. Materials

Materials for CNF preparation are NaOH, H₂O₂, and H₂SO₄. Materials for making foam are CNF from tea wastes, starch, MgS, and PVA. Tea wastes are obtained from various shops in Medan City, North Sumatra.

B. Cellulose Nanofiber Preparation

CNF is prepared using the following procedure: tea wastes are first washed, dried, and mashed with ball mill to 200 mesh in size. Materials then delignified with 12% NaOH at 90-95°C for 3 hours and then neutralized.

The tea waste pulps were blanched with 10% H₂O₂ at 80-90°C. Acid hydrolysis was carried out with 64% H₂SO₄ at 40°C.

After hydrolysis, the tea wastes were reduced to

nano-sized with ultrasonication by ultrasonic bath.

C. Foam Preparation

The foam prepared by using hot mold baking. The starch, tea waste cellulose nanofibers (CNFs), polyvinyl alcohol, and magnesium stearate were weighed according to the research variables. All materials were mixed with rapid stirring using a mixer until a homogeneous mixture is formed.

The dough was poured into a mold, then put into the oven at a temperature of 105 °C for 60 minutes. After 1 hour, foam was removed from the oven and cooled at room temperature.

D. Density test

Density test conducted by cutting the foam with a size of 3 x 3 cm, and measure its thickness with micrometer to obtain volume. The foam is then weighed to obtain density.

E. Tensile strength

Method of the test is according to ASTM D3574 Test E for tensile strength test of foam.

F. Moisture Content and Absorption test

For moisture content, foam is cut with a size of 3 x 3 cm. The foam that has been cut was weighed as the initial weight. The weighed foam was heated in an oven at 105°C for 3 hours. The foam was then weighed again and recorded as the final weight.

For moisture absorption test, the cut foam was weighed and soaked in water for 60 seconds. The foam was removed, then cleaned to remove any residual water that sticks to the foam.

The foam was then weighed again and recorded as the final weight. The difference in weight of the initial and final foam was the amount of water absorbed by the foam.

G. Degradability test

Foam is cut to the size of 2 x 6 cm then buried inside humus soil with EM4 bacteria and allowed to stay for one week.

The foam was then dried and weighed until a constant weight is obtained. Foam which has been tested for biodegradability over the week was weighed to obtain a constant weight. The degree of degradation of foam was then obtained.

III. RESULTS AND DISCUSSION

A. Density of Foam

Results shown that density of the foam produced increased with the number of MgS added (Fig. 1). Density of the foam produced is also significantly higher, with the range of 0.87-0.9 g/cm³, while commercial styrofoam has density number of 0.05–0.09 g/cm³ [13]. This increase may caused by hydrophobic nature of MgS [15], which will make the

foam reject most moisture and create a densier foam than its more commercial counterpart. This finding is also found on other researches with MgS as additive [15] – [16].

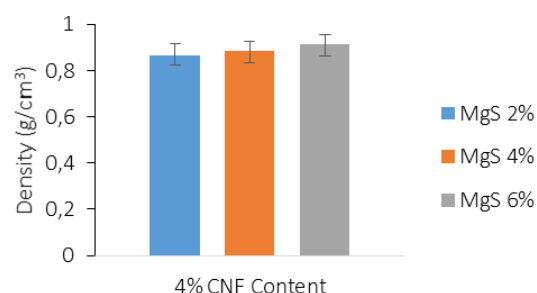


Fig. 1. Effect of magnesium stearate concentration on density of CNF-reinforced foam.

B. Tensile strength of Foam

Tensile strength of the starch-based foam increased with the amount of MgS added (Fig. 2). This is because addition of MgS form foam with high density, thus increasing the strength of the foam and reducing its flexibility. Foam with mixture of only 2 % of MgS has the highest tensile strength with 4.96 MPa, as opposed to with polystyrene one with the range of 0.95-1.11 MPa [17].

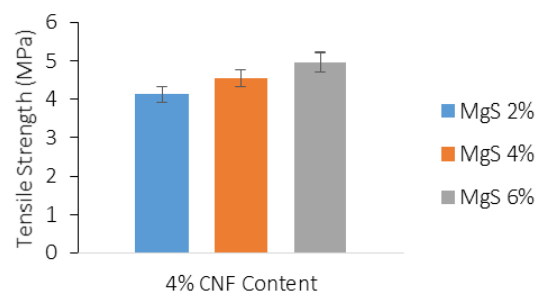


Fig. 2. Effect of magnesium stearate concentration on tensile strength of CNF-reinforced foam.

C. Moisture Content and Water Absorption of Foam

The moisture content of the starch-based foam shown to be affected with the addition of the MgS, albeit insignificant (Fig. 3). Moisture content of starch-based foam with addition of MgS is around 2.22-2.56%, which were greater than polystyrene foam (1.11%) [17]. The moisture content is high because of the properties of the starch, which is hydrophylic. Thus attracting more moisture inside the foam [18]. However, based on the results, addition of MgS on the mixture reduce the percentage of moisture inside the foam. A slight deviation occurred on addition of 6% MgS, in which it increase moisture content. This deviation may occurred on. The reduction is mainly because of the hidrophobic nature of MgS [15]. Hence, while starch-based foam may contain more water, addition of MgS can reduce that number.

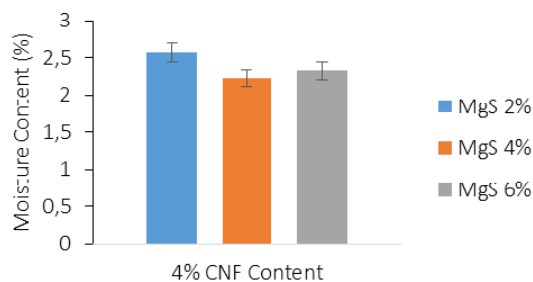


Fig. 3. Effect of magnesium stearate concentration on moisture content of CNF-reinforced foam.

Water absorption of the foam is influenced by the number of MgS added (Fig.4). Results shows that foams form good water barrier as the concentration of MgS increased. This can be caused by the hydrophobic nature of MgS strengthen the foam and increase its density [15], which will reduced the distance of each partical and giving few spaces for water particle to enter the foam. The lowest water absorption rate of the biofoam produced is 13%, 4 times higher than commercial styrofoam (3%) [19]. Given that starch-based foam may absorbs more water, additional MgS may be applied further to decrease its water absorption capability.

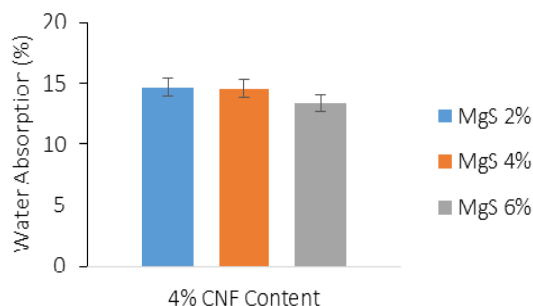


Fig. 4. Effect of magnesium stearate concentration on water absorption of CNF-reinforced foam.

D. Degradability of Foam

Degradability of foams produced decreased with the addition of MgS (Fig. 5). Degradability of the foam is closely related to the density, moisture content, and water absorption of the foam. With the addition of MgS, density of the foam increased. As previously discussed, this increase will restrict the movement of moisture inside, or entering foam. With degradability depends on growth of decomposer, minimal amount of water may negatively affected it. Thus within 1 week, the amount of foam degraded with higher MgS concentration less than foam with minimal amount of MgS.

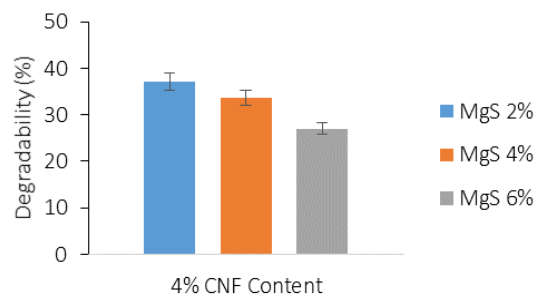


Fig. 5. Effect of magnesium stearate concentration on degradability of CNF-reinforced foam.

IV. CONCLUSION

This study was conducted to improve quality of CNF-reinforced foam for food packaging, preferably fruits. All results shows that addition of MgS decrease the absorbing water capability, moisture content, and degradability of the foam. While density and tensile strength are increasing. Some properties of foams produced are close to commercial styrofoam. With tensile strength, density, and water absorption shown to be higher than commercial styrofoam, although the latter were expected from a starch-based foam. Therefore, further research and modification is necessary if the product is set to replaced commercial styrofoam.

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RELATIONSHIPS BETWEEN FOREIGN DIRECT INVESTMENT FIRMS AND DOMESTIC FIRMS IN NORTH MACEDONIA

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Abstract -

Beginning in 2006, North Macedonia's government embarked on a program of active pursuit of foreign direct investment projects. Some of its main reasons for doing so were to develop supply chain relationships between foreign and domestic firms and to help its workforce to develop skills through technological and knowledge transfers from the foreign firms. The paper centers around interviews with foreign and domestic company managers, and focus groups with foreign and domestic company employees to determine whether the policy resulted in these positive spillovers to domestic firms. It will be seen that domestic firms are not able to supply foreign firms for three reasons: they do not have the scale required to produce at the required amounts, the quality of their products is too poor, and they do not have the technological capabilities to supply the foreign firms. What sourcing relationships do exist are for unsophisticated products, including catering, furniture, and similar items. Likewise, knowledge transfers remain limited. These unsophisticated sourcing relationships leave the country trapped in a cycle of only being able to provide basic products and services. On the basis of this assessment, the following policy recommendation is provided: to develop a triple helix program of domestic firm development that is in conversation with the foreign direct investment attraction program, where industry and education forms programs around being able to serve as sources for foreign firms for both goods and services. This will enable the country to more wholly benefit from foreign direct investment attraction in terms of its effects on the domestic market.

Keywords - Foreign Direct Investment, Domestic Investment, Spillovers, Knowledge Transfers, Supply Chain

I. INTRODUCTION

One of the most prominent sources for both criticisms and praises of foreign direct investment is the effects of foreign firms on domestic firms. This question is especially pertinent in the North Macedonian FDI policy context, where the main component of the attraction policy in practice was providing benefits specifically to foreign firms. In general, the findings of the research indicate that the Macedonian government's strategy of not seeking to attract companies in the same field as domestic ones and thus introducing competition into the market has also disallowed local purchasing and technological transfer from taking place between foreign and domestic firms. Business synergy and knowledge transfers/productivity spillovers are one of the key positive domestic effects of FDI highlighted both in the literature and by the Macedonian government itself, but it seems that they are limited at this stage. Furthermore, the size and abilities of the domestic firms disallow the domestic market from engaging with foreign firms in any meaningful way.

II. METHODOLOGY

The research utilizes interviews with four ministers related to foreign investment in North Macedonia: two current ministers and two former ministers (of different political parties: the one formerly in power, and the one currently in power). The point of view of domestic firm management and employees was so fundamental to the picture of FDI's effects on the

domestic economy that the research included interviews with an equal number of managers from foreign and domestic firms. It asked questions about their relations with one another and their views on the effects of FDI in the country and on their work. The research further relies on data from an equal number of domestic and foreign employee focus groups, which provides a more holistic picture of the effects of the policy. The research attempted to uncover answers to some general criticisms of FDI as they relate to existing domestic firms, which are the source of much of the contention surrounding FDI generally, and especially in the country. The questions revolved around the extent to which foreign and domestic firms purchase from or sell to one another and generate spillovers. The questions asked can be found in appendix.

III. RESULTS

The main question examined by the research is how foreign and domestic firms interact with one another as a result of the FDI policy in buying and selling relationships. A further, related question is what spillover effects, whether positive or negative, might have occurred from foreign to domestic firms.

A foreign company operating in the technological/industrial development zone in Skopje in the automotive parts sector discussed sourcing domestically in the country:

Manager: Right now we are not being involved with the local companies. There are several reasons. First

of all the size of the companies and the level of maturity of the business, or certificates.

Researcher: Is your company open to sourcing locally?

Manager: The type of products I mentioned we are sourcing from Poland, Portugal, so high-volume production where simply economies of scale are [the] deciding factor whether one is winning the business or not.

(Foreign firm management, Skopje).

Described here is a fundamental problem faced by domestic firms in the country: due to their size and not having achieved economies of scale, it is very difficult for them to be integrated into the supply chain of a foreign firm. This is especially true because, once a company seeks to locate parts of its supply chain in different countries to create savings, it may already have a supply chain well-established. That well-established supply chain was probably one of the factors that enabled it to become successful in the first place. On the other hand, it is possible that if an investor is looking to move a part of its supply chain to a developing country (for the goal of creating savings) they would be open to moving other parts of it as well (which could also create savings). If the Macedonian government can make a good case, the investor may be willing to locate more parts of the chain there than they originally planned. Doing this could simplify the operation for the foreign firm. However, the case the government makes would need to be strong; the country could not possibly supply all types of firm needs. Any strategy to develop supplier capacity would need to be purposeful and focused on depth rather than breadth.

While it was the case with all the foreign and domestic firms interviewed that there were no major sourcing or selling relationships with one another within the country, many firms and employees discussed the items that were purchased from domestic firms by foreign firms. However, these items were mainly lower-cost and related to mere operational necessity rather than integrated supply chain:

Manager: Our main machineries are inputs from the European Union. I mean machineries are high quality machines for underground work. Like so most of the machinery and tools and equipment are not produced in Macedonia.

Researcher: So the non-technical things are from Macedonia?

Manager: Yeah not that. Like computers, office equipment, chairs, everything is produced in Macedonia. This machinery we don't have that kind of market so France, Germany, Sweden and Denmark.

Foreign Firm management, Central

This was a very common occurrence among the foreign firms interviewed: the inputs were largely purchased abroad, but less expensive items like office equipment and catering services were purchased

locally. Therefore, it is clear that, on the basis of these interviews, domestic firms are not very well integrated into the supply chains of the foreign firms that locate in the country. This has to do again with the fact that the firms cannot scale to their needs or provide the exact technical equipment needed. Small effects on domestic firms do exist—caterers, office supply stores, public transit authorities, property management companies, and restaurants/bars do see some marginal benefit through sourcing relationships. However, it could not be argued that domestic firms are incorporated into foreign supply chains in any significant way. Ironically, the lack of sourcing of sophisticated technology and higher-skill services may prevent them from being created to consume within the country, leaving the country trapped in a less refined market. This less refined market consists of a vicious cycle where a supply of “sophisticated” products and skills does not exist because the demand for them does not exist.

It was the opinion of other interviewees that it is clear that the foreign companies themselves stand to benefit from purchasing locally. This was most often the view from the governmental side, and from both political parties.

When asked whether foreign firms buy domestically, the new minister for foreign investments Kjahlil stated:

Yes, and I see that they do buy. It doesn't pay off for them to import things (imports can be late), and these other companies (Macedonian ones) are right here. Macedonian companies are slowly developing understanding that they should have good quality products at affordable prices. I see that more and more firms purchase from Macedonia, as it's more practical and cheaper.

Current Minister for Foreign Investments

It seems from this comment that domestic firms may stand to benefit more and more from the presence of foreign firms, provided they increase the quality of their inputs and lower their prices. This comment agrees with former minister for foreign investments Jerry Naumoff's views that the main supply chain issue lies with domestic companies not understanding or being unwilling to make changes in order to obtain foreign customers. However, it may be, especially based on the assessment from managers of foreign and domestic firms, that Mr. Naumoff and Mr. Kjahlil are overestimating the ability of domestic firms to provide what is needed by foreign firms. While it is true that imports can be late, the domestic firms simply may not be able to provide the same quality-to-cost ratios of firms in other countries that have scaled, even when transportation costs are taken into account.

In sum, foreign firms were asked whether and to what extent they source domestically or were open to sourcing domestically. It was generally agreed that Macedonian firms generally are not able to either (1) scale to the need of the foreign firm at competitive

enough prices and/or in the right amount of time, (2) provide the level of technological specification necessary for the input needed by the foreign firm, or (3) develop a product/service of sufficient quality for the company's end product/service. While Mr. Naumoff of VMRO and to some extent Mr. Kjahil of SDSM seemed to believe this was a conscious choice on the part of the domestic firms, the interviews with managers suggest that a lack of ability (the three issues listed above) was more likely the cause. The case might be argued that foreign firms (from large well-developed economies) prefer to do business with firms similar to them (also from large, well-developed economies). The case also might be argued that there is a lack of trust between firms from large, developed economies and smaller, weaker ones. If the problem were only the lack of trust or the tendency of firms to stay with what is similar, the solution would be to market the country, educate foreign firms, and forge relationships. For example, potential activities could be, and in fact have been, a campaign of advertising Macedonian firms as potential suppliers and providing fora where foreign and domestic businesspeople could meet, or, as the government has done under SDSM, provide an incentive to purchase locally. Former Minister Naumoff agreed with this by saying "You have to [advertise] and it's even harder, much harder, because nobody knows Macedonia and they've got a bad image of Macedonia and it's not true. The only bad image is the politics." Incentivizing local sourcing and advertising/forging relationships would likely have solved the domestic sourcing problem if the unwillingness to source there had been about inconvenience or lack of familiarity. It appears, however, that the issues are more structural and run deeper than the mere "bad image;" even domestic firms, who are not affected by the biases of the foreign firms, do not buy domestically: Manager: No, most of our inputs are bought from abroad.

Researcher: Like about how much percentage if you could give me a ballpark?

Manager: I would say 80%.

Researcher: From where do you buy?

Manager: It's from Western Europe, it's from far east, it's from north Africa.

Domestic firm management, West

This and the earlier interviews indicate that it is not because of lack of familiarity or trust that foreign firms don't source from domestic ones, but it is more likely due to general lack of firm development. This finding suggests that, in addition to marketing and incentivizing local purchasing, a program of domestic firm development is a crucial third pillar that will bolster the effectiveness of the other two. Such a program would ensure that government dollars were not being spent fruitlessly on marketing and networking, and may enable the incentivization scheme to be phased out over time as foreign firms come to trust the quality of Macedonian products and

services. Similarly, since SDSM's change in FDI policy to focus more on incentivizing local purchasing, a portal has been added to the Invest Macedonia website called the "Macedonian Suppliers Business Portal" where foreign and domestic companies can post their offers and demands, and search for suppliers that meet their needs. It may be a new feature, but so far no posts have been made. Such a step is, similar to the incentivizing local purchasing, a good idea, but will be fruitless if not accompanied by a program of domestic firm development. Again, the issue is not primarily the foreign firms' lack of awareness, but the lack of ability of domestic firms to supply what is needed.

Appendix: Questions asked to Foreign and Domestic Company Managers.

- 1) Have you heard about the Macedonian government's program to encourage FDI in the country? (+ Follow-up) What do you think about that policy? Дали сте запознаени со политиките на Владата на РМ за охрабрување на странски инвестиции?
- 2) How do you view the competition on the Macedonian market in your sector between foreign and domestic companies? Што мислите за конкурентноста во пазарот помеѓу домашните и странските компании?
- 3) (If they are a domestic firm) What have been the effects on your company from the FDI inflow? (Returned workers, new machines, forced competition, standardization of technology/management, forced increase of salaries) Доколку се домашна фирма. Кои се ефектите на вашата компанија од СДИ? (повратници работници, нови машини, стандардизација на технологија, покачување на плати)
- 4) (If they are a domestic firm) Do you have any linkages with foreign firms? (+Follow-up) Has there been any knowledge transfer between their employees and yours? (Доколку се домашна фирма) Дали имате некаква поврзаност со странските фирми? (дополнително прашање) Дали имало случај на трансфер на знаења помеѓу нивните и вашите вработени?
- 5) (Foreign company) Do you have numbers on how many people you hire out of unemployment? About how many is it? (странска компанија) Дали имате бројка/статистика за тоа колку од лицата што се вработуваат кај вас биле претходно невработени (односно не прават трансфер од една во друга компанија)
- 6) (If they are a foreign firm) Has there been any knowledge transfer between the foreign employees and domestic ones? (+Follow-up) Does the firm provide trainings or other types of professional development for its domestic employees? (странска фирма) Дали имало

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| трансфер на знаење помеѓу вработени во странски и домашни компании? (дополнително) Дали фирмата обезбедува обуки или друг вид на професионален развор за своите локални вработе | (+Follow-up) With which companies do you have supply chain relationships? (за странска фирма) Какви врски имате со секундарните индустрии во Македонија (дополнително) со кои компании имате соработка во снабдување(supply chain). |
| 7) (If they are a foreign firm) What linkages do you have with secondary industries in Macedonia? | |

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REFORM OF COMPANY LAW FOR LAWYERS IN GERMANY

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Abstract - Initiated by a paper with cornerstones of the German Federal Ministry of Justice and Consumer Protection the reform of company law for lawyers in Germany entered a next level. Whereas until now the possible forms are limited, the paper intends to increase the possibilities. However such reform does not take enough into consideration the special status of a lawyer in German administration of Justice. As he is an independent organ of it, special professional law has to be followed. The reform has a focus on making the lawyers's market more economical. But it increases the risk that individuals and consumers will lose the possibility to enforce their rights.

Keywords - Reform Legal Profession in German, Partnership, Corporations, Lawyer as Independent Organ.

I. INTRODUCTION

The German Federal Ministry of Justice and Consumer Protection published on 27th August 2019 cornerstones for a new regulation of the professional law governing professional associations of lawyers¹. This paper will outline the development and actual status (II.), the main cornerstones of the publication of the German Federal Ministry of Justice and Consumer Protection (III.), followed by a critical analysis (IV.).

II. DEVELOPMENT AND ACTUAL STATUS

Originally a lawyer used to work alone as a single law firm or in case more lawyers decided to work together they did it in a civil law partnership.

The reason for this is – among others – that the lawyer is an independent organ of the administration of justice (§ 1 of the German Federal Lawyers' Act - BRAO²). This short sentence succinctly describes the special position of the legal profession in a constitutional state: The legal profession is not a profession like any other. It is associated with special rights, but also with special duties. Lawyers have to support not only big companies but also consumers, ordinary people and in disputes that do not have a high value but might be of great importance for individuals. Otherwise such individuals have no access to justice, as they do not have access to the deciding courts. Having said that, one of the central characteristics of the lawyer is independence. Only this guarantees that the lawyer can perform his duties in the rule of law on an equal footing with the other organs of the administration of justice (judges and prosecutors).

Legal form for such a civil law partnership was for a long time the civil law partnership according to § 705 (“Gesellschaft bürgerlichen Rechts”, “GbR”) of the

German Civil Code³. Such association of lawyers jointly exercised their profession by jointly accepting clients, followed by joint remuneration and joint liability. Such joint liability was later seen as a big disadvantage.

The tendency in the legal practice to step away from the general lawyer working on all fields of law to specialize on only some fields was followed by the need to set up bigger and bigger partnerships. Therefore a need came up to create and allow for new possibilities for cooperation.

In 1994 the German legislator provided the lawyers a new possibility to set up a partnership by adopting a new act to partnership companies for members of liberal professions, called partnership (“Partnerschaft”)⁴.

In addition to the introduction of this partnership the Bavarian Supreme Court in Munich, Germany, decided also in 1994 that lawyers may in addition organize themselves in the form of a company with limited liability (“Gesellschaft mit beschränkter Haftung”, “GmbH”⁵). In its decision⁶, the court addressed the fears of the legal profession that the admission of the GmbH could further promote the commercialization of the legal profession, however based its decision on two arguments. Firstly the High Federal Court in Germany has decided⁷, that it is also for dentists allowed to collaborate under the umbrella of a GmbH. Secondly the legislator did not expressly forbid a GmbH for lawyers. Therefore is has to be allowed for lawyers working under the umbrella of GmbH. Such argument is based on Art. 12 of the German constitution that guarantees the free exercise

³ Bürgerliches Gesetzbuch dated 2. Januar 2002, Bundesgesetzblatt Teil I 2003, page 738

⁴ Gesetz zur Schaffung von Partnerschaftsgesellschaften und zur Änderung anderer Gesetze, Bundesgesetzblatt Teil I 1994 Nr. 48 dated 30.07.1994

⁵ Gesetz betreffend die Gesellschaften mit beschränkter Haftung, dated 20.04.1982, Bundesgesetzblatt Teil III, section 4123-1

⁶ BayObLGZ 1994, 353

⁷ BGH, NJW 1994, page 786

¹ https://mitteilungen.rak-muenchen.de/fileadmin/magazin_pdf/Eckpunkte_Berufsrecht_Berufsausübungsgesellschaften.pdf

² Bundesrechtsanwaltsordnung dated 01.08.1959, Bundesgesetzblatt Teil III, section 303-8

of the profession.

Six years later, in 2000, the Bavarian Supreme Court again decided that in addition to the GmbH lawyers are also entitled to collaborate under the umbrella of a joint stock company ("Aktiengesellschaft", "AG")⁸.

So at that time the lawyers could choose between a civil law partnership ("GbR"), a partnership ("Partnerschaftsgesellschaft"), a company with limited liability ("GmbH") and a joint stock company ("AG").

III. THE CORNERSTONES OF THE PUBLICATION OF THE GERMAN FEDERAL MINISTRY OF JUSTICE AND CONSUMER PROTECTION FOR A NEW REGULATION OF THE PROFESSIONAL LAW GOVERNING PROFESSIONAL ASSOCIATIONS OF LAWYERS

The publication of the German Federal Ministry of Justice and Consumer contains 20 cornerstones which should be taken into account in the revision of the law governing the legal profession. The aim is a clear, uniform and transparent regulation.

This paper will not list all of them, but focus on such cornerstones, that will be of importance in the following section of the critical analysis.

Uniform regulations are to be created for the professional companies of lawyers as far as possible, irrespective of legal form. In principle, all national and European legal forms should be available to professional companies of lawyers (No. 1).

Professional companies are to be entered in an electronic register maintained by the German Federal Chamber of Lawyers. Such register will provide information for the concerned stakeholders, e. g. clients. All partners - including non-lawyers - and all lawyers working on behalf of the professional company are to be registered (No. 4).

It should be regulated for all professional companies that they are authorized to provide legal services and to represent clients in court (ability to postulate), insofar as they act through personally authorized persons (No. 5).

In accordance with the applicable law, only natural persons who actively exercise their profession in the professional company should be able to become shareholders. Pure capital investments by shareholders who are not active in the company should basically remain prohibited in order to protect legal independence. Where pure equity investments are permitted, compliance with the law governing the legal profession should be specially safeguarded (e.g. upper limit for equity investments, special professional duties for lawyers), (No. 6).

The possibility of allowing pure equity participation with the aim of opening up alternative financing channels through venture capital for those lawyers

who, for example in the legal tech field, have to make high initial investments in order to provide new legal services will be considered (No. 7).

The possibilities for inter-professional cooperation should be improved. In future, partners or shareholders in professional companies will be allowed to be members of all "allowed" professions, which lawyers themselves may also practise as a second job (No. 9).

The principle of personal responsibility for the individual lawyer should be kept. Lawyers should be obliged to ensure that the professional obligations are observed by the company and by partners from outside the profession (No. 11).

All professional companies themselves will in future be subject to professional duties and professional sanctions. All professional companies are to be licensed under professional law and are to become members of the Bar Association (No. 12).

The lawyers involved and the professional company are to be obliged under professional law to ensure compliance with professional law in the company by means of implementing respective articles of association and in actual management. How this is done is left to the lawyers and companies itself. An obligation to appoint professional officers, who as "compliance officers" have the task of ensuring that professional law is observed and who serve as contact persons for the bar association, should not be mandatory (No. 13).

IV. CRITICAL ANALYSIS

The aim of the reform is to open up as many of the existing forms under company law for lawyers as possible, with various restrictions that are the basis for legal profession.

Ultimately the question which companies form to choose is a business decision limited by the allowed possibilities. In case more lawyers work together, the only form that guarantees that all lawyers are equal is the (civil law) partnership. Any other form beyond provides instead of joint management a hierarchical control of the company. The larger the company is, the more business management and hierarchical control mechanisms are necessary.

The market leader among the Law Firms in Germany made e.g. 2012/2013, according to the trade journal JUVE⁹, a total turnover of EUR 334,000,000. The turnover per professional in this law firm was EUR 732,000, the turnover per equity partner was EUR 3,093,000. Even from the totals it can be seen that the companies can only be run and controlled by hierarchical structures. As a consequence not all partners are involved in the decision-making processes themselves, but rather these are made at the levels of the Executive Partners or the Practice Group Leaders. In doing so, the Law Firms introduced control by a

⁸ Aktiengesetz dated 06.09.1965, Bundesgesetzblatt Teil I page 1089

⁹ JUVE journal 10, 2013, page 56 ff.

system of "minimum billable hours", the fulfilment of which is closely monitored daily, weekly and annually by IT systems¹⁰. Even the control of the selection of clients according to specific revenue opportunities and sales developments should be common ("willingness to pay").

Contrary to such development are the real facts in the local courts in Germany in 2018: 33.9 % of the proceedings before the local courts (of 884,593 completed proceedings) have a value in dispute of up to EUR 600¹¹. The vast majority are handled by lawyers. The fee for a lawyer in such a dispute value is EUR 292. There is no need to state further that these fees do not allow covering the costs of a mandate, which means that they have to be cross-subsidized. Also the vast majority of these proceedings at the local courts do not contribute to the acquisition of economically attractive clients.

The decision-making parameters in large law firms are strategic and economic¹². This results in big law firms will not accept such small disputes as described above. This leads to big law firm regularly not work for consumers and private individuals. The conflict of interest would be understood by the big law firm as being client-related (and not dispute-related). Therefore consumers cannot consult a highly specialized lawyer in a big law firm in a claim against a big company.

The actions of the management board of a (limited liability or joint stock) company must be governed by the shareholder approach, which is primarily oriented towards the interests of the shareholders. The overall interest of the company is therefore directed towards maximizing profits. This because to prevent shareholders switching to more profitable investment options. Without meeting a certain return on investment that is expected by investors, they will not invest further in the company. Therefore the financial investors' expectations of the return on investment already changes the attitude of the management board of a company, irrespective of the size of their stake in the company. In other words, financial investors' expectations of return on investment already change the parameters of action of the management board of a corporation.

If the corporation does not earn the capital market's expected return, investors will step away. In this respect, no decisive influence on the appointment of the management board is required.

Such tendency cannot be avoided by limiting the investment e.g. to 25 % (applying § 53 para. 2 GmbHG or § 179 para. 2 AktG mutatis mutandis) of the share capital. Because in case such investment is needed for

the company, the management will avoid losing it. In addition 25% of the share capital is already material.

Basically, the governance structures of capital market law and the function of the lawyer as an independent organ of the administration of justice do not fit together¹³.

After this more general analysis I would like to comment on the above mentioned cornerstones in detail:

The professional companies should be entered in an electronic register, No. 4. It is unlikely that every person seeking a lawyer would first do a research, in which form of company the person concerned is in. The influence of the type of company on possible later claims of the person seeking legal assistance against the lawyer may only be apparent to a very small number of persons. In addition such a register will be confusing for consumers. Already now, lawyers may be searched in the official nationwide list of lawyers.

As already generally stated above, there is a risk that lawyers will focus too much on the interests of the investors and thereby neglect other obligations ("independent organ of the administration of justice"). In reality there are sufficient alternative ways to obtain financing (No. 6 and 7). So there is no need to find new possibilities for financing law firms.

In professional companies partners or shareholders of another profession will also be allowed. Such "allowed" profession should be those the lawyers themselves may practice as a second job. First, the definition of such "allowed" profession is not included in the cornerstone and therefore might be rather vague for reality and opens room for discussion. Second, the question of the compatibility of a second job cannot be transferred to the question, if also other professions are allowed for a profession corporate, because that is another scenario: one issue is if the lawyer is allowed to practice another job in addition, whereas this issue is about to allow connecting lawyers and people of other professions in the same company.

Also in a company each lawyer should remain personally responsible and ensure that the professional obligations are observed by the company and by partners from other professions (No. 11). The only way a lawyer can ensure this, is to implement such obligations in the articles of the company. There are two disadvantages: such obligations are not directly imposed (as compared to the professional obligations for lawyers), but only by using the articles and in reality it will be difficult for a lawyer to enforce it. Here goes the same as said in connection to financial investors.

As well the lawyers and the professional company are subject to follow professional law (No. 13). How this is done is left to the lawyers and companies itself. The professional law for lawyers itself does not foresee any

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<http://www.azur-online.de/2017/04/stundenvorgaben-kanzleien-verlaegen-im-schnitt-1-657-billables-jaehrlich>

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<https://www.destatis.de/DE/Themen/Staat/Justiz-Rechtspflege/Publikationen/Downloads-Gerichte/zivilgerichte-2100210187004.html>

¹² Hartung Markus, NJW 2020, 1772 page 1774

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https://mitteilungen.rak-muenchen.de/fileadmin/magazin_pdf/Anwaltschaftliches_Gesellschaftsrecht_01.pdf

guidelines and leaves the problem to practice. In addition an obligation to appoint professional officers, who have the task to make sure that professional law is observed, is not mandatory. The appointment of such officer would be a minimum standard to ensure that the professional law is complied with. As it is planned now, no one is towards the Bar primarily responsible and serves as first point of contact. The obligation to implement such an officer would therefore be recommendable.

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ITALY'S COLONY IN CHINA: THE TIANJIN CONCESSION (1901-1943)

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Abstract - After the quelling of the Boxer Rebellion (1899-1901), Italy was awarded with a consolation gift, 457,000 square meters for an indefinite period of time, in Tianjin, between the Austrian and the Russian concessions. Rome's gains were symbolic more than anything else. Firstly it obtained equal status with the other powers by acquiring the same extraterritorial privileges and the right to maintain a military force in the Legation Quarter in Beijing. Secondly, it now had official authorization to use the international quarters in Shanghai and Xiamen. Finally, Rome secured the right to protect mines, churches and railways by force if necessary

Keywords - Qing China, Liberal Italy, Colonialism

I. INTRODUCTION

The Italian concession was a part of the Beijing peace treaty and was concluded *de jure* on 7 June 1902 with the "Agreement with China for the Italian concession in Tianjin". By this treaty Rome finally obtained a base in the Orient after the failure to acquire Sanmen a few years earlier.

II. ESTABLISHING THE NEW "COLONY"

Lieutenant commander Mario Valli had already occupied the location on 22 January 1901 to secure its future possession by a *fait accompli*. Raggi, the Italian ambassador witnessing the Russians and Belgians establishing themselves in the area of the Hai river, sent a telegram to Foreign Minister on 19 January 1901, asking for Rome's authorization to proceed to the provisional occupation of "the best of what remained". The Italian Minister in Beijing asserted: "[...] the provisional occupation of these terrains would serve to prevent the others from seizing them". Unsurprisingly, Venosta gave his consent and Valli captured the area and delimited it with markers, an action that irritated the Chinese and the neighbouring Russians alike. As early as 27 April 1901, Raggi was authorized by the new Foreign Minister Prinetti to commence negotiations with the Chinese plenipotentiaries in order to obtain a concession in Tianjin in exchange for the definitive renunciation of the Italian aspirations in San Mun (Sanmen) and Zheijang. On 12 March 1902 the two sides agreed on the following terms: The land and the property of the agreed territory, including the salt quays, were passing to the Italian government; the latter had to resolve any territorial differences with the owners of the adjacent railway line. The Chinese residing in the villages were to remain landlords of their property, but the Italian government retained the right to expropriate it for public utility and sanitary reasons for a price 10% lower of what was regulated for the Japanese concession. The Chinese residents,

in contrast to other "foreigners", were free to sell or acquire property within the Italian zone. Every other issue would be regulated "in the same way as established for the concessions obtained by the other foreign powers"; Italy was finally recognized as an equal in China. On 7 June the Italian embassy's secretary and later on ambassador in China, Giovanni Gallina (1852-1936), Raggi's successor, and the inspector of Tianjin's maritime customs signed the agreement. Indeed "to encourage Italy's commercial growth in northern China, the Chinese government ceded indefinitely to Italy an area left of the river Hai, upon which the Italian government had the right to exercise total and full jurisdiction in the same manner that had been agreed for the concessions obtained by other nations". The juridical status of the Tianjin concession, arranged by the 1902 Italian-Chinese agreement, was bewildering in every respect. Beijing preserved its sovereignty upon the territory but recognized to Rome the right to administer it and to confiscate and obtain, nominally vacated land. Non Italian nationals could acquire terrains exclusively through the Italian authorities'. Thus, in this regard, Italy acted as Beijing's proxy by possessing "full jurisdiction". It was a rare instance of one state ceding sovereignty and another acquiring it. Since the concession did not entail any variation to the level of Italy's political control or borders Tianjin is not considered an Italian colony by many scholars. As already examined, a settlement was concluded with the leasing of a territory, which remained under China's nominal ownership, to foreigners. The contract usually had a duration of 99 years. Concessions were a particular kind of settlement. They were terrains ceded in perpetuity to the foreign governments that placed them to their citizens' disposal attributing a predefined land tax to the Chinese government. In their turn the foreign nationals, always under the extraterritoriality status, regulated the concession's fiscal, financial and municipal administration while imposing public order as well. The Italian establishment in Tianjin was a

concession in every manner. Furthermore, the 'full jurisdiction' clause gave Rome the special right to purchase estates and not just lease them, as was the common practice in these cases.

The concessions were typically administered by the respective nations' consuls or local committees that were elected by the foreign citizens of the quarters. In theory, the June 1902 protocol entrusted the administration to the Consul General as a representative of the Italian government. Before the treaty and even afterwards, as the consular executive authority was unprepared, Italian Tianjin, much like Eritrea and Somalia, was directed by servicemen; in this case by the lieutenant Domenico Guido Biancheri under the supervision of the Foreign Ministry. The Italian consuls and observers demonstrated an interest for the British "township" model of administration. The British concessions were managed by a council, whose president exercised powers similar to a town's Mayor. The French method was deemed as more "centralized". In 1905 the Foreign Ministry approved the British municipal-neighbourhood model. In the meanwhile (1903-1905) Tianjin was administered in a provisional manner, by an appointed delegate, a royal commissary. The subsequent "Building regulations" promoted western modernity in urban architecture, landscaping safety and hygiene. The consul had the power to demolish any building and drive away any Chinese inhabitant if this course of action would contribute to Tianjin's moral and technical advancement. Everything that was Chinese was downgraded and put aside whereas European superiority was vividly exalted. However, the lives and property of the Chinese inhabitants of the town living on the Italian-Chinese territory were supposedly guaranteed by the 1902 protocol. The foreign administrations were bound to respect and exercise the imperial estate legislation. From a juridical point of view Chinese and foreigners alike were appertained to the township's and municipal police's jurisdiction; violations of the penal code in Tianjin the Chinese offender was to be extradited to Qing authorities and the Italian to the consul or mayor-chairman of the quarter.

III. TOO SMALL TO SATISFY THE ITALIAN AMBITIONS

Italy gained some international recognition but certainly not enough. Its concession, among the 9 foreign ones in Tianjin, was the second smallest after Belgium's and probably the more destitute one, from a sanitary and financial point of view. The Chinese city numbered just 200 shops and almost 900 houses; the 13,074, after the 1902 census, residents were mainly salt pit workers. The Italian vice counsel there, Cesare Poma (1862-1932), nominated in April 1901 but commencing his duties in August, lamented the poor choice of the location. On 19 November

1901 he reported to Camillo Romano Avezzana (1867-1949), the new ambassador, that Italy had made a "miserable acquisition"; he regarded the territory as a composition of a Chinese village, a cemetery and an unsanitary pond and he deemed the local population too impoverished to be able to contribute any taxes and the district's rearrangement and expropriation, in order to accommodate Italian citizens, burdensome. He addressed reports also to Raggi, highlighting discouragingly the difficulties. Foreign Minister Prinetti ordered Avezzana to dismiss the vexatious Poma on 18 November. In January 1901 lieutenant commander Valli claimed: "There the only Italian thing that exists is the barracks where our guard troops reside; the rest is an obstacle of swamps and Chinese graves [...]. It seems that the Italian concession of Tianjin is there just to satisfy modest nominal ambitions and makes (us) wonder with melancholy that it is maybe a good thing that the San Mun affair failed". Vice admiral Carlo Mirabello (1847-1910) visiting Tianjin in 1903 as the Royal Navy's inspector noted the activity in the nearby Russian, Austrian and Japanese settlements in comparison to the abandonment in the Italian sector. The only Italian firm operating within the concession was the "Italian Colonial Trading Company". The greatest advantage of the concession, as lieutenant Biancheri underlined in 1902 was its proximity to the Mukden-Beijing railway, an advantage that could boost production and commercial transactions with the interior. Minister Gallina after a survey telegraphed to Prinetti on 12 April 1902: "I have visited our settlement there and I am convinced that if its situation is handled with intelligence, it could present in the future real advantages either for our general position or for the interests of Italian individuals that will come here to trade". The scarce number of Italian citizens and the meagre financial interests urged some to propose the concession's abandonment or relocation to a more commercially active Chinese region. Rome selected to maintain it as part of its tedious, self-deceptive policy aiming to achieve equality. The debate over Tianjin is highly reminiscent of the 1870-1880 intense deliberations over Assab.

No commercial association and private company appeared disposed to invest in Tianjin except one. In January 1901 a group of Italian capitalists presented to Raggi a somewhat vague developmental proposal for the transformation of the Tianjin area to a "centre of considerable importance". Raggi, elated by this example of Italian entrepreneurship, presented the plan to Venosta. In March the same businessmen addressed an official note to Raggi with the intention of developing "the whole area if the land had been granted to them free of charge". The investment group would undertake the infrastructural projects and requested to administrate the region autonomously, without the army's and the state's

intervention, in line with the British and American examples. However, Raggi appeared reluctant to make any commitments when the establishment of a consular office and the official transfer of Tianjin were still underway. The government, having to secure funds for infrastructure works such as roads, the swamps' drainage, and the urgent relocation of the cemetery, resorted to low-price land auctions with the hope of attracting funds. Light taxation was also imperative in order to cope with the road maintenance fees and the initial infrastructural costs. Full Italian jurisdiction, granted by the 1902 agreement, deprived the Qing government of the right of taxation which was passed to the Italian authorities. On 27 December 1901 Prinetti authorized Avezzana to award the demanding reorganization of the concession to a private Italian company. The company for the development of Tianjin would undertake the expropriation of the necessary areas, the removal of the cemetery, the construction of a 7 kilometre road network and the flattening of the ground. For its services, it would receive a portion of the land. The government would remain responsible for the implementation of the 1902 protocol until the signing of the sub concession between the future developers and the authorities. No firm demonstrated the smallest interest. The area was abandoned for almost 10 years, like Assab. Accordingly in 1908 the newspaper *La Tribuna* reported: "In Tianjin the Italian trade is zero, the only Italian firms are a barber shop and the company Marzoli, property of a brick factory". In June 1909 Tianjin's administration was almost bankrupt and Minister Tommaso Tittoni (1855-1931) suggested the state's intervention for "prestige" and "dignity" reasons in the Far East. Between 1902 and 1908 some improvements were accomplished: elementary hygiene organization, expropriation of land and houses and ground levelling thanks to the "scanty savings of the concession's balance". Further construction projects such as a hospital, a dispensary, a school of arts and crafts were funded by a 400,000 lire loan.

IV. CONCLUSION

Italy was substantially more experienced and cautious in China, after the African debacle, and acted in unison with the Great Powers' interests and more specifically with the British, a policy that eventually yielded some results. Tianjin bestowed Italy with prestige, recognition, and equality at least theoretically. Italy seemed to finally obtain an international role and an audible voice in the conferences and conventions that would shape future policies. Psychologically, the haunting Adwa shadow was cast away slightly in China, substantially in Libya in 1911 and completely in Ethiopia in 1936; its unsettling, self-doubting uneasiness made a comeback in 1943. From a material point of view, the inability of the late 19th century Italian industrial

production to cope with the international antagonism and the urgency to invest whatever surpluses were available amidst economic crises and the absence of a "capitalistic" consciousness, especially in southern Italy's stagnate interior, made investments and grandiose imperialistic adventures abroad strenuous. Tianjin's development, mirroring the entire early Italian colonial phenomenon, faced many financial problems in the first years when it came close to being abandoned. Since it was unable to render itself profitable, as Eritrea and Somalia in the past, the government was compelled to provide the funds for its sustenance; an impractical and, even worse, burdensome operation that was to act as a display of Italy's modernization and splendour in order to keep up appearances with the rest of the world. Interestingly enough, it would be the allied, fellow latecomers Japanese that would expel the Italians from Asia. Forged by identical distressing experiences and having risen together in the New Imperialism epoch as students of the European expansionism doctrines, they would occupy Tianjin in 1943.

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SEARCHING FOR DETERMINISTIC CHAOS IN FUEL CELL VOLTAGE VARIABILITY

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Abstract - Fuel cells are very complex systems to model because of the diversity of components and the intricate relations among them. There is a diversity of complicated models with many parameters and variables that make difficult their understanding, simulations and control. In this work we present a new and different approach to empirically model the fuel cell dynamics with a nonlinear dynamical system obtained from a time series of measurements of the fuel cell voltage. This method generates models of complex systems with potential chaotic behavior depending only on the information contained in a time series of measurements. However, real experimental time series have information limitations and different sources of contamination. Therefore, a final nonlinear dynamical model of fuel cells is still a challenge depending on a fine tuning between experiments, simulations, model parameters and the identification of the sufficient state variables of the complex system.

Keywords - Deterministic Chaos, Fuel Cells, Complex Systems, Time Series Analysis, Renewable Energy.

I. INTRODUCTION

A model is a theoretical scheme representing a complex reality and serves to facilitate its understanding. Nonlinear dynamics is a strong mathematical tool to develop models of complex systems because they describe important nonlinear interactions between the different state variables of the system [1, 2]. Fuel Cells are very complex systems with a diversity of physical and chemical variables such as voltage, humidity, gas pressures, materials, cathodes compositions and temperature among others [3-5]. A nonlinear dynamical system may have diverse solutions including an attractor in phase space towards which the dynamic system tends to remain with the passage of time. The attractor may have different forms including a fractal structure when the trajectory shows chaotic behavior, i.e. sensitive to initial conditions but robust to external perturbations, among other emergent properties of complex systems such as fuel cell [6].

The construction of a three-dimensional (3D) dynamical system from a scalar one-dimensional (1D) time series, is an inverse problem, a process of calculating from a set of observations the causal factors that produced them. In this case the inverse problem is supported by two important mathematical results: the reconstruction theorem [7, 8], and the formal proof that all the possible attractors of any dimension can be represented in a 3D phase space conserving all the topological properties [9]. Therefore, at least theoretically, we may attempt to build simple models with complex solutions corresponding to the complexity of real systems using the information contained in a time series of measurements of only one observable of the system under study [10, 11]. However, real time series of measurements have limitations in number and precision of data points, time length coverage,

sampling frequency and diverse contamination sources of low and high frequency noise that can make very difficult to capture and isolate the potential deterministic chaos content of the time series. A system is deterministic when the state variables follow established rules and their behavior can be predicted with a mathematical model. A nonlinear dynamical system is a system of autonomous differential equations of the state variables as functions of time. The solution of the dynamical system is the trajectory of the system in phase space as the state of the system evolves over time. The state variables can be physical observables or complex combinations of them with the enrolment of parameters that define the time, space and energy scales among other important characteristics of the system. Therefore, the reconstruction of the dynamical system to model the real system from a time series of measurements, in general needs a preprocessing of the time series in order to capture its deterministic chaos content.

In section II we present the reconstruction of a nonlinear dynamical system from an ideal time series with controlled contamination to evaluate the impact of noise contamination in different steps of the modeling process. Then we present the preprocessing applied to the contaminated time series to recuperate the deterministic chaos content, and finally the description of the reconstruction process of the dynamical system from an ideal time series. The two processes, namely preprocessing and dynamical system reconstruction, have a strong feedback that eventually converges and capture the deterministic chaos content of the time series and finally justify the nonlinear dynamical system modeling process. In section III we describe the necessary and pertinent parts and characteristics of the fuel cell sufficient to describe the complex system and define the voltage

measurements as the necessary and sufficient time series. In section IV we present and describe some results of the modeling process using voltage time series obtained from fuel cells in specific operation conditions.

II. PREPROCESSING TIME SERIES AND DETERMINISTIC CHAOS

The modeling process is an optimization numerical reconstruction of a 3D dynamical system from a 1D time series. Without loss of generality but with a great deal of simplification, a dynamical system can be described in terms of polynomials in three variables with nonlinear terms up to order two. In general, real time series of measurements need preprocessing to capture its deterministic chaos content and justify the modeling process, it starts with a visual qualitative analysis in frequency and time domains, using the power spectrum and nonlinear measures of chaos. The preprocessing has three main steps:

1. The power spectrum of a time series shows the strength of periodic and stochastic behavior respectively with a few predominant frequencies or a flat distribution over a large range of frequencies. In these two cases the time series does not worth a nonlinear dynamical model, and also respectively linear and statistical models are more appropriated. If the power spectrum shows an exponential decay for low and medium frequencies, the time series may contain deterministic chaos.
2. Chaos measures strengthen and quantify the initial evidence of deterministic chaos content, guide the preprocessing and determine the value of important parameters needed in the reconstruction and modeling process. The most important and used chaos measures are the Mutual Information, Correlation Function, False Nearest Neighbors, Lyapunov Exponents and Fractal Dimension [12-14].
3. Detrending and denoising constitute an iterative process in which different filters are applied to the time series in order to reduce contaminations, but also periodic and stochastic information in order to highlight its deterministic chaos content. This feedback process is directed by the tendencies of the chaotic measures obtained before and after each filter application.

III. MODELING IDEAL TIME SERIES

Once the deterministic chaos content of the time series justifies the modeling process, it is performed in three steps:

1. The 3D reconstruction of the trajectory, $\mathbf{x}_n = (x_n, y_n, z_n)$, from the scalar 1D time series, x_n , with $n=1, \dots, N$, where N is the number of data points, is obtained by the application of the reconstruction theorem. The chaos measures provide the time lag τ

in units of the time interval between measurements to get:

$$\mathbf{x}_n = (x_n, x_{n+\tau}, x_{n+2\tau}). \quad (1)$$

At all points of the 3D trajectory in phase space, $\mathbf{x}_n$, it can be constructed an orthonormal base of polynomials in three variables with nonlinearities up to order two by using the Gram-Schmidt orthonormalization procedure.

Finally, the nonlinear dynamical system model is obtained through the Adams-Moulton multistep method of numerical integration using a function $\mathbf{F}(\mathbf{x})$ expressed in terms of the orthonormal base [15]. The integration is performed under the constraint of a least square optimization to uniquely determine the value of the coefficients of each orthonormal polynomial. Limited precision of the polynomial base orthonormality indicates low deterministic chaos content of the time series. The model as a nonlinear dynamical system in 3D is of the form:

$$d\mathbf{x}/dt = \mathbf{F}(\mathbf{x}) = \mathbf{C} \cdot \mathbf{\Pi}(\mathbf{x}) \quad (2)$$

where $\mathbf{\Pi}$ denotes the orthonormal base of polynomials up to order two in the three variables, $\mathbf{C}$ are the correspondent coefficients determined by the Adams-Moulton and least square procedures. In this framework the general dynamical system has 30 coefficients, however, for all known chaotic attractors most of these coefficients are zero. The left side of (2) indicates the time derivative, therefore, the equation is a deterministic simple dynamical model that may have chaotic solutions depending on the values of a few coefficients. As an illustrative example we show the Lorenz dynamical system:

$$\begin{aligned} dx/dt &= \sigma(-x+y) \\ dy/dt &= x(\rho-z)-y \quad (3) \\ dz/dt &= xy-\beta z \end{aligned}$$

where the 3D phase space is expressed in terms of the three components state variables $\mathbf{x}=(x,y,z)$. This nonlinear dynamical system has 23 coefficients equal to zero and seven coefficients corresponding to five linear terms and only two nonlinear terms. The values of the seven coefficients are one with the corresponding sings except for $\sigma=10$, $\rho=28$ and $\beta=8/3=2,666$ when the solution of this dynamical system has chaotic behavior known as the Lorenz attractor of fractal dimension between 1 and 2. The 30 coefficients of the general form of any 3D dynamical systems in terms of polynomials with nonlinearities up to order two, correspond to one constant, three lineal and six nonlinear terms for each one of the three variables. The Lorenz dynamical system of (3) can be represented by a table with the corresponding values of the 30 coefficients. Table 1 presents the general form of the Lorenz attractor with the

corresponding 30 coefficient values when the system has chaotic behavior:

	c	x	y	z	x^2	xy	xz	y^2	yz	z^2
dx/dt	0	-10	10	0	0	0	0	0	0	0
dy/dt	0	28	-1	0	0	0	-1	0	0	0
dz/dt	0	0	0	-2.6	0	1	0	0	0	0

Table. 1

Lorenz Dynamical System general form, 30 coefficients.

As an illustration of the impact of noise contamination, in Fig. 1 the left upper panel displays the plot of the 3D trajectory reconstructed from the x component of the chaotic Lorenz attractor numerically obtained from integration of (1). The other three panels display the corresponding plots with added contamination of white noise at 1%, 5% and 10%. Since x is an ideal time series the preprocessing is not necessary and the application of the modeling process recuperates the correct values of the 30 coefficients as indicated in Table 2. In the same table we observe the effects of the corresponding contamination levels. The attractor is increasingly distorted by higher noise contamination but the reconstruction procedure is robust and the general topological properties of the attractor are not lost. However, the modeling process is more sensitive to contamination, as it is observed in the estimated values of the coefficients presented in Table 2 corresponding to noise contamination 1%, 5% and 10% compared with 0%. These results indicate the importance of preprocessing of real time series before the modeling process; real time series always have some noise contamination of different kinds and sometimes they are enough to make the nonlinear modeling process useless.

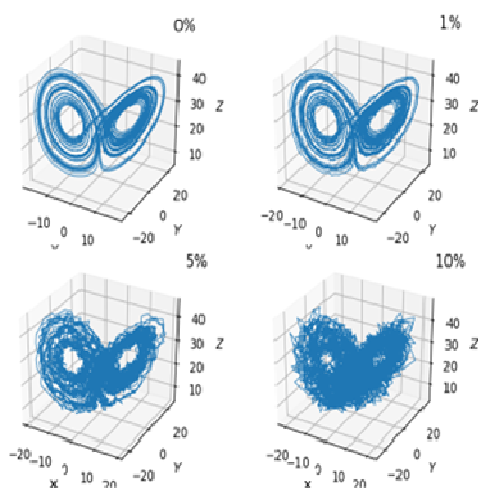


Figure 1: Lorenz attractor obtained by integrating respect to time the nonlinear dynamical system (3) with coefficient values corresponding to chaos. From left to right and top to bottom: 0%, 1%, 5% and 10% white noise contamination.

d/dt	c	x	y	z	x^2	xy	xz	y^2	yz	z^2	%
x	0	-10	10	0	0	0	0	0	0	0	0
	3	-11	10	-3	0	0	0	0	0	0	1
	9	-27	20	-9	-1	.1	.4	0	-2	0	5
	1	-40	25	-1	-1	.1	.7	0	-3	0	10
y	0	28	-1	0	0	0	-1	0	0	0	0
	-8	28	-1	0	0	0	0	0	0	0	1
	-5	36	-6	.4	0	0	-1	0	.1	0	5
	-1	45	-12	.4	.1	-1	-1	0	.2	0	10
z	0	0	0	-2	0	1	0	0	0	0	0
	-4	-0	0	-2	.1	.9	0	.0	0	0	1
	-14	1	-.9	.2	.6	.3	0	.1	0	-.1	5
	15	1	-.3	-1	.8	.1	0	.2	0	-.1	10

Table.2 Estimated coefficients of Lorenz attractor with noise % contamination.

When the preprocessing is properly applied to the contaminated time series and the added noise is then removed, the correct values of the 30 coefficients are obtained and the Lorenz attractor is recuperated. Indeed, the reconstruction of a 3D nonlinear dynamical model from a 1D time series can be obtained, at least for ideal and controlled conditions.

IV. COMPLEXITY OF FUEL CELL

Hydrogen is an excellent energy carrier with many unique properties, it is the lightest, most efficient, cleanest fuel and can be converted to electricity in fuel cells with higher efficiencies than conversion of fossil fuels to mechanical energy in internal combustion engines or to electrical energy because it is not subject to the Carnot cycle limitations [16]. A fuel cell is an electrochemical energy converter, it converts chemical energy of fuel, typically hydrogen, directly into electrical energy. As such, it must obey the laws of thermodynamics. The basic electrochemical reactions in fuel cells happen simultaneously on both sides of a membrane, the anode and the cathode, therefore the fuel does not generate byproducts waste like a battery, just a small amount of heat and water. The heart of the Proton Exchange Membrane (PEM) fuel cell, is a polymer membrane that has some unique capabilities. It is impermeable to gases but conducts protons. The membrane that acts as the electrolyte is squeezed between the two porous and electrically conductive electrodes. These electrodes are typically made of carbon cloth or carbon fiber paper. At the anode, hydrogen is converted into hydrogen ions plus electrons, in the cathode oxygen, hydrogen ions and electrons are converted into water. This is the same reaction as hydrogen combustion therefore some energy is released in the process. A theoretical maximum energy release of 286kJ/mol is obtained at ambient conditions of 1 atmosphere and 25°C; of which 237kJ/mol can be converted into electrical energy. The corresponding PEM fuel cell electric potential is 1.23 Volts. Fuel cells efficiency depends

on several parameters, the maximum theoretical efficiency would be of 94.5% and has a logarithmic dependence on the partial pressure of hydrogen and the square root of oxygen partial pressure divided by water pressure [16, 17].

PEM fuel cells have several components and diverse physical and chemical interactions, they are complex systems with many parameters and variables that have to be finely controlled to obtain the desirable efficiency, stability and durability. Since their origin in the 1970s numerous papers on fuel cell modeling have been published, covering various domains and physical phenomena as well as many new modeling methods and techniques. These models, in conjunction with improved diagnostic techniques, have provided better understanding of the intricacies of fuel cell operation. Operating fuel cells have three types of voltage losses: activation polarization losses, ohmic losses, and concentration polarization losses; well-designed fuel cells may operate with 83% to 85% of fuel utilization and above 90% when operated with pure hydrogen [17, 18].

Because of fuel cell complexity, in some of the components more than one process takes place, very often with conflicting requirements. The materials and design must be optimized through the understanding of the processes involved, their mutual interdependence, and their dependence on component design and material properties. This complexity implies that changes in one parameter cause changes in one or more other parameters, and sometimes at least one of them has an opposite effect of the one expected [19]. However, the complexity of fuel cells is the origin and reason why emerge the important and exceptional capacity to transform fuel into energy with such efficiency and renewability, and the corresponding dynamical complexity of the system has the potential to be described by a chaotic attractor in phase space with its characteristic dynamical robustness and stability.

V. DELAYFUEL CELL MODELLING

The modelling procedure of the dynamics of the fuel cell in terms of nonlinear dynamical systems in 3D is applied to time series of voltage measurements taken from a pile of five PEM fuel cells.

Modeling plays a significant and important role in the fuel cell design and development process [18]. Reliable diagnostics are needed not only to find out what is wrong with the existing design so that it can be improved but also to calibrate and verify the models and assumptions used in developing them. Hence, modeling has a critical role in the fuel cell design and development process, and afterwards in the operation control to optimize fuel cells performance.

Using fuel cell modeling as a successful design tool requires the model to be robust, accurate, and able to provide usable answers quickly. In terms of robustness, the model should be able to predict fuel cell performance under a large range of operating conditions. The model must also predict fuel cell performance accurately, but accuracy does not necessarily mean that a model should accurately predict the absolute value of all the physical phenomena being modeled at any point in space and time. Instead, a model should accurately predict the relative values or the trends using the correct assumptions, correct properties and other numerical input parameters, predicting the correct physical phenomena by using the correct governing equations. Most importantly, the model must be able to match modeling results with experimental data. The modeling process proposed in this work ideally tries to transfer all the fuel cell complexity to a numerical complex analysis, taking advantage of the very valuable empirical information contained in time series of measurements carefully taken by important experimental efforts, and applying appropriated time series preprocessing when necessary. However, enhancing model robustness and accuracy often trades off with computational efficiency [20]. Any model is only as good as the assumptions on which it is built and assumptions are needed to simplify the model.

The traditional models provide in general sets of equations that have to be solved numerically using modern programs and specialized software based on finite difference, finite volume or finite element methods where the input is either the cell voltage or the average current density with some parameter's values and boundary conditions [21]. On the other hand, the approach presented in this work is different, it provides a model of the dynamics of the complex system in a phase space that captures the necessary dynamical stability when it is generated by the subtle combination of the diversity of microscopic physical and chemical interactions of the fuel cells complex dynamics. The capacity to identify these special dynamical equilibria as a chaotic attractor is also available by means of high computational capacities, which are not very demanding in the present standards of computational science. The voltage is the main variable and the final practical output of the fuel cell, it hopefully provides sufficient information and capture enough accuracy of the dynamics of the whole system from the complex and reach variability of this one observable. The proposed modelling method is a new tool for researchers, designers, and developers alike to explore fuel cells, ranging from elucidating new fundamentals to characterizing fuel cell system performance. In the context of complex systems, the idea is to simplify the complications of detailed microscopic models by identifying phase state variables that capture the essentials of the

voltage variability. Obtain a deep and detailed description of all the microscopic phenomena faces very difficult challenges; the traditional methods fail to give a better understanding of many aspects in particular of the voltage variability that leads to lower performance of the fuel cell. Test equipment integrated with several diagnostic techniques can give more information to support the development of empirical models or validate theoretical models predicting performance as a function of operating conditions and fuel cell characteristic properties. The modeling procedure presented and applied to fuel cells in this work is a new source of empirical information that may help and complement the understanding and control of the voltage variability of fuel cells.

VI. NONLINEAR DYNAMICAL MODELS OF FUEL CELLS

The voltage time series used in this first approach of nonlinear dynamical modeling were obtained with the following parameter values of the fuel cell operation: PEM fuel cell made up of 5 membranes, with an active area given by $10\text{cm} \times 10\text{cm} = 100\text{cm}^2$, at 60°C , 100% relative humidity, with current densities of 0.6 to 0.9 A/cm^2 , sampling frequency of 100, 200 and 500 Hz, for time periods of thirty minutes per experiment. Table 3 presents six particular cases where some potential deterministic chaos content was initially identified for specific parameter values: hydrogen relative humidity, RH H_2 between 33% and 81%, air relative humidity, RH Air between 47% and 78%, stack temperature, T between 50°C and 60°C , anode stoichiometry, AS between 1.3 and 1.75, cathode stoichiometry, CS fixed to 2, and stack current density J between 1 and 0.3 A/cm^2 .

File name	RH H_2 (%)	RH Air (%)	T stack ($^\circ\text{C}$)	AS	CS	J (A/cm^2)
Case 5	69	59	60	1.3	2	0.9
Case 6	67	58	60	1.3	2	0.8
Case 14	65	59	55	1.3	2	0.9
Case 19	81	78	50	1.5	2	0.8
Case 22	76	73	50	1.3	2	1
Case 29	33	47	60	1.75	2	0.3

Table 3 Six particular cases of PEM fuel cell voltage time series with potential deterministic chaos content.

Given the different experimental conditions and measurement characteristics the working time series have to be carefully chosen by visual inspection regarding their low and high frequency contamination, and in particular choosing an appropriate time window with sufficient data points where chaotic content is promising. The visual

criteria are simple but subtle: not too much periodic nor too much stochastic behavior, something in between. Figs. 2 to 7 present some results for the cases 19 and 22 of Table 3. These two cases have been chosen to make more evident some interesting preliminary results. The voltage time series of Case 19, Fig. 2, shows an interesting compromise between periodicity and complex variability as potential deterministic chaos content that may justify the nonlinear dynamical system modeling procedure. In contrast, the voltage time series of Case 22, Fig. 5, shows very high variability that may indicate strong contamination of high frequency noise. However, both cases are interesting even though both time series have not been preprocessed, because a great experimental effort was made to avoid the application of filters that may introduce some artificial information into the measurements.

The corresponding power spectrums of cases 19 and 22 show both an exponential decreasing behavior. However, in Case 22 there are large amplitudes for a few frequencies that may represent dominant periodic behavior. Therefore, Case 19 seems more promising than Case 22, the later suffers more from limitations introduced by the two dynamical behaviors that tend to exclude chaos: stochastic and periodic dynamics. These observations are consistent with the final results presented in Figs. 4 and 7 as a preliminary attempt to reconstruct a chaotic attractor from these two corresponding time series. In Fig. 4, corresponding to Case 19, the fast variability concentrated in a cluster indicates the superposition of both periodic and stochastic behavior, however, there are also some traces of wings or extensions departing from the cluster as a possible indication of typical characteristics of a chaotic attractor. In Fig. 7, corresponding to Case 22, the cluster is larger, with dominant and more spherical high dimensional shape hiding any possible chaotic behavior, at least at this stage.

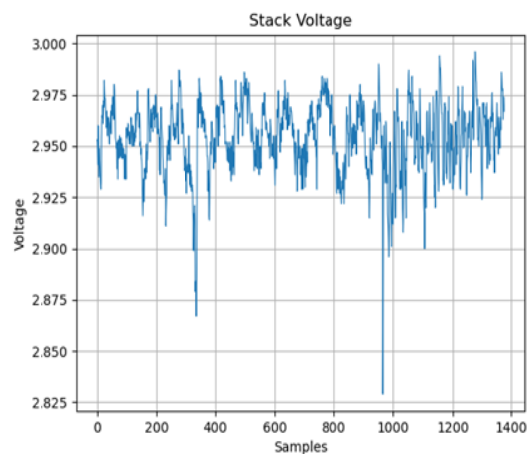


Figure 2: Voltage time series of a stack of 5 PEM fuel cells, Case 19 of Table 3.

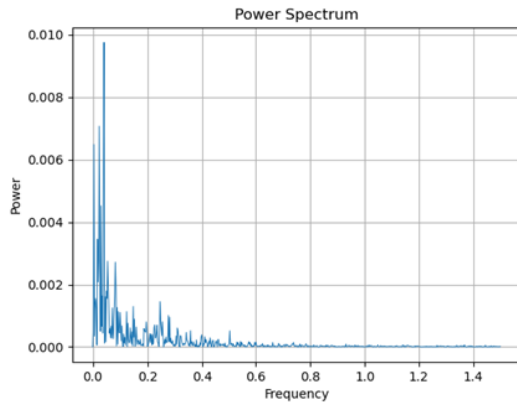


Figure 3: Power Spectrum of Case 19 of Table 3

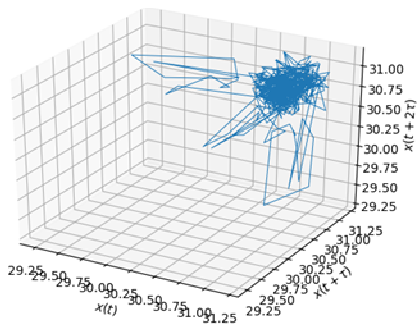


Figure 4: Reconstructed attractor Case 19 of Table 3.

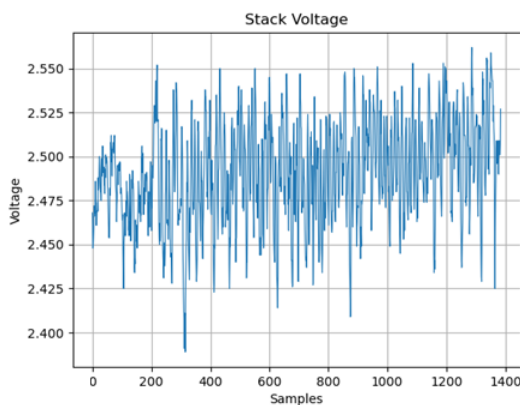


Figure 5: Voltage time series of a stack of 5 PEM fuel cells, Case 22 of Table 3.

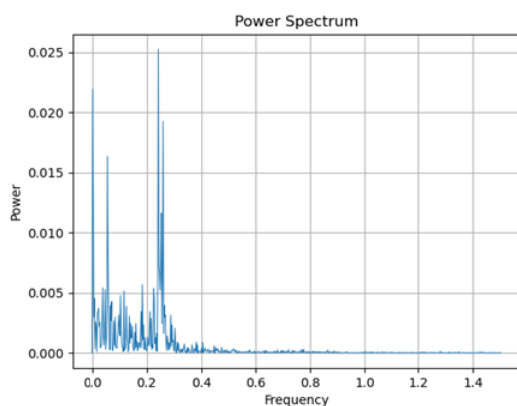


Fig. 6. Power Spectrum Case 22 of Table 3.

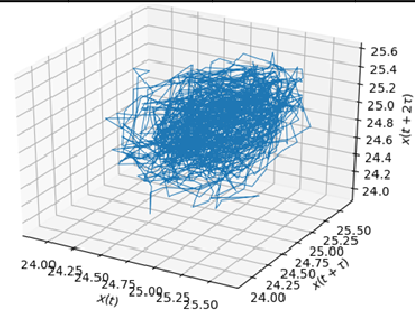


Figure 7: Reconstructed attractor Case 22 of Table 3.

VII. CONCLUSION

The voltage time series obtained from piles of five PEM fuel cells may have useful deterministic chaotic content sufficient to develop nonlinear dynamical models. The models obtained by this method are not about the detailed microscopic processes of the fuel cell complexity but describing the time evolution of the voltage as the main observable, useful state variable and measurable physical variable of the fuel cell. These models can contribute for a better understanding of the fuel cell complex dynamics and be also useful for the design, operation control and improvement of the efficiency, stability and durability of fuel cells. A deeper theoretical and empirical understanding of fuel cells complexity are the scientific and technical gaps to fulfill for a final transformation of fuel cells as a real and effective clean, cheap and renewable source of energy. The results of this new modeling process in terms of nonlinear dynamical systems can be highly improved by specializing the experimental and operational conditions of the fuel cells to obtain better and more precise voltage time series, but also and in particular, developing appropriated preprocessing methods of time series to isolate their deterministic chaos content.

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A STUDY OF FACTORS AFFECTING IN REPO RATE OF RBI

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Abstract -

Repo Rate is an important asset of the Indian Reserve Bank for controlling the level of market inflation and liquidity. Repo rate is the interest rate charged by the central bank when other banks come to them for short-term borrowing. The purpose of the study was to understand the working of Repo Rate after effects of its decrease and how it affects the bank, an individual and economy. Repo rate indirectly helps to maintain market equilibrium between inflation and liquidity. This study provides the monthly information from 2015 to 2020 and the reason of why Repo Rate cut constantly. The Repo Rate is continuously changing because of inflation and the economy growth. Inflation is a rate when prices of goods and services are rising and the purchasing power of currency is reducing. Rising retail price inflation to a six-year high of 7.35 percent in December 2019, rising unemployment rate to three years high of 8.5 percent and falling GDP growth rate to 4.8 percent in the lowest six-year period in the first quarter of 2020 (IMF) has led to fear of stagflation. Since 2018, the Indian economy has faced continuing slow growth. The current year's economic growth was expected to be 5 per cent. According to some economists, this slowdown is due to lack of adequate demand for goods and services. Therefore, the government and many others suggested that, the RBI should cut interest rates in order to boost demand. But the price of goods began to rise at a faster rate despite continuous reductions in the repo rate.

Keywords - Repo Rate, Inflation, Liquidity, Stagflation, Marginal Standing Facility(MSF), COVID 19

I. CHAPTER 1

INTRODUCTION:

Definition of repo rate

Repo rate is the rate at which a country's central bank (India's Reserve Bank in the case of India) lends money to commercial banks in the event of any financing shortfalls. Monetary authorities use the repo-rate to control inflation.

In the event of inflation, central banks increase repo rate and act as a disincentive for banks to borrow from the central bank. This ultimately reduces the money supply in the economy and thus helps in arresting inflation.

In the case of a decrease in inflationary expectations the central bank assumes the opposite position. Levels for repo and reverse repo are a part of the liquidity adjustment facility.

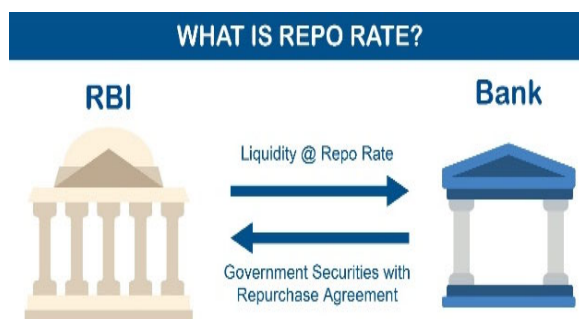


Figure 1 Image adopted from link.

WHAT IS THE REPO RATE IN INDIA?

The rate of interest at which commercial banks borrow money from RBI against government securities is called the repo rate.

WHAT IS THE CURRENT REPO RATE IN INDIA?

The current repo rate in India is 4, effective from 22nd May20.

HISTORY OF CHANGES IN REPO RATE:

The Reserve Bank of India had raised the Repo Rate from 6% p.a. to 6.25% p.a. on 6 June 2018. That hike in repo rate was the first in over four years. The last time The Reserve Bank of India had increased the Repo Rate from 6% p.a. to 6.25% p.a. on 6 June 2018. This hike in repo rate was the first in more than four years. The last time before this was in January 2014 the repo rate had been increased. **The Reserve Bank of India increased the Repo Rate again on the 1st of August 2018 from 6.25% to 6.50%.** Even the reverse repo rate increased from 6% to 6.25%, and the Marginal Standing Facility Rate increased from 6.50% by 25 basis points to 6.75%. Before this was in January 2014, the repo rate increased. The Reserve Bank of India increased the repo rate from 6.25 percent to 6.50 percent on 1 August 2018. Even the reverse repo rate increased from 6% to 6.25%, and the marginal standing facility rate increased from 6.50% by 25 basis points to 6.75%.

The repo rate change will also affect all other types of rates fixed by RBI and private banks, discussed in detail below.

However, the repo rate, the reverse repo rate and the Marginal Standing Facility Rate decreased by 25 basis points on 7 February 2019, followed by another 25 basis points decrease on 4 April 2019. The last change took place on 6 June 2019, with the repo rate dropped to 5.75%. After the 7 August 2019 reduction of 35 bps, the repo rate stood at 5.40%.

The repo rate change will also affect all other types of rates fixed by RBI and private banks, discussed in detail below.

II. CHAPTER 2

REASON OF REDUCING REPO RATE:

YEAR 2015

❖ JANUARY

The RBI decided to cut the benchmark repo rate by 0.25% to 7.75% to aiming to boost growth amid slowing inflation. The RBI keeping the benchmark interest rate 8% in Jan 2014 but RBI has been decided to reduce the policy rate under the liquidity adjustment facility by 25 basis points from 8% to 7.75% with the immediate effect.

REASONS:

- Low domestic capacity utilization.
- Mixed indicators of recovery.
- Subdued investment.

The reduction in the repo rate will lower cost of funds for banks and is a signal to them to reduce lending rate.

❖ MARCH

RBI Cuts Repo Rate to 7.5%

In a surprise meeting on March 4, India's Reserve Bank cut its benchmark policy repo rate by 25 bps to 7.5 per cent this was year's second-rate cut, citing slowing inflation, weak growth and important government reforms.

❖ JUNE

India Cuts Repo Rate for a Third Time

India's Reserve Bank cut its benchmark policy rate by 25 bps to 7.25 percent as expected at the June 2nd meeting, saying the move was more appropriate given low capacity utilization, mixed recovery indicators, and underinvestment and credit growth.

❖ AUGUST

RBI Holds Policy Rate Unchanged

India's Reserve Bank left its benchmark repo rate as expected at 7.25 per cent. Policymakers have said they await greater transmission of their embarking monetary easing cycle since January this year and leave opportunities for more accommodative policies, depending on the Federal Reserve 's outlook for inflation and possible action.

❖ SEPTEMBER

India Cuts Repo Rate by 50 Bps to 6.75%

On September 29th, 2015, the Reserve Bank of India cut its benchmark repo rate by a 50 bps higher than expected to 6.75 percent. It was year's fourth reduction, bringing the rate to the lowest since April 2011, as policymakers wanted to bolster the economy.

❖ DECEMBER

RBI Keeps Policy Rate Unchanged

As expected, Reserve Bank of India left its benchmark repo rate at 6.75 per cent. Policymakers have said they will monitor commodity prices, particularly food and oil, while monitoring inflationary expectations and external developments.

YEAR 2016

❖ FEBRUARY

India Leaves Policy Rate Unchanged

As expected, the Reserve Bank of India left its benchmark repo rate at 6.75 per cent during the meeting on 2 February. While awaiting further inflation data, policymakers said they would stay accommodating but look forward to the budget statement from the government at the end of February. The central bank was also decided to keep the cash reserve at 4.0 per cent, provide liquidity under overnight repos at 0.25 per cent and maintain daily variable rate repositories and reverse liquidity repositories.

❖ APRIL

India Cuts Repo Rate to Lowest in Over 5 Years.

During the meeting on April 5, 2016, the Reserve Bank of India cut its benchmark repo rate by 25 bps to 6.5 per cent as widely expected. It was the first decrease since September 2015 and the lowest from January 2011. At the same time, the bank increased the reverse repo by 25 bps to 6.0% while ensuring more cash availability in the banking system by reducing the cash ratio of its daily reserve requirements and maintaining the cash reserve at 4.0%

❖ JUNE

India Holds Policy Rate Unchanged at 6.5%

As expected, the Reserve Bank of India left its benchmark repo rate unchanged during the meeting on June 7 at a five-year low of 6.5 per cent. While awaiting further data to assess the impact of seasonal rainfall and certain external risks, policymakers said they'd stay accommodating. The central bank was also decided to keep the cash reserve at 4.0 per cent, providing liquidity as needed but gradually lowering the system 's average ex ante liquidity deficit from one per cent of net demand and time liabilities (NDTL) to a neutral position.

❖ AUGUST

India Keeps Policy Rate Unchanged at 6.5% in August

During the meeting on August 9, the Reserve Bank of India left its benchmark repo rate unchanged at a five-year low of 6.5 per cent, as widely expected. While awaiting space for policy action, policymakers said the monetary policy stance will remain accommodating and continue to stress adequate

liquidity provision. The central bank was also decided to keep the cash reserve at 4.0 per cent, providing liquidity as required but gradually lowering the system's average ex ante liquidity deficit from one per cent of net demand and time liabilities (NDTL) to a neutral position.

❖ NOVEMBER

India Cuts Repo Rate to a 6-Year Low of 6.25%:

On October 4th, 2016, Reserve Bank of India lowered its repurchase rate by a surprise of 25bps to 6.25 percent, saying the monetary policy stance remains accommodating and the decision will help bring the inflation rate back to the medium-term target of 4 percent for central bank while supporting growth. India's consumer price index in August rose 5 per cent year-on-year, loosening from its 6 per cent July rise. The repo policy rate had reached its lowest point since November 2010.

❖ DECEMBER

India Keeps Monetary Policy Unchanged at 6.25%

The Indian Central Bank unexpectedly left its benchmark repo rate unchanged after a severe cash crisis at a six-year low of 6.25 percent during the meeting on December 7 despite broad expectations of a rate cut.

YEAR 2017

❖ FEBRUARY

India Keeps Key Rate At 6.25% At its February 2017 meeting, the Reserve Bank of India left its key repo rate unchanged for the second time at 6.25 percent, compared with expectations of a 25bps cut. Policymakers decided to change the position from accommodative to neutral while assessing the inflation and growth effects of demonetisation. The reverse repo rate was also maintained at 5.75%, and the marginal standing facility and the bank rate at 6.75%.

❖ APRIL

India Holds Repo Rate At 6.25%

As widely expected, the Indian Reserve Bank held its benchmark repo rate at a six-year low of 6.25 percent on April 6 and raised its reverse repo rate by 25bps to 6 percent, saying inflation outlook poses upside risks amid an uncertain global economic environment. Annual inflation rose from a record low of 3.17 per cent in the previous month to 3.65 per cent in February 2017. Policymakers expect inflation in the first half of the year to average 4.5 per cent and 5 per cent in the second half for 2017-18.

❖ JUNE

India Leaves Repo Rate At 6.25%

As widely expected, the Indian Reserve Bank held its benchmark repo rate at 6.25 per cent on June 7, 2017, saying the decision was consistent with a neutral

monetary policy stance. Policymakers added that the outlook for inflation in the coming months is uncertain and revised its GVA growth forecasts for 2017-2018 by 10bps to 7.3 per cent. After a 25bps cut in April, the reverse repo rate was also left unchanged at 6 percent; the bank rate at 6.5 percent and the cash rate at 4 per cent.

❖ AUGUST

India Cuts Key Rate to 6%

On August 2017, the RBI lowered its benchmark interest rate by 25bps to 6 percent in line with market expectation. It was year's first rate cut so far, bringing borrowing costs to the lowest since 2010 amid a sharp slowdown in inflation. Also, the reverse repo rate was lowered to 5.75 per cent by 25bps and the marginal standing facility rate and the bank rate to 6.25 per cent.

❖ OCTOBER

India Leaves Key Rate at 7-Year Low of 6%

After a 25bps cut in August and in line with market expectations, the Reserve Bank of India kept its benchmark interest rate steady at 6 per cent on October 4th 2017. Policymakers said the decision was consistent with a monetary policy neutral stance aimed at achieving the 4 percent + /- 2 percent inflation target in the medium term, while supporting growth. The central bank also increased its October-March inflation forecasts to a range of 4.2 percent to 4.6 percent, while the gross value-added projection dropped from 7.3 percent to 6.7 per cent.

❖ DECEMBER

India Leaves Key Rate on Hold at 6%

On December 6, 2017, the Indian central Bank kept its benchmark interest rate steady at 6 per cent, in line with market expectations. Policymakers said the decision was consistent with monetary policy's neutral stance aimed at achieving the 4 per cent + /- 2 per cent medium-term inflation target while supporting growth. The central bank, however, expressed concerns about inflationary risks, mainly due to higher prices for house rent allowances, food and fuel, and raised its inflation forecasts to between 4.3 and 4.7 percent from the previous 4.2 percent to 4.6 percent in the second half of the current financial year. The projection of gross value-added growth remained unchanged at 6.7 per cent. The reverse repo rate at 5.75 percent and the marginal standing facility rate and the bank rate at 6.25 percent were also left on hold.

YEAR 2018

❖ FEBRUARY

On February 7, 2018, the Reserve Bank of India kept its benchmark interest rate steady at 6 per cent, corresponding to market expectations. Policymakers reinforced the decision was consistent with a

monetary policy neutral stance that aims to achieved the 4 percent + /- 2 percent medium-term inflation target, while supporting growth. The central bank raised inflation forecasts from 4.3-4.7 per cent to 5.1 per cent for Q4 of the current fiscal year (January to March 2018) and GVA growth expectations were lowered from 6.7 per cent to 6.6 per cent for 2017-2018. The reverse repo rate at 5.75 percent and the marginal standing facility rate and the bank rate at 6.25 percent were also left on hold.

❖ APRIL

India Leaves Monetary Policy Unchanged

For the fourth meeting on April 5, 2018, the Reserve Bank of India left its key policy rate steady at 6 per cent, matching market expectations. Policymakers once again said the decision was consistent with monetary policy's neutral stance aimed at achieving the 4 percent + /- 2 percent medium-term inflation target, while promoting growth. The central bank lowered inflation projections from 5.1 per cent to 4.5 per cent for Q4 of the current fiscal year (January to March 2018). GDP growth for 2018-19 was 7.4 per cent higher than 6.6 per cent in 2017-2018. The reverse repo rate at 5.75 percent and the marginal standing facility rate and the bank rate at 6.25 percent were also left on hold.

❖ JUNE

India Hikes Key Repo Rate 6.25%

India's central Bank raised its benchmark policy repo rate on June 6, 2018 by 25bps to 6.25 per cent, while markets did not expect any changes. It was the first hike in borrowing costs since January 2014, referring to inflation upside risks which include higher oil prices and global financial market uncertainty. Policymakers said the decision was consistent with a neutral monetary policy stance and was consistent with achieving the 4 percent + /- 2 percent inflation target while fostering growth. The reverse repo rate was also adjusted from 5.75 per cent to 6 per cent and from 6.25 per cent to the marginal standing facility rate and the bank rate.

❖ AUGUST

India Raises Key Rate 6.5%

As of 1 August 2018, the Reserve Bank of India increased its benchmark policy repo rate by 25bps to 6.5 percent, in line with market expectations and following a similar hike at the previous meeting. As of 1 August 2018, the Reserve Bank of India increased its benchmark policy repo rate by 25bps to 6.5 percent, in line with market expectations and following a similar hike at the previous meeting. Policymakers mentioned uncertainty about inflation, and projections for H2 2018-19 slightly increased from 4.7 per cent to 4.8 per cent. While the central bank believes growth momentum was sustained, it has noticed several global risks that might weigh on

the outlook, including rising trade protectionism, geopolitical tensions and higher oil prices.

❖ OCTOBER

India Leaves Rates Unchanged

The Reserve Bank of India unexpectedly left its key policy rate steady at 6.5 per cent on October 5, 2018, following a 25bps hike in the previous meeting, surprising markets that expected a similar rise to support a falling currency and curb inflationary pressures from oil prices. Policymakers said the decision was consistent with a calibrated tightening aimed at achieving an inflation target of 4 per cent + /- 2 per cent and promoting growth. The central bank was cut its inflation forecasts, citing low food inflation: to 4% from 4.6% in Q2:2018-19 (July-September 2018); to 3.9% -4.5% from 4.8% in H2 (October 2018-March 2019); and to 4.8% from 5% in Q1:2019-2020 (April-June 2019). Growth projections were also slightly lower revised: to 7.4% from 7.5% in Q2:2018-2019 (July-September 2018); to 7.1% - 7.3% from 7.3% -7.4% in H2 (October 2018-March 2019); and to 7.4% from 7.5% in Q1:2019-2020 (April-June 2019).

❖ DECEMBER

India Leaves Rates Steady as Expected

For the second straight meeting on December 5, 2018, the Reserve Bank of India left its key policy rate steady at 6.5 per cent, in line with market expectations. Policymakers reiterated that the decision was consistent with a calibrated tightening aimed at achieving an inflation target of 4 per cent + /- 2 per cent and supporting growth.

YEAR 2019

❖ FEBRUARY

India Unexpectedly Cuts Key Policy Rate 6.25%

Reserve Bank of India unexpectedly lowered its benchmark interest rate on February 7th by 25bps to 6.25 percent and shifted its stance to "neutral" in an attempt to boost a slowing economy as the inflation rate remains well below its 4 percent midpoint target. The central bank also released its bi-monthly economic review, where it forecasts India's economy will expand 7.4% in 2019-20, up from 7.2% in this fiscal year.

❖ APRIL

India Cuts Key Rate 6%

As widely anticipated, India's Reserve Bank lowered its benchmark interest rate on April 4 by 25bps to 6.0 percent. This was the second rate cut this year so far. Policymakers said the decision was consistent with the goal of achieving the 4 per cent (+ /- 2 per cent) medium-term target while supporting growth. The Committee noted that the output gap remains negative and was facing headwinds from the domestic economy. Also, the reverse repo rate was

lowered to 5.75 per cent by 25bps and the marginal standing facility rate and the bank rate to 6.25 per cent.

❖ JUNE

RBI Cuts Key Rate 5.75%

During its June meeting, Reserve Bank of India lowered its policy interest rate by 25bps to 5.75 per cent and changed its monetary policy stance from "neutral" to "accommodative." This was the third straight interest rate cut so far this year, as policymakers expressed concerns about the sharp slowdown in investment activity and continued moderation in growth in private consumption. In the fourth quarter of 2018-19 fiscal year, the economy grew by 5.8 per cent, the slowest pace in more than four years. In addition, the RBI lowered its growth forecast to 7 percent in 2019/20 from 7.2 percent previously estimated; and increased its retail inflation outlook from 2.9 percent to 3 percent in the first half of fiscal 2019-20 to 3.1 percent.

❖ AUGUST

RBI Cuts Interest Rates by 35bps During its August meeting,

Reserve Bank of India lowered its benchmark repo rate by 35 bps to 5.40 per cent, while markets had forecast a lower 25bps cut. This was the fourth straight rate cut so far this year in a bid to boost economic growth while the outlook for inflation remains benign. The RBI also lowered its growth forecast to 6.9 percent for 2019/20 from the previously estimated 7.0 percent; and inflation was forecast to be 3.4-3.7 percent for the second half of fiscal 2019-20.

❖ OCTOBER

RBI Cuts Key Lending Rate, Slashes Growth Forecasts

During its October meeting, India's Reserve Bank lowered its benchmark repo rate by 25 bps to 5.15 per cent, as widely expected. This was this year's fifth straight rate cut so far, in an attempt to boost slowing growth. The RBI also lowered its GDP forecast to 6.1 percent from the previously estimated 6.9 percent for 2019/20; while inflation outlook was revised up to 3.4 percent from 3.1 percent.

❖ DECEMBER

India Unexpectedly Holds Interest Rate at 5.15%

During its meeting in December 2019, the Reserve Bank of India unexpectedly held its benchmark repo rate at 5.15 per cent, after five consecutive rate cuts and surprising markets that expected a 25bps cut in the midst of a sharp economic slowdown. The central bank has revised its forecasts of growth to 5 per cent from 6.1 per cent for the current fiscal year ending in March 2020. Inflation in the second half of the current fiscal year is higher at 5.1 per cent-4.7 per

cent, mainly due to vegetable, milk, pulses and sugar prices. However, policymakers said that they will continue to be accommodating as long as it was necessary to revive growth while ensuring that inflation remains within the objective.

YEAR 2020

❖ FEBRUARY

RBI Holds Interest Rates as Expected

During its February meeting, the Reserve Bank of India held its repo rate, at which it lends to banks at 5.15 percent, saying it maintained an "accommodating position" to support growth in the face of rising inflationary pressure. The reverse repo rate at which RBI borrows from banks too were kept unchanged at 4.90 percent and the marginal standing facility (MSF) rate at 5.40 percent and the bank rate. The committee has revised its inflation forecast upward to 6.5 percent for the last quarter of the current fiscal year from 5.1-4.7 percent earlier, while CPI inflation was pegged at 5.4-5.0 percent for the first half of fiscal 2021 compared to 4-3.8 percent earlier. Meanwhile, GDP growth for fiscal 2021 is 6 per cent, compared to previously estimated 5.9-6.3 per cent. The bank has also said policy space is available for future action.

❖ MARCH

RBI Cuts Interest Rates to 4.4% in Emergency Move

In an emergency move on March 27th, India's Reserve Bank lowered its benchmark repurchase rate by 75 bps to 4.40 per cent, joining central banks around the world in providing stimulus to mitigate the impact of COVID-19 on the economy after the country entered a nationwide three-week lockdown. In order to boost liquidity, the central bank also cut the cash reserve ratio by 100 basis points to 3 per cent. The reverse repo rate at which banks' RBI borrowing was also lowered to 4.15 per cent by 75 bps. For the fourth quarter of fiscal 2019-2020, inflation was projected at 6.5 per cent.

❖ APRIL

RBI Unveils Additional Stimulus Measures

On April 1st, the Reserve Bank of India announced a new package of stimulus measures to help mitigate the negative economic impact of the coronavirus pandemic. The measures include postponement of the implementation of countercyclical capital buffer, review of the Way and Means States / UT advances limits and an extension of the export proceeds realization period. Policymakers had already cut their benchmark buyback rate by 75bps to 4.40 percent on 27 March, joining central banks around the world in providing incentives to fight COVID-19 after the country entered a three-week national lockdown.

RBI Announces Special Liquidity Facility

The Reserve Bank of India (RBI) has launched a 500 billion rupees (USD 6.56 billion) Special Liquidity Facility for Mutual Funds (SLF-MF) to ease the pressure from the coronavirus pandemic. The bank will perform 90-day tenor repo operations at the fixed repo rate. The scheme is available from April 27, 2020 until May 11, 2020 or until the allocated amount is used, whichever is earlier. Depending on market conditions the Reserve Bank will review the timeline and amount. Under this facility, exposures will not be considered under the large exposure framework and will be classified as holding up to maturity, even exceeding 25 percent of the total investment permitted. On 27 March, policymakers had already cut their benchmark buyback rate by 75bps to 4.40 percent.

❖ MAY**India Unexpectedly Slashes Repo Rate to 4%**

In an emergency move on May 22nd, the Reserve Bank India unexpectedly lowered its benchmark repurchase rate by 40 basis points to 4 percent, amid an ongoing nationwide lockdown to prevent further coronavirus spread. Also, the reverse repo rate was lowered to 3.35 percent by 40 basis points and the marginal standing facility rate to 4.25 per cent. The Committee also decided to continue the accommodating monetary policy approach with a view to achieving the 4% + /- 2% medium-term inflation target and mitigating the economic impact of COVID-19 while promoting growth.

III. CHAPTER 3**IMPACT OF REPO RATE IN VARIOUS SECTORS:****Impact on the Banking System****Increase in Repo Rate:**

- Bank loan rates and deposits are impacted by a rise or fall in repo rates. It may not have an immediate effect though. Before increasing deposit rates and lending rates, banks can analyse their liquidity position and cost of funds
- After analysing the cost of the funds and the position of the liquidity, banks may begin to transfer their interest rate burden to their end customers in the form of high lending rates. That means higher monthly instalments for current borrowers and higher credit rates for new borrowers.
- Home loans and other floating loans are significantly affected by the change in the rate. Higher lending rates can lead to a slowdown in the banking sector's lending business, which will impact its profitability.

- After analysing the liquidity position, banks may also raise the bank deposit rate offered to customers in order to attract more cash flow into the banking system.

Reduction in Repo Rate:

- Banking is the first sector to become affected by any monetary policy change. When Reserve Bank of India decides to lower the repo rate, it is a big relief to bank. With the repo rate dipping, banks can borrow at an affordable rate from Reserve Bank of India.
- With low-cost credit accessibility, banks may even lower their customer loan rates after analysing liquidity and deposit inflows. Banks can offer their end customers credit at a reduced rate.
- Consumers can spend and borrow more while spending much less on borrowing as bank loans become affordable; Increased lending will increase the profitability of the banking system as a whole.
- Lending rate reductions and deposit rate hikes are, however, purely dependent on the liquidity position of the bank and on customers' deposit demand.

Impact on An Individual**Increase in Repo rate:**

- When Reserve Bank of India decides to raise the repo rate, it becomes more expensive for commercial banks to borrow funds from Reserve Bank of India for the short term. Higher repo rate discourages the bank from taking advantage of short-term loans and advances from RBI.
- Due to non-availability of low-cost funds, banks hike my lending rate for their customers to pass on their high interest burden. For a common man, that means loan becomes more expensive. This may automatically reduce the purchasing power of consumers.
- On the other hand, banks can start offering higher-rate fixed deposits to attract more cash inflows. It basically helps consumers to save more on bank deposits with an increased rate.

Reduction in Repo rate:

- When Reserve Bank of India decides to lower the repo rate, loans and advances become affordable to commercial banks as they can use short-term loans at a reduced rate from Reserve Bank of India.
- Cutting rates can push banks to lower their prime lending. Reducing the prime lending rate encourages more borrowers by making

loans accessible to the common man at lower rates.

- With increased borrowing opportunities, consumers can spend more and make use of loans to easily attain future financial goals. To manage their finances better one should understand the repo rate.

Impact on the Economy

Increase in Repo Rate:

- When Reserve Bank of India raises repo rates, borrowing by banks becomes more expensive. In other words, banks will have to pay the Reserve Bank of India more interest on their short-term borrowings. Costlier credit option for banks prompts them to raise their end customers' lending rate.
- Costly bank loans discourage the borrower from making use of the credit. This reduces on-the-market money supply and thus stabilizes the system liquidity. Consumption, expansion, and production, with the lesser money supply, also take a fall. Even when inflation rates come under control, expensive credit hinders economic development and GDP growth.

Reduction in Repo Rate:

- Short term loans for commercial banks become affordable when Reserve Bank of India decides to cut the repo rate. That prompts them to offer relatively discounted consumer loans. Many times, with the reduction in the repo rate, the base lending rate gets reduced.
- **The base lending rate is the rate that banks can not lend to their customers at below. Reduced base rate increases consumption, as more money will be available to people. Rising consumption has a positive impact on the growth of the country's Gross Domestic Product (GDP).**
- Credit availability is affordable and encourages companies to grow and expand. Product prices get lower when low cost capital is available. New investments lead to better economic employment opportunities.

IV. CHAPTER 4

FINDING

A cut in the rates of Repo essentially lowers the bank's borrowing costs from the RBI to add to its reserves. It allows banks either to increase the interest

rate spread on bank loans or to offer lower interest rates to borrowers without eating into their own interest rate spread. A reduction in the Repo thus increases the potential of the banking system by expanding more loans profitably.

IMPACT ON INDUSTRY

With lower repo rates, industry gets to borrow more and can even pay lower interest rates on their borrowing. Those companies which are in a position to secure additional loans from the banking system will therefore benefit from lower repo rates.

IMPACT ON AN INDIVIDUAL PEOPLE

One can feel the impact on ordinary people in 2 ways. In the near future, greater lending to businesses will lead to more investment in business and more opportunities for employment. However, the dominant factor influencing ordinary people in the medium and longer term will be the increased money supply (inflation), which will send prices of consumer goods to soar, resulting in future pressure to raise interest rates thus forcing inflationary bubble pricing and the onset of depression.

IMPACT ON THE ECONOMY

Long-term, lowering the Repo rate is harmful to the economy as it is just a means of lending reserves to banks, allowing them to engage in far greater inflation to undertake much more credit expansion through FRB. While this lending will have some positive effects for the short term, it creates and worsens the inflationary boom of the familiar boom-bust cycle in the long run. It also sets the conditions for the inevitable increase in interest rates, pricing the inflationary bubble and causing depression.

CONCLUSION

Reserve Bank of India (RBI) is Indian national bank. Its primary purpose is to ensure the nation's financial solidity. For this purpose, it is equipped with the freedom to form and implement financial approaches, bearing in mind the ultimate goal of maintaining value reliability and adequate cash supply in the framework.

In order to achieve its objectives, RBI takes various expansionary and contractionary steps and uses its instruments such as Cash Reserve Ratio (CRR), Statutory Liquidity Ratio (SLR), Bank Rate, Open Market Operation (OMO) and Liquidity Adjustment Facility (LAF) for this purpose.

Among all the rates, Repo rate is the rate that impacts most of the economy's given money supply. Repo rate is the rate at which RBI provides the Bank with short-term funds. It is a borrowing that is secured in a similar nature to a loan against fixed deposits or property made available by people during emergencies. In order to increase the total cost of funds in the RBI banking system, Repo Rate increases. Due to higher costs the demand for funds

will be under control. It becomes expensive for banks to borrow money from RBI if the RBI increases its rate of repo, so that banks increase the rates at which they grant loans to the general public to compensate for the hike in Repo Rate.

In the long run, the policy of reducing the Repo is basically not good for the economy, as it greatly helps to create the business cycle. It also hurts the ordinary people's pockets by sending soaring interest prices. However, both industry and the banking system derive huge benefits from it in the short term. This explains a lot why a policy of reducing repo and reverse repo rates also finds fairly broad-based support from both the banking and general industry.

V. CHAPTER 5

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ROBO-ADVICE: AN ESSENTIAL ELEMENT OF FUTURE BANKING?

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Abstract - This paper aims to elaborate from a bank customer point of view on the question if robo-advice is an essential service in future banking. Especially after or during the Covid-19 pandemic, it is of great scientific interest to assess the investment behavior of customers to see if banks should adjust their strategies. In doing so, a literature review was conducted to aggregate the most important findings in the current literature debate. Based on that, an interview guideline was developed to perform qualitative in-depth interviews (n=11) with German bank customers. The interviews were transcribed and underwent a structured content analysis to funnel the key information. The research shows that robo-advisors are still lacking in terms of dealing with financial complex situations. Standardized products may not seem to satisfy the mass retail clients, even though their financial needs are not as complex as from HNWI's. In addition, German customers still want to possess the opportunity of reaching to human services or advisors, especially in times of crisis. There is no evidence in our sample that the Covid-19 pandemic led to higher acceptance in the digital advisory service.

Keywords - Robo-Advice, ETF, Passive Investments, Disruption, Banking, Retail Banking, Financial Innovation, Digital Financial Services

I. INTRODUCTION

The COVID-19 news has dominated the global media since the beginning of this year. The time is marked by a high level of uncertainty, both in the context of health and financial aspects. Starting from numerous shutdowns and production stoppages in various industrialized countries, economies and the global capital markets collapsed.

There is no doubt that the latest pandemic can be dubbed a “financial crisis”, as a result of which numerous private investors have lost money on the capital markets. Despite significant price drops, the global capital markets largely recovered within a few months. This phenomenon illustrates that investment strategies need to be reconsidered regularly in today's times. In the past few decades, private investors bought stocks and sold them after a long holding period in order to realize profits. Due to the high volatility on the stock markets and the frequency of global crises (e.g. Financial Crisis in 2007, Euro Crisis in 2010 or the current Covid-19 pandemic), a more “active” investment strategy is required in today's age.

In addition to the financial aspects, the pandemic has also forced some industrial companies and banks to rethink their strategy. The current situation relentlessly reveals that a future-oriented and data-driven banking business model is relevant.[1] Such a business strategy must inevitably be able to connect the stationary and the digital world.[2] Thus, the voices for a more intensive implementation of digitization strategies at financial institutions are getting louder. Because the corona pandemic has not left the banks without a trace. On the one hand, there was a need even before the crisis to rely more on digital technologies in order to offer modern services. Big techs like Facebook, Amazon or Google reach

billions of users every day and shape their digital experience. This has a direct impact on the digital expectations of customers of a bank. On the other hand, the digital offer became more important when branch visits were not possible due to health reasons. Customers increasingly chose alternative and therefore digital channels in the form of mobile and online banking.[3] However, these channels often “only” offer basic services and no digital advice. Due to the novelty of robo-advice and the Covid-19 pandemic, there is only little literature to find on this topic. This makes it hard to have a scientific discourse. One exemplary research work refers to Ben David and Sade, who recently published their findings on the changes in customer behavior due to Covid-19. The results indicated that there was a higher acceptance for traditional advice at the time of the outbreak. [4]

II. ROBO-ADVICE AS FINANCIAL INNOVATION

As already outlined, the paper focus lies on private investment advice in times of necessary digitization strategies. Consequently, the qualitative area includes numerous questions on the topic of robo-advice.

This is an investment option that is partially or completely digital. The decisive factor here is the use of artificial intelligence (AI) in order to offer an all-round service that is always available and therefore independent of human working hours. In addition, the AI is based on scientific investment knowledge that ensures fact-based and objective portfolio management. Above all, this implies that investment decisions are algorithm-based and thus made rational. On the other hand, there is often a comparison with human greed, which leads to emotional and thus uneconomical decisions.[5] The way of portfolio

management can differ from provider to provider. According to a definition by the German institute “Stiftung Warentest”, robo-advisors can be divided into three categories: (1) self-service, (2) half-service and (3) full-service robo. The former is a pure information medium where the investor receives information in order to carry out an execution-only transaction. With the Half-Service-Robo, the provider acts as a financial investment broker in accordance with §34f trade regulations (GewO). The customer's consent is always required in order to carry out transactions. The third form is an asset manager regulated by Bafin – the German Federal Financial Supervisory Authority – in accordance with Section 32 of the German Banking Act (KWG). This full-service robo can manage the assets completely autonomously, as there is a corresponding mandate on the part of the customer.[6]

In the study by the consulting firm Bearing Point, possibilities of a successful implementation of robo-advice and an assessment of the current robo-advisors are discussed. The growth forecasts of the managed assets of robo-advice providers can grow to around 13 billion euros by 2022. However, due to the short observation period and the relatively young business model, this development must be followed critically. Nevertheless, the topic continues to gain in importance. In Germany alone, an average of 55,000 Google search queries were made per month in 2018.[7]

Robo-advisors primarily pursue passive portfolio strategies, so that the asset allocation is primarily characterized by ETFs.[8] ETFs are known for their cost-efficient structures because the major aim is to replicate a certain benchmark, thereby leading to few transactions and thus less costs. It is necessary to perform regular trades or try an active approach to outperform the market because ETFs solely try to reflect the market performance as good as possible. Using this investment vehicle, robo-advisors can keep the costs reduced or at a low level.[9]

One advantage of this type of investment is that investors do not have to constantly deal with their portfolio. Based on buy and sell recommendations or the independent implementation, human emotions can be bypassed in securities trading. Private investors tend to let profits run for “too long” and therefore usually do not sell their securities at the ideal time. Either you want to make further profits, or the investors do not want to admit their failure to realize losses. Robo-advice can therefore be a sensible form of investment, especially for private investors, when presented adequately (e.g. including human elements in the digital service).[10]

III. RESEARCH GOAL AND DESIGN

The aim of the empirical work is to highlight the necessity of the digital transformation of the banking business with a focus on investment advice for

private investors. The focus of the empirical study is on the analysis of the needs of young bank customers. As a result, this scientific work provides academic added value as it analyzes further research content in this area. In any case, it should be emphasized that this is a very young research topic, so that not too many empirical studies exist on this yet. There is very little research that relates to the German-speaking area.

The literature review shows a list of important papers from the current research discussion. It can be seen that many the studies focus on the areas of (1) customer profiling, (2) portfolio management, (3) customer needs and (4) disruptive potential.

The result of the literature review provides the starting point for the second step of the investigation. The areas of “customer needs” and “customer profiling” are to be examined in more detail in this thesis in order to find out more about the need for robo-advice against the current market background. The next step is to use a qualitative method approach in the form of expert interviews. In the context of qualitative research, a total of 13 interviews were conducted with customers of German banking institutions. In order to obtain representative research results, a largely heterogeneous group of participants was recruited based on professional activity. As a result, consumers from different industries were surveyed. This made it possible to ensure that the answers can be viewed as a kind of “cross section of society”. However, in terms of the age of the participants, it is a homogeneous group. The age range is from 26 to 34 years.

In the course of the evaluation, Mayring's qualitative content analysis was conducted.[11]

Topic	Question Number
Robo-Advice	1-6, 10
Branch business and banking advice	7-8
Investment Behavior	9-11

Table 1 Topics

First, a standardized questionnaire with 12 questions was developed. The questions can be clustered as follows:

Number	Question
1	“Are you familiar with the term” robo-advice “and have you already had some initial experience with this type of investment?”
2	If question one was answered in the negative: “How do you feel about this form of investment?”
3	If question one was answered in the affirmative:

	"What reasons did you decide to use this form of investment?"
4	"What percentage of your total assets have you invested in the robotic system?"
5	"What possible advantages do you see in robo-advice / in the digital investment option?"
6	"What possible disadvantages / concerns do you see in this?"
7	"What concrete advantages do you see in personal advice in a branch and how will the relevance of the bank branches change in the future?"
8	"To what extent has your investment behavior changed as a result of the corona pandemic and the shutdown?"
9	"Would you now (after the shutdown) rather resort to digital investment advice? Please justify your answer."
10	"Are you prepared to invest more in digital investment instruments in the future if the service also offers the option of contacting a personal advisor?"
11	If the answer to question 10 is yes: "Please give reasons for your decision"

Table 2 Interview Questions

IV. RESEARCH FINDINGS ON ROBO ADVICE & RECOMMENDATIONS FOR BANKS

The research results are divided into the three subject areas, which is described and explained in the following text.

(1) Importance of banking advice and branches: The analysis of the questions about the future and current importance of face-to-face counseling in bank branches comes to a clear result. The group of participants is of the overwhelming opinion that advice in a bank branch does not currently play a major role for them and even states that this role will continue to lose relevance in the future.

The respondents state that the restricted opening times do not suit their "preferred lifestyle". Due to the various possibilities of the internet and the omnipresent use of digital media, services are increasingly required that are available regardless of location and time. This also affects the role of information gathering in the course of the subject of one's own financial investments. The Internet offers consumers a variety of different information sources and platforms that are flexibly accessible at any time.

Various formats, such as podcasts or videos complete an offer that traditional banks do not currently have. Advice from a bank advisor is not required, especially for less complex and standardized issues. This aspect primarily concerns the banking services. In contrast to this, the interviewees attribute an essential role to the bank branches in the context of advising on complex issues:

"Branches will remain important for the small number of digitally adverse customers, otherwise they can still play a role in complex systems or financing decisions."

(Interview partner 8)

Examples of this include the conclusion of a construction loan or pension advice, which relates to a comprehensive clarification of the current and future pension situation. Further findings on the importance of bank branches are listed below:

- Low trust in the consulting service due to historical incidents (e.g. financial crisis)
- High confidence in your own financial ability to research information yourself and to make decisions based on it (at least in "simple" money matters)
- The Internet often offers more targeted information media to clarify investment issues (e.g. YouTube videos, podcasts)
- Digital technology (e.g. chatbots, video advice) should be equated with personal advice for the participants, so that going to a branch is deselected

(2) Investment behavior: Furthermore, the empirical analysis was carried out to determine the extent to which investment behavior has changed as a result of the pandemic. It should be emphasized here that the respondents increasingly emphasize that they use the volatile markets to realize short-term profits.

For the same reason, among other things, most respondents invest in crypto currencies. This asset class is dominated by Bitcoin. Reasons for investing in Bitcoin are the use of volatility and the supposedly low correlation to other asset classes. In addition, the interviews have shown that investors with less experience first have to deal intensively with the topic of crypto currencies before they are ready to invest in this asset class.

"Yes, I have invested a few small amounts in Bitcoin and Ripple. I started investing during the corona pandemic because at the time I had more time to deal with the topic"

(Interview partner 2)

Despite the essential price drops, few respondents changed their investment strategy due to the pandemic. Since the majority of those surveyed are

self-sufficient and do not make use of face-to-face counseling, the pandemic has only minor effects on a possible increase in the number of users of digital investment services. Nonetheless, the volatile markets have led to some more cautious behavior on the capital markets.

"My investment obsolescence has not changed. I am generally a little more cautious and try to take some profits with me. I assume a strong market correction."

(Interview partner 4)

(3) Robo-Advice: Many of the questions related to the topic of robo-advice. It should be underlined here that although robo-advice is known in the age group, it is rarely used. The consumers surveyed are aware of the numerous advantages. In particular, the time saved by the automated recommendations for action is characterized as a major advantage.

"I chose this type of investment because I don't have to worry about anything [...]."

(Interview partner 3)

Furthermore, the cost structure is also perceived as an advantage due to the ETF-based fund selection. It is worth noting that avoiding human emotions is also found to be an advantage. Because the use of algorithms promises an objective approach that should be based on rational facts and therefore decisions. There should be no room for emotional actions such as Panic sales or hasty action remain. Robo-advisors advertise particularly strongly with this argument, since it shows the superiority of the "robotic" system.

Nevertheless, the majority of those surveyed do not currently use a robo-advisor. Three main reasons for this can be identified. Consumers are concerned that robo advisors are primarily pursuing a passive portfolio strategy. However, a robo-investment is more cost-intensive compared to a pure ETF strategy. The respondents therefore doubt whether the long-term performance will be better than a pure ETF strategy despite the higher cost structure.

"This is a relatively new form of investment. I am currently not sure whether a robo-advisor performs better than other passive investments."

(Interview partner 4)

Another reason that currently speaks against a robo-advice investment is the lack of an option to invest in installments. The majority of robo advisors charge a one-off payment of around EUR 5,000.00 or higher. This one-off amount is a showstopper for the respondents, as they primarily invest money on the capital market in installments, see interview number two. In addition, the respondents prefer a mix of digital and human advice for high investment sums.

Particularly with higher investment volumes, the combination of "digital know-how" and "human empathy" could convince consumers of this type of investment.

Based on the empirical findings, the following recommendations for action are to be made to banks:

(1) Importance of banking advice / branch business: On the basis of the findings from the interviews described, it is recommended that banks offer digital and flexible advisory models so that professionals, among other things, in the evenings or on weekends you can rely on the bank advice. As a result, the banking advisory service adapts to the preferred lifestyle, especially of those with a high level of professional involvement and younger customers. This also includes the range of digital advisory and information media. The participants gave examples of the use of chatbots, messaging services as well as telephone and online advice via video. However, these recommendations aim to cover standardized transactions in retail banking. For more complex issues, it is advisable to maintain a certain branch network so that customers have a point of contact. A downsizing of the branch network in smaller towns or in rural areas in favor of isolated large main offices or headquarters can already be seen today. Many banks are already partially implementing this strategy. The empirical studies carried out underline the need for digital transformation in banking consulting.

(2) Investment behavior and robo-advice: It is true that empirical evidence has shown that, for example, robo-advice is not yet used by most respondents. Nevertheless, the respondents associate immense advantages with this technology. As a result, and due to the immense potential, banks should cooperate with robo-advisors as soon as possible or anchor their own service in their business model. While robo-advice is currently not very widespread in Germany, the demand in the United States of America is already significantly higher. As a result, German providers could secure market shares for themselves through the consistent and timely establishment of a robo-advisor who covers customer needs. In addition, from a banking perspective, it is advisable to offer a human robo-advisor that combines the advantages of digitization with the human component. As a result, consumer needs could also be met with high volumes of money. In particular, the avoidance of human errors on the capital market and the time savings are great advantages of robo-advice. Moreover, empirical evidence made it clear that the respondents are increasingly investing in crypto currencies, so that banks should enable their customers to invest in this asset class in the long term.

V. CONCLUSION AND OUTLOOK

As the empirical elaboration has shown, credit institutions must make their business model more digital. In this way, on the one hand, customer needs

for advice that is independent of time and location can be ensured.[12] On the other hand, this can counteract possible sales losses due to further future pandemics.

Bank branches are still required. It should be emphasized here, however, that consumers demand high quality advice so that they receive added value from visiting the branch. Robo-Advice undoubtedly brings immense advantages for the consumer as well as for the credit institute. This is currently a novel technology and market penetration is not yet widespread.[13] Provided that robo-advisors perform better than conventional passive portfolio strategies in the long term, the general acceptance of this type of investment will increase significantly.

Ultimately, the development of robo-advice over the next few years is exciting to follow because it shows a lot of potential in terms of the service quality as well as the use of the technology behind.[14] Undoubtedly, banks have to offer their customers such forms of investment in a more sophisticated way. Caratelli et al. came to the same qualitative research results that robo-advice needs to evolve, e.g. by offering a hybrid service. [15] Moreover, Merkle affirms that the availability of branches still plays an important role for non-tech-savvy customers. Banks are well-advised not to hastily relinquish their branch network. [16]. The investment opportunity in crypto currencies shows a promising business for the future banking but may require more research for confirmation. If this does not happen, numerous customers will migrate to FinTechs, as they offer the chance for faster and more digital processes.[17].

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DETERMINATION OF THE CARBON FOOTPRINT OF AN ENGINEERING COLLEGE CAMPUS IN KOLKATA

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Abstract - At present, with the aggravating crisis of 'Global Warming', the need for reduction of Greenhouse Gases (GHGS) have increased manifolds. Catering to this global issue, the need for determining and reducing the Carbon Footprint of different regions, institutes, industries, products etc. have also increased significantly. The present study has been undertaken to determine the Carbon Footprint of an engineering college in Kolkata. It is an educational institute that has about 2700 students and 220 employees. For fulfilling the aim of the research, a commuting profile survey was conducted for students and employees and some other required datas were collected from the college authority. All these datas were analysed with the help of two softwares and after performing some manual calculations, the results were recorded. Finally, conclusions were drawn based on the recorded results and per capita GHG emission of the institute was compared to the per capita GHG emission of Kolkata as well as that of India.

Keywords - Carbon Footprint, GHG, Ecological footprint, Direct Carbon Emission, Indirect Carbon Emission, Kyoto Protocol, Paris Agreement, GHG Protocol, Global Warming, Educational Institute, Carbon Dioxide.

I. INTRODUCTION

A carbon footprint is historically defined as the total emissions caused by an individual, event, organization, or product, expressed as carbon dioxide equivalent.

Greenhouse gases (GHGs), including carbon dioxide, can be emitted through land clearance and the production and consumption of food, fuels, manufactured goods, materials, wood, roads, buildings, transportation and other services.

The ecological footprint measures human demand on nature i.e. it is a measure of human impact on Earth's ecosystem and reveals the dependence of the human economy on natural capital. Ecological footprint analysis is widely used around the Earth in support of sustainability assessments allowing us to measure and manage the use of resources throughout the economy.

Direct carbon emissions: Direct carbon emissions or scope 1 emissions come from sources that are directly from the site that is producing a product. For example emissions related to burning a fuel on site or, emissions from personal vehicles or gas burning stoves.

Indirect carbon emissions: Emissions that come from sources which are not directly related to the site that is manufacturing the product. These emissions include scope 2 and scope 3 emissions. Scope 2 emissions are the emissions related to purchased electricity, heat, and/or steam used on site while Scope 3 emissions are emissions from sources upstream or downstream from the process being studied Transportation of materials/fuels energy used, emission outside of the production facility, any end-

of-life process or treatments are examples of upstream and downstream process.

Schemes to Reduce Carbon Emissions:

Kyoto Protocol: The Kyoto Protocol is an international treaty which extends the 1992 UNFCCC that commits state parties to reduce Greenhouse gas emissions, based on the scientific consensus that global warming which entered into force on 16 February 2005. The Kyoto Flexible Market Protocol mechanisms include: Clean Development Mechanism (CDM), Emission Trading and Joint Implementation (JI). They also adopted Carbon trading.

Paris Agreement: An agreement within the UNFCCC, dealing with greenhouse-gas-emissions mitigation signed in 2016. The main aim was the Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.

Average carbon footprint per person by country: According to The World Bank, the global average carbon footprint in 2014 was 4.97 metric tons CO₂ /cap. The EU average for 2007 was about 13.8 tons CO₂ e/cap, whereas for the U.S., Luxembourg and Australia it was over 25 tons CO₂ e/cap. In 2017, the average for the USA was about 20 metric tons CO₂ e.

II. LITERATURE REVIEW

A few of studies based on surveys involving carbon footprint related problems carried out in different parts of the world are reviewed and reported.

- Mary Lissy P N (Assistant Professor, Dept of Civil Engg, Toc H Institute of Science & Technology, Arakkunnam) made a comparative study based on carbon footprint of an educational institution in order to evaluate the amount of carbon dioxide produced and to suggest the remedial measures for the reduction of emissions as a part of social commitment which is published on The International Journal of Engineering And Science (IJES). In this journal the methodology of carbon footprint described in two phases such as defining the carbon foot print and quantifying the carbon foot print.
- The carbon footprint of Muralidhar Girls College is assessed for the year 2015-16 following direct (Scope 1) and indirect (Scope 2 and Scope 3) emission sources are estimated and reported as per 'The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)' by World Resources Institute (WRI).

III. OBJECTIVE OF THE RESEARCH

In this report we have chosen an Engineering College Campus in Kolkata for determining the carbon footprint.

IV. SCOPE OF THE RESEARCH

Due to the following reasons, the travelling data for students and employees can play a crucial role in this research.

- Lack of connectivity of the college, with rail and metro till date.
- Unavoidable break journey from the bypass road unless travelling by private vehicle.
- Most of the students commute from their houses without availing the hostel facility in the college vicinity.

Due to the following reason, the collection of annual diesel consumption data from DG sets may also play a vital part in carbon footprint calculation.

- Frequent power cuts in college locality.

V. METHODOLOGY

The following step by step procedures were followed before arriving at conclusions of this research.

- Commuting profile survey of students and employees were recorded manually with the help of questionnaire.
- Annual LPG consumption, diesel consumption, electricity consumption were recorded.
- All the above collected datas were analysed with the help of two softwares ("Mobile Combustion GHG Emissions Calculation

Tool Version 2.6" & "Stationary Combustion Tool Version 4.8") and results were recorded.

- Some calculations were performed manually, relevant charts were drawn until the aim of research was fulfilled.

VI. RESULTS AND DISCUSSION

According to a study titled 'CO2 Emissions from Fuel Combustion (Highlights) 2017', which was released in November 2017, CO2 levels in India from fuel combustion increased from 181 million tonnes (MT) in 1971 to 2,066 MT in 2015 which is a 1,041 percent increase. Not surprisingly, the national capital region of Delhi has the highest annual carbon footprint in the country. In fact, Delhi's annual CO2 emission of 69.4 million tonnes is equal to the CO2 emission of Bengaluru, Hyderabad and Chennai put together. After Delhi, Kolkata holds the second position by emitting 42.9 million tonnes of CO2 annually. In Kolkata the value of per capita CO2 emission is also very high which is 1.83 tonnes/ capita. Therefore extreme weather events started affecting Kolkata and other Indian cities frequently also temperatures have increased astonishingly. To reduce increase in temperatures, cities have to reduce their carbon footprint.

VI.I. Estimation of the Carbon Footprint for an Engineering College in Kolkata

The carbon footprint of an engineering College in Kolkata is assessed for the year 2018-19 following 'The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)' by World Resources Institute (WRI).

VI.II. Defining the Organizational Boundary

An organizational boundary defines the facilities / entities that will be included in the CO2 inventory of the organization. An Engineering College, has its campus situated at Kolkata-700150 with a total land area of 4587.49 m² and a total built-up area of 12145.72 m². It has fifty-six class rooms, twenty-eight laboratories, eighteen staff rooms, seven office rooms, one central library, one reading room, nineteen toilets, three seminar halls, one canteen, one workshop building, one medical unit and one store area. These facilities define the organizational boundary for the Engineering College for carbon footprint estimation.

VI.III. Defining the Operational Boundary

Emissions result from a variety of activities undertaken by an institution. The operational boundary of the carbon footprint calculation process is defined by selecting the activities to be considered for preparing the GHG emission inventory. Table-1 lists the activities for the Engineering College in Kolkata and defines the operational boundary.

Scope	Emission Type	Activities	Inventory Data Source
1	Direct	Generation of power in DG sets	Record of annual diesel consumption for 2018-19
		LPG burning in canteen for food preparation	Record of annual LPG consumption for 2018-19
2	Indirect	Generation of purchased electricity from WBSEDCL	Monthly electricity bills for 2018-19
3	Indirect	Teachers and staff commuting in vehicles not owned by the college.	Commuting profile survey
		Students commuting in vehicles not owned by the college.	Commuting profile survey

Table 1
(GHG EMISSION SOURCES OF THE ENGINEERING COLLEGE IN KOLKATA)

VI.IV. Inventory Preparation and Estimation of the GHG Emissions.

Once the organizational and operational boundaries are defined emission, inventory is prepared. For each type of emission source, the activity data is prepared and GHG emissions are estimated as described in subsequent sections.

VI.V. Direct GHG Emissions (Scope 1)

Diesel burning for generation of power in DG set, LPG burning in canteen for food preparation and LPG burning in laboratories for practical classes are identified as Scope 1 direct emission sources. The annual consumption of diesel and LPG for the said purposes is reported in Table-2.

Calculations for annual Diesel consumption of the college:

Total no of generators(DG)= 3,
Avg Consumptions of generators= 6liters/hour,
Avg working hour for each generator= 3hour/effective day,
No of effective days in which generators are operated (Within 5 working days)= 3 days, Avg diesel consumptions of the college in a week= $\{(3 \times 3) \times 6 \times 3\} = 162$ liters/week.
Average diesel consumptions of the college in a month= $(162 \times 4) = 648$ liters/ month
Total no of working month of college= 10 months
Total annual diesel consumptions= $(648 \times 10) = 6480$ L

Activities for Direct Emission	Type of Fuel	Annual Fuel Requirement
Generation of power in DG set	Diesel	6480 Liters
LPG burning in canteen for food preparation	LPG	1740 kg (120 Cylinders @ 14.5 kg each)

Table 2
(ANNUAL FUEL CONSUMPTION FOR DIRECT GHG EMISSION SOURCES FOR THE ENGINEERING COLLEGE IN KOLKATA (SCOPE 1))

The emission is calculated using 'World Resources institute (Revised Edition). GHG Protocol Tool for

Stationary Combustion Version 4.8' and the results are reported in Table-3.

Activities for Direct Emission (Type of Fuel)	GHG Emissions			
	CO ₂ (tonnes)	CH ₄ (tonnes)	N ₂ O (tonnes)	Total GHG Emissions, (tonnes CO ₂ e)
Generation of power in DG set	17.344	2.34×10^{-3}	1.4×10^{-4}	17.446
LPG burning in canteen for food preparation	5.048	4×10^{-4}	8×10^{-6}	5.061
Total	22.392	4.234×10^{-4}	8.014×10^{-6}	22.507

Table 3
(SUMMARY OF THE DIRECT GHG EMISSION (SCOPE 1))

VI.VI. Indirect GHG Emissions (Scope 2)

Indirect emissions are the consequences of the institution's activities that occur from sources owned or controlled by another organization. For reporting purposes, indirect emissions are divided into 'Scope 2' emissions - those from the generation of purchased electricity, steam, or heat and 'Scope 3' emissions - a label which covers everything else. Accounting for and reporting on Scope 2 emissions is required under the GHG Protocol because these are likely to make up a significant percentage of any organization's inventory and are relatively easy to quantify.

For the Engineering College in Kolkata, electricity is purchased from West Bengal State Electricity Distribution Company Ltd. (WBSEDCL). Accounts of these are collected from the monthly electricity bills as listed in Table-4.

Month	Total Electricity Consumed (kWh)	Net Electricity Consumed (kWh)
June, 2018	22790	22790
July, 2018	34105	34105
August, 2018	31360	31360
September, 2018	28370	28370
October, 2018	21475	21475
November, 2018	21630	21630
December, 2018	16120	16120
January, 2019	16765	16765
February, 2019	20775	20775
March, 2019	31795	31795
April, 2019	37120	37120
May, 2019	37065	37065
Total	319370	319370

Table 4
(MONTHLY ELECTRICITY BILLS SHOWING ELECTRICITY PURCHASED FOR THE ENGINEERING COLLEGE IN KOLKATA)

Once the activity data for purchased and generated electricity under the 'Scope 2' of 'The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)' by World Resources Institute (WRI) is gathered, the appropriate emission factors are chosen from the same standard for emission estimation. The emission is calculated using the present CO₂ emission factor for coal based thermal power plant and the results are reported in Table-5.

Item	Electricity Consumed / Generated (kWh)	GHG Emissions			
		CO ₂ (tonnes)	CH ₄ (kg)	N ₂ O (kg)	Total GHG Emissions, (tonnes CO ₂ e)
Total Electricity Consumed (kWh)	319370	389.30	0.00	0.00	389.30
Net Electricity Consumed (kWh)	319370	389.30	0.00	0.00	389.30

Table 5
(SUMMARY OF THE INDIRECT GHG EMISSION FROM PURCHASED ELECTRICITY (SCOPE 2))

VI.VII. Indirect GHG Emissions (Scope 3)

Commuting of teachers, staffs and students in non-institution owned vehicles is identified as the main Scope 3 emissions source. To prepare the activity data, a commuting profile survey has been conducted. Among the 220 employees and 2700 students, a sample survey was run for 57 employees and 399 students respectively. The total activity is projected from the survey results and presented in Table-6 through Table-8.

Mode of Transport	Total Weekly km for Surveyed Employees	No. of Working Week/Year	Total Annual km for Surveyed Employees	No. of Employees Surveyed	Total No. of Employees	Total Annual km for All Employees
Car	1535.25	47	72156.75	57	220	159577.4279
Auto	992.5	47	46647.5	57	220	103162.7404
Bus	2632	47	123704	57	220	273576.1538
Metro	0	47	0	57	220	0
Train	928.5	47	43639.5	57	220	96510.43269
Motorbike and Scooter	596	47	28012	57	220	61949.61538
Cycle/Rickshaw/Walk	106.25	47	4993.75	57	220	11043.87019

Table 6
(COMMUTING PROFILE AND ACTIVITY DATA FOR EMPLOYEES OF THE COLLEGE)

Mode of Transport	Total Weekly km for Surveyed Students	No. of Working Week/Year	Total Annual km for Surveyed Students	No. of Students Surveyed	Total No. of Students	Total Annual km for All Students
Car	1209.5	47	56846.5	399	2700	384675.56
Auto	3786.5	47	177965.5	399	2700	1204277.8
Bus	23908	47	1123676	399	2700	7603822.5
Metro	900	47	42300	399	2700	286240.60
Train	6150	47	289050	399	2700	1955977.4
Motorbike and Scooter	1298	47	61006	399	2700	412822.5564
Cycle/Rickshaw/Walk	3221	47	151387	399	2700	1024423.308

Table 7
(COMMUTING PROFILE AND ACTIVITY DATA FOR STUDENTS OF THE COLLEGE)

Mode of Transport	Total Annual km for All Employees	Total Annual km for All Students	Total Annual km
Car	159577	384676	544253
Auto	103163	1204278	1307441
Bus	273576	7603823	7877399
Metro	0	286241	286241
Train	96510	1955977	2052487
Motorbike and Scooter	61950	412823	474773
Cycle/Rickshaw/Walk	11044	1024423	1035467

Table 8
(COMMUTING PROFILE AND ACTIVITY DATA FOR EMPLOYEES AND STUDENTS OF THE COLLEGE)

The emission is calculated using 'World Resources Institute (Revised Edition). GHG Protocol Tool for Mobile Combustion. Version 2.6' and the results are reported in Table-9 through Table-11. From figure 1 we can conclude population is directly proportional with carbon emission.

Mode of Transport	GHG Emissions			
	CO ₂ (tonnes)	CH ₄ (kg)	N ₂ O (kg)	Total GHG Emissions, (tonnes CO ₂ e)
Car	37.894	0	0	37.894
Auto	24.137	0	0	24.137
Bus	18.189	0.102	0.085	18.215
Metro	0	0	0	0
Train	11.094	0.120	0.06	11.113
Motorbike and Scooter	7.8	0	0	7.8
Cycle/Rickshaw/Walk	0	0	0	0
Total	99.115	0.222	0.145	99.163

Table 9
(SUMMARY OF THE INDIRECT GHG EMISSION FROM EMPLOYEE TRANSPORT)

Scope	Emission Type	Activities	GHG Emissions					
			CO ₂	CH ₄	N ₂ O	Total GHG Emissions,	Per Capita GHG Emission	Unit Area GHG Emission
			(tonnes)	(kg)	(kg)	(tonnes CO ₂ e)	(tonnes CO ₂ e/Capita)	(tonnes CO ₂ e/Capita)
Scope 1	Direct	Generation of power in DG sets, LPG burning in canteen for food preparation and LPG burning in laboratories for practical classes	22.392	0.4234	0.008014	22.507	0.0077	0.00185
Scope 2	Indirect	Generation of purchased electricity from WBSEDCL	389.30	0.000	0.000	389.30	0.133	0.032
Scope 3	Indirect	Teachers, staffs and students commuting in vehicles not owned by the college.	1283.598	6.199	4.078	1284.968	0.44	0.1058
Total Carbon Footprint for the Engineering College in Kolkata			1695.29	6.6224	4.086	1696.775	0.5807	0.13965

Table 10
(SUMMARY OF THE INDIRECT GHG EMISSION FROM STUDENT TRANSPORT)

Mode of Transport	GHG Emissions			
	CO ₂ (tonnes)	CH ₄ (kg)	N ₂ O (kg)	Total GHG Emissions, (tonnes CO ₂ e)
Car	129.242	0	0	129.242
Auto	305.906	0	0	305.906
Bus	523.742	2.937	2.447	524.473
Metro	28.991	0.711	0.356	29.106
Train	235.941	2.551	1.275	236.350
Motorbike and Scooter	59.775	0	0	59.775
Cycle/Rickshaw/Walk	0	0	0	0
Total	1283.598	6.199	4.078	1284.968

Table 11
(SUMMARY OF THE INDIRECT GHG EMISSION FROM EMPLOYEE AND STUDENT TRANSPORT (SCOPE 3))

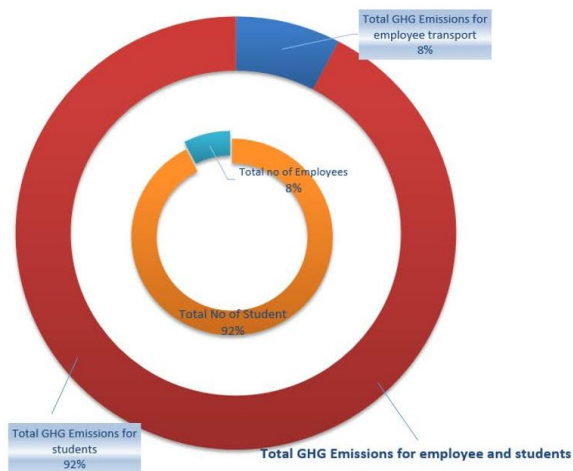


Figure 1: Indirect GHG Emission from Employee and Student Transport & Distribution of Student & Employees

VI.VIII. Carbon Footprint of the Engineering College in Kolkata

In the previous sections the GHG emission for the Engineering College in Kolkata from different direct (Scope 1) and indirect (Scope 2 and Scope 3) emission sources are estimated and reported as per 'The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)' by World Resources Institute (WRI). The total carbon footprint of the institute accounting for

all the three scopes is presented in Table-12 and comes out to be 1696.775 tonnes of CO₂e for the year 2018-19.

From the break-ups of the total GHG emission for different GHG gases viz. CO₂, CH₄ and N₂O, and for different emission sources under different scopes, CO₂ is found out to be the major GHG gas contributing more than 99% of total share. Among different emission sources, employee and student commuting (under Scope 3) emerges as the major GHG emission source contributing more than 75% of the total share from figure 2.

The unit area emission considering the total built-up area (12145.72 m²) of the institution is found to be **0.13965 tonnes of CO₂e/ m²**. The per capita emission for MeghnadSaha Institute of Technology is found to be **0.5807 tonnes of CO₂e/ Capita**. It is well below the Indian average per capita emission of **1.800 tonnes of CO₂e/ Capita**. It is also below the average per capita emission for Kolkata city which is **1.830 tonnes of CO₂e/ Capita**.

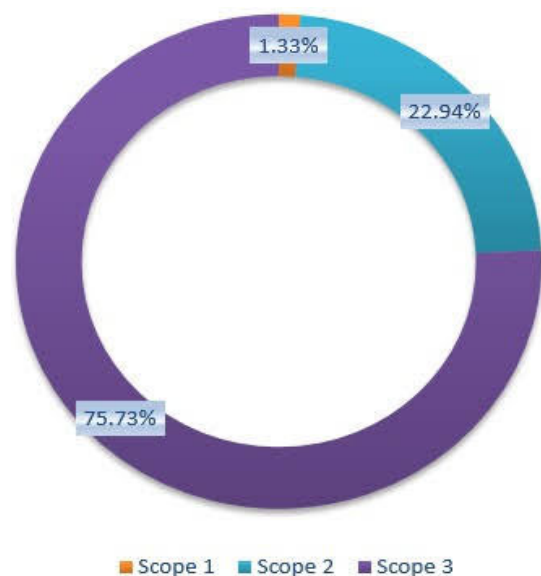


Figure 2: Share of Scope-1, Scope-2 and Scope-3 from Total Emission

Mode of Transport	GHG Emissions			
	CO ₂	CH ₄	N ₂ O	Total GHG Emissions, (tonnes CO ₂ e)
	(tonnes)	(kg)	(kg)	(tonnes CO ₂ e)
Car	91.348	0	0	91.348
Auto	281.769	0	0	281.769
Bus	505.553	2.835	2.362	506.259
Metro	28.991	0.711	0.356	28.106
Train	224.847	2.431	1.215	225.237
Motorbike and Scooter	51.975	0	0	51.975
Cycle/Rickshaw/Walk	0	0	0	0
Total	1184.483	5.977	3.933	1185.805

Table 12
(CARBON FOOTPRINT OF THE ENGINEERING COLLEGE IN KOLKATA)

VII. CONCLUSION

Based on the results obtained, the following conclusions can be drawn:

- Scope 3 emissions for the institute is significantly higher than Scope 1 and Scope 2 emissions. So, the total indirect carbon emissions is much more than direct carbon emissions.
- Amongst all the GHGs, CO₂ constitutes the major segment in all the scopes of emissions. Therefore it also has the maximum contribution to the Carbon Footprint of the institute.
- From the pie chart of total GHG emissions caused by students and employees, it is clearly evident that the emissions caused by them is in accordance with the number of students and employees.
- The percentage of constituent gases of GHGs for students and employees, when tabulated separately, showed a similar reflection in the overall percentage of the individual gases that are emitted in each case.
- The per capita GHG emission of the educational institute is well below the average per capita GHG emission of Kolkata as well as the average per capita GHG emission of India.

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MOBILE APP DEV FOR E-VEHICLES' SMARTCHARGING

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Abstract - It's not a new concern that fossil fuels are getting depleted and the usage of electric vehicles is the future we are heading to. The old age convention, that EVs cannot hit a good speed is exploding as innovators at companies like Tesla, Nissan are producing the best of the best in the sector. The localized revolution has been started as e Scooters and e-Rickshaws have started to fill the Indian roads. The typical batteries of such eVs consist of many sub batteries or cells, which need to be monitored in real time for the possible tendencies of failures either of device (No charge condition) or of the batteries themselves (like overcharge and undercharge). These need to be monitored in real time so that proper planning could be made before using the eVs as unlike those of conventional fossil fuel vehicles these require hours of charging and monitoring. The conventional wired battery management systems have a good chance of developing faults, being expensive and less available. A mobile app supported by Bluetooth/IoT (if required) based B.M.S could possibly serve this purpose of monitoring the battery statistics and calculating the user needed information like hours till failure, health of battery, best speed to cover maximum distance etc. There are already some solutions in this sector but, as observed, while these solutions do help monitoring the stats of a battery, they are heavily inclined towards making a consumer/user get help from remote agencies of battery assistance. The target of the project is different. The aim is to provide user insights based on his battery status, the available charge, vehicle model, driving habits etc., this could really make the charging smart. This target can be achieved by employing electronics components like Arduino, Bluetooth module for sending data such as battery's open circuit voltage to the mobile application. Google's Flutter framework along with Bluetooth and widgets' dependencies could be used to code the application to display this data into the widgets and perform the necessary calculations. It's the game of how state of charge changes with respect to open circuit voltage. The major challenges that could be faced are, to analyze the curves based on vehicle model, battery model and the average speed user travels at. Basically, it's the load vs Charge monitoring. Many factors are involved in this like the type of road vehicle is travelling, amount of traffic (i.e. stops per hour). Another challenge is standby performance of the battery, real Time speed monitoring of the vehicle and averaging it over time while keeping consideration of the open circuit voltage of the battery for the prediction of possible distance that can be covered etc.

I. INTRODUCTION

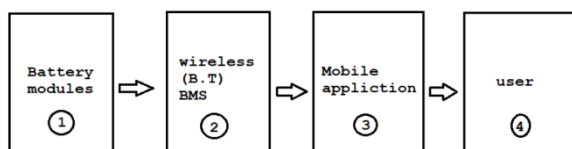


Fig1

As shown in the above figure the components are aimed to first gather information like open circuit voltage, state of charge from the battery modules (1) and then using electronic microcontrollers (2) like Arduino with the help of Bluetooth modules to transfer the gathered information to the portable computer device (smartphone) (3) where it will get processed to show interactive relevant data about battery and vehicle in user readable form (4). The project needs a reliable system to transmit the required information like present open circuit voltage of the battery, batteries' temperature etc. to mobile through any means. In the initial stages of the project Bluetooth serves as a good means to do the same. Target of the application is to get this data and process it into user readable form for helping the user to understand the competence of the present state of

the battery. While there are already some mobile applications [1][2][3][4] some of which can display the batteries' information and some can display nearby charging stations but they are not serving their purpose correctly as reported by their users. Also, the interactive vehicle insight is absent in these. We aim to develop a mobile application which could not only handle the data effectively but also to some extent predict how vehicle will behave as far as present battery conditions are concerned. Pastworks [14] to make android based B.M.S are serving their purpose but are not targeted towards vehicles behavior as far as instantaneous battery conditions are concerned. The data transmitted from the battery can be processed using techniques such as coulombs counting method [5][13] to obtain SOC estimate as charge matters a lot while we perform estimation while considering the speed, location and other factors of the electric vehicle.

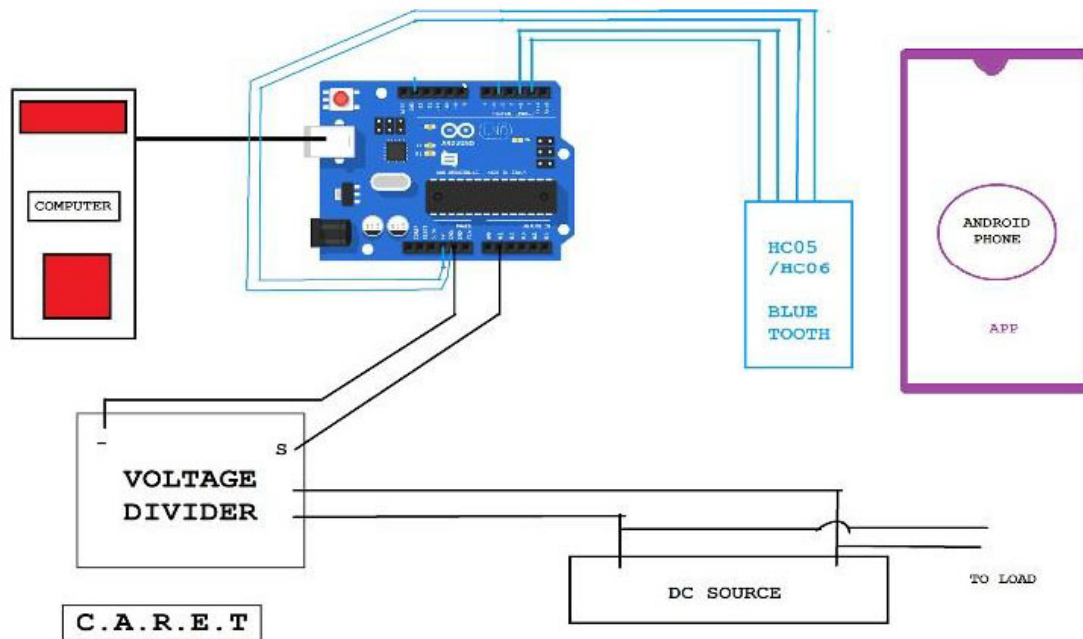
II. THE ELECTRONIC CIRCUIT DESIGN AND CODE

A. Arduino

This is the circuit needed to implement (2) of the Figure (1). We will be needing Arduino UNO with

USB cable, Voltage sensor(divider) 0-25v, HC05/06 Bluetooth Module and a Multimeter (For seeing the actual measurement vs on the application). These

should be connected and as shown in the following figure. The Arduino code and clarified connections can be seen in repository [7]



These arrangements are enough to yield a circuit which could transfer the batteries' open circuit voltage in realtime to mobile device via Bluetooth for accuracy we can use[5]SOC techniques. Once this open circuit voltage gets started to scatter using Bluetooth, an application needs to be designed which can fetch this information. Once this data is fetched, it can be parsed into JSON format and can easily be used to calculate, display the required information to the user. The widget structure and wireframes of the app could easily be decided once the data to be displayed and calculated is decided. A GitHubRepository [7] flutter_bluetooth_serialisa good demonstration. This can easily:

- Adapter status monitoring,
- Turning adapter on and off,
- Opening settings,
- Discovering devices (and requesting discoverability),
- Listing bonded devices and pairing new ones,
- Connecting to multiple devices at the same time,
- Sending and receiving data (multiple connections)

Using these services information can be fetched and displayed.

III. THE APPLICATION

After devising a circuit that can transfer the battery's open circuit voltage to a mobile device, these are the things to know.

- How will the application be planned to display user friendly data?
- Background calculations for the above.

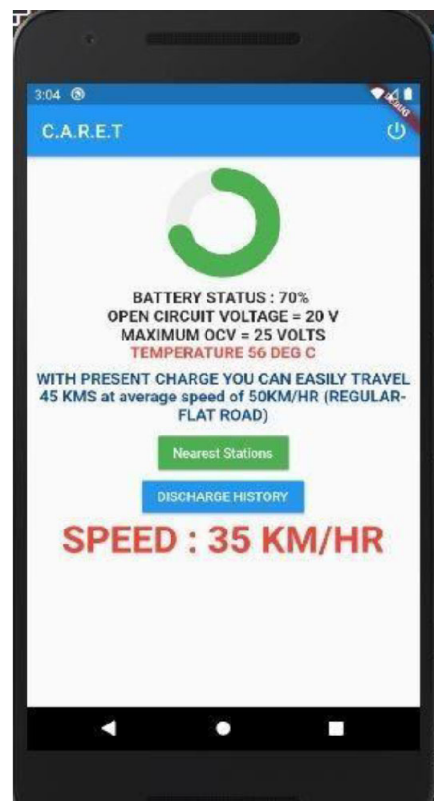


Fig (3) Application Wireframe

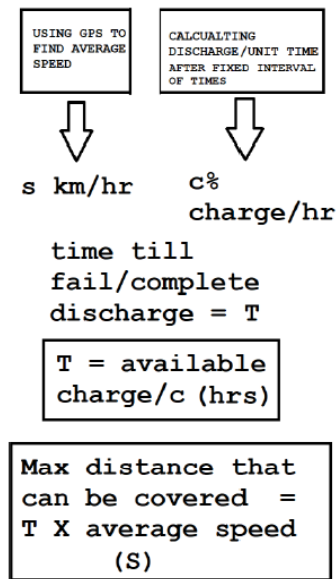


Fig (4) The above figures show how the app is aimed to work.

Fig (4) shows how approximately maximum distance can be predicted using basic formulas. Of course, the analysis will be approximate and the maximum distance will be kept in low proportions for safety purposes. In Fig(1) nearest stations can be pointed out stations in GPS enabled google maps since the application is keeping the log of instantaneous device location while calculating speed[12]. The blue statement interactively predicts how far can your vehicle can go as far as the present charge is concerned; this data will be updated constantly as the OCV of the battery changes as the flutter dependency automatically updates in realtime. Similarly, green circular statusbar will also change as the voltage drops. The discharge history button will enlist all the recentdrivesessionstilldatewhichweresavedinalocalizedatabase likeSQLFLITE [8] and can provide users insights based on past rides. This can help users get information based on his driving habits, roads and his battery behavior(which surely changes). The battery behavior could also be analyzed(using discharge vs time vs speed graphs and temperature monitoring) by user to determine if it should be changed.

Role of Speed:

This is a very important aspect to provide insights once flutter can communicate with GPS and google maps speed can easily be calculated. This speed can be used as suggested in Fig (4) and other places as development progresses. The following algorithm could be used to calculate speed.

- Calculate present location of the device in real realtime
- Keep storing the present location in a temporary variable after equal intervals of 1 second.
- After each second keep calculating the distance

[9] between temporary variable and current location in suitable units that will basically calculate the speed

between two points (i.e. the distance travelled in one second).

- Hence successfully the speed can be calculated after each second.

The Provider package [10] of flutter provides good support for state management and streaming information like dynamically changing location all over the code base of the application. This can be achieved by using Stream controller functionality [11]. The flutter implementation of the speed determination algorithm can be seen in the repository [12]. Now the prediction algorithms needing average speed distance, discharge per unit time, SoC and other factors can be implemented easily as required by the flutter developers. As far as protection of battery from over heating and temperature is concerned works [15] have been made which could be implemented in addition to this application. These [15] uses the same Arduino along with HC05 Bluetooth module to transfer information of the battery's temperature to the computer device and take decisions accordingly. The techniques mentioned can be applied in various battery based devices and are not limited to E-Vehicle sector.

IV. CONCLUSION

A Mobile application which is fetching required data from battery of EVs using electronic components like Arduino is able to get it transferred to flutter application using flutter_bluetooth_serial[7] where using basic prediction algorithms developer can make an application which can display the required insights to a user. This report guides such developers to code such applications. If enough experimentation on the vehicles and the battery used is done the accuracy of the prediction algorithms can be increased using techniques like SoC curve analysis[13], vehicle battery behavior analysis, curve tracing etc. This is a rigorous process and requires plethora of experimentation being done on different vehicles on different roads and conditions. The predefined experiments could be mapped into suitable data and posted into online databases. These databases could then be used in future (through the mobile application) by the users of the same vehicles on which experimentations were done.

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MEDIGATE: THE SMART GATEWAY TO LIFE

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Abstract - E-Health is the use of technology to improve the quality of healthcare to allow both patients and medical professionals to gain access to a variety of resources. E-health empowers patients to take active role in their health, allowing them to gain deeper understanding of their condition and how to effectively manage them. Health informatics focuses on developing tools to improve healthcare while E-health is designed to make it easier to share this valuable information. The two can work in conjunction to provide patients with top quality care, in a much more efficient manner. This paper proposes an IoT based health monitoring system with a gateway device. An Android based smartphone is used as a gateway device. It will handle the complex wireless sensor network infrastructure. This type of smart gateway will help in expanding health monitoring system in terms of its reliability and energy efficiency. The gateway further sends the data to the web server. Therefore, it will establish a platform for both the doctors and the patients to interact.

Keywords - IOT, Gateway, Health Monitoring

I. INTRODUCTION

Healthcare has been one of the greatest challenges to mankind. There is always scope for betterment of the available healthcare services. With the advent of technology, the advancements in the healthcare industries have also risen manifold. The integration of technology with the traditional healthcare units have opened doors to numerous research opportunities. Many industries have taken up the challenge of bringing in effectiveness and efficiency to the current medical facilities and in turn increase patients' safety. According to the constitution of WHO the highest attainable standard of health is a fundamental right of every individual. In the traditional diagnosis scenario, the treatment highly revolves around the doctor. The doctor must be physically available to treat the patient. Another major drawback is that the patient must be glued to the bed- set with all the wires attached to him. This paper proposes a more patient centric approach which will negate both these drawbacks. E-healthcare focuses on the use of Internet and related technologies to deliver healthcare information and services. E-healthcare, as an industry has evolved over the years. It encompasses a wide variety of technologies ranging from telemedicine to big data. In times of a pandemic we understand the importance of telemedicine service even more. There are various offshoots of E-healthcare like home monitoring systems, interactive health records, automated online therapy, health care system portals. Under E-healthcare we have various technologies like Internet and Smartphones. Now-a-days with a click of a button and the ease of internet, data can be transmitted to any remote location where the patient's family or the concerned doctor can be alerted about his wellbeing.

II. METHODOLOGY

The smartphone centric architecture consists of a Wireless Sensor Network which collects and filters the data. This data is further sent to the gateway device which is the smartphone. From the smartphone the data will be sent on to the web server using Wi-Fi. The web server will be in the hospitals. This data can be accessed by doctors and other staff members.

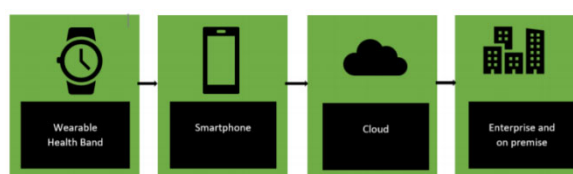


Figure 1: Block Diagram For Smartphone Centric Architecture

A. Wireless Sensor Network (WSN)

The WSN consist of the Sensors and the Bluetooth module that is controlled by a microcontroller.

1) Sensors

The Wireless Sensor Network (WSN) consists of two sensors, heart rate (INVNT11) and temperature (LM35).

Heart Rate Sensor is used to measure the pulse rate of the patient. The sensor uses optical power variation. This method exploits the fact that light is absorbed and scattered as light travels through the blood. It uses the principle of photo plethysmography. The change of volume of blood through any organ of the body causes a change in light intensity through that organ. This change is measured by the sensor. The blood flow is decided by the heart rate. Therefore, the signal pulses are equivalent to the heartbeat pulses.

The sensor values were calibrated against a commercially available device called “Fingertip Pulse Oximeter with Heart Rate Monitor”. The LM35 temperature sensor returns an output voltage which is proportional to the body temperature. These sensor output values are further processed.

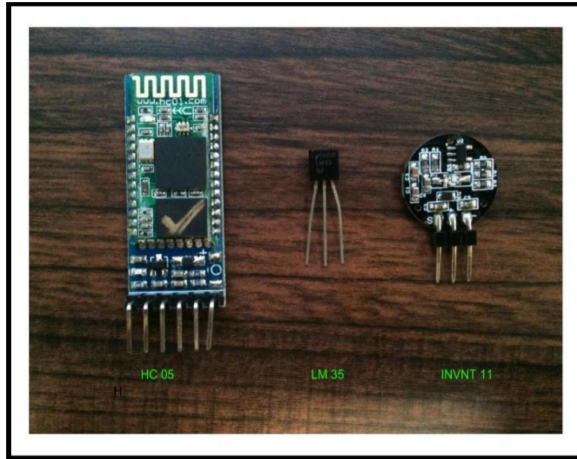


Figure 2: Sensors and Bluetooth Module

2) Printed Circuit Board (PCB)

The data from the sensors is processed by Atmega328 microcontroller and further transmitted to the Android Application using the Bluetooth Module. BLE- Bluetooth Low Energy or Bluetooth Smart is an important short-range communication technology. It is particularly famous in wearable product space and smartphone. It requires significantly reduced power consumption. It is more suitable for small chunks of data. It works on a frequency band of 2.4GHz and covers a range of 50-150m and has a data rate of 1 Mbps. The modulation technique used is Frequency Hoping Spread Spectrum Technique.

B. Android Application

1) Data Collection

Temperature and heart rate values were sent to the android application. To receive data from the Wireless Sensor Network Bluetooth API was used. Android supports Bluetooth network stacks for wireless exchange of data. These functionalities are accessed using android Bluetooth API. The following actions were performed using the Bluetooth module: (a) Scan for other Bluetooth devices. (b) Connect to other devices through discovery service (c) Get data from the WSN. To use Bluetooth API, we first need to define permission in the android manifest of the project. Following this we create a Bluetooth handler. It reads data from the created socket. The data sent from the WSN is read from the socket. Multiple data were segregated using the keywords used with the dataset while transmitting from the WSN. This data is further sent via the message handler which plots and sends the data to the server.

2) Graph Plot on Android Application

To plot the graph, we used the GraphView. GraphView is an Open Source android library, which is used to programmatically create line, bar, point and other types of graphs. It comes with features like XML integration which is the key requirement as this is what enables us to use it with Android Studio. It also provides real time or live chart plotting with the help of auto scrolling and pagination. It can be used to scroll scale and zoom the plot. It is also very customizable. Graph is initialized to the minimum and maximum values so as to set the origin for the graph. The heart rate was plot using GraphView.

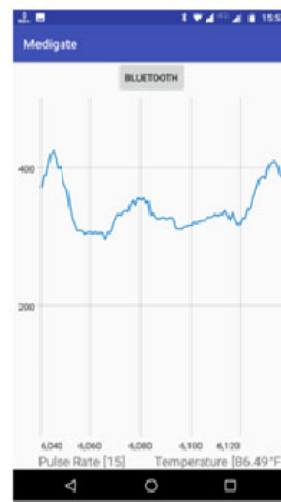


Figure 5 Plot of Heartrate Sensor Using GraphView

3) Authentication

To provide authentication for the application, we built a login form. There are two modes of logging in. One being email id based and the other is using Google SignIn Client API. The Google SignIn Client API allows the user to sign in using the google account registered to that android phone. The Google SignIn Client if used, gives us information such as name, email id and profile picture. The other method to sign in is using an email id and password. On proceeding to the form, the user is asked to fill in his health details. When a doctor registers he is asked for additional details which will help the patients get better acquainted with the doctor and his specialization. The username is stored for future login to the app to avoid going through the login procedure repeatedly. This username also helps us to uniquely identify and extract the data from various tables using object relational mapping, which is a key feature of server-side software, Django.

4) Server-Client Communication

Data was sent from the android device to the server using Java Script Object Notation (JSON). It is an open standard file format in human readable text, to transmit objects consisting of key and value pairs. It is a language independent format. This is a very strong

feature of JSON which enables us to make the client independent of the server-side language. AsyncTask is a class which enables us to implement functions such as `doInBackground()` and `onPostExecute()`. The `doInBackground` enables us to continuously send data to the server without interrupting or providing latency in reading data from the WSN. We have used OkHttp client. Which is an HTTP client for android and java applications. Client exchanges data and media through HTTP with the server. It efficiently makes the objects load faster and saves bandwidth too. OkHttp is an HTTP client that is efficient by default:

- i. HTTP/2 allows all requests to the same host to share a socket.
- ii. Connection pooling reduces request latency (if HTTP/2 isn't available).
- iii. Transparent GZIP shrinks download sizes.
- iv. Response caching avoids the network completely for repeat requests.

OkHttp perseveres when the network is troublesome: it will silently recover from common connection problems. If your service has multiple IP addresses OkHttp will attempt alternate addresses if the first connection fails. This is necessary for IPv4+IPv6 and for services hosted in redundant data centers. OkHttp initiates new connections with modern TLS features (SNI, ALPN), and falls back to TLS 1.0 if the handshake fails. Using OkHttp is easy. Its request/response API is designed with fluent builders and immutability. It supports both synchronous blocking calls and async calls with callbacks. OkHttp supports Android 2.3 and above. For Java, the minimum requirement is 1.7.

The `onPostExecute()` function helps to schedule tasks as and when a `doInBackground()` task is executed. We have used this function to get feedback from the server such as complete post, missing attributes, socket creation error, json stack error, input/output errors etc. are used for showing set point and viewing resultant output.

5) Web Server

Django is a free and open source web application framework, written in Python.

The data at the web application can be structured and manipulated using the abstraction layer called models provided by Django. We have created different classes for patients, doctor, patient information and sensor data inside the model. These models can be used by editing the settings file and adding the name of the model to the installed apps.

The users request can be processed, and the response can be returned by using the concept of View provided by Django. A python module called URL configuration is created which is a mapping between URL path expressions to python functions. Django scans each URL pattern and imports the View from

the matched URL. The view is a simple python function. The View gets passed the following arguments:

- (a) An instance of HTTP Request.
- (b) The matches from the regular expression are provided as positional arguments in case if the matched URL pattern returned no named groups.

A designer-friendly syntax is provided by the template layer for giving the information to be presented to the user. A static part of the desired HTML output and some special syntax describing how dynamic content will be inserted is included in the template. A range of tools and libraries is provided by Django which helps in building forms to accept input from site visitors, and then process and respond to the input. Form allows the user to enter text, select options, manipulate objects or so on and then send that information back to server.

GET and POST are the HTTP methods to be used while dealing with the forms. The browser bundles up the Django's login form data and returns it using the POST method. The form data is then encoded for transmission, sent to the server, and then received as response. GET bundles the submitted data into a string and uses this to make a URL. URL consists of the address where the data must be sent and the data keys and values. POST is used in case if the request changes the state of the system. GET is used only for the systems where request does not affect the state of the system.

A dedicated settings file is used to configure things like Django applications, databases, templates and middleware. This file is known as the central place for all the configurations for the project. To enhance security DEBUG is set to FALSE and allowed hosts is kept empty. This makes the Django refuse serve requests and respond with HTTP 400 bad request pages.

Secretkey is used to cryptographically protect any sensitive data structure in a Django project. The secret key is provided to any of these sensitive data structure before Django sends it to the users on the internet. Whenever the data structure is called to execute any action, Django re-checks these sensitive data structures against the secret key. If there is any tampering on the data structure, then the Django stops running the process.

Databases contains settings for all the databases to be used with Django.

Middleware is a light low-level system used to alter Django's input or output globally. It is a framework used in Django's request/response processing. Authentication middleware in Django maps users to requests using sessions.

III. RESULTS

A. Data collection using Wireless Sensor Networks

The wireless sensor network mounted on the patient's arm continuously monitors the vitals and filters the data as configured by the device. The filtered data is further sent to the android application for further processing and storing.

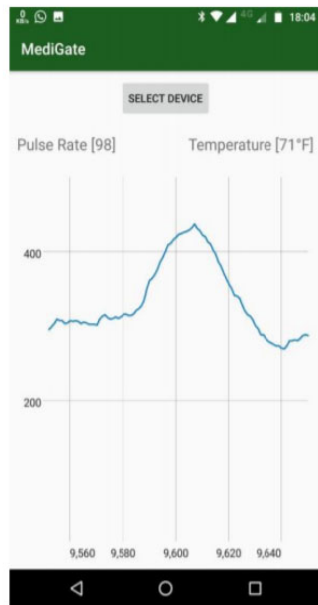
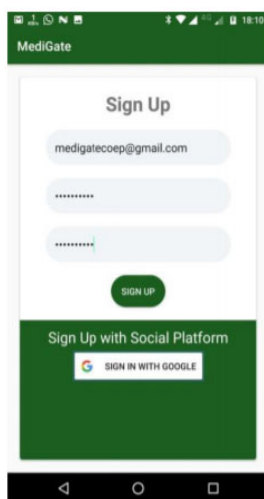


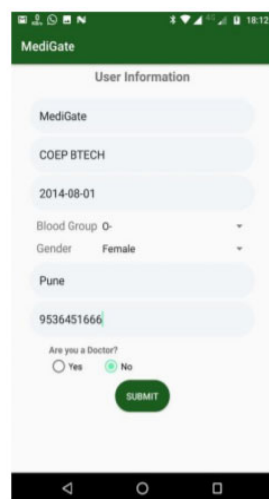
Figure 7 : Plot of Heart Rate and Sensor Values

B. Android Application

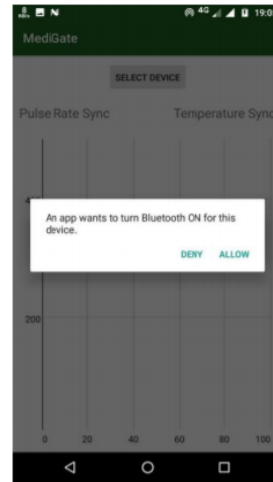
The data from the WSN is sent to the Android application. To view this data the user first needs to sign up if he has not already. Once the profile has been created, the patient can view the graph plot and values by first connecting to a Bluetooth device. The application first asks permission to use Bluetooth. Then, an option of connecting to already paired devices is given to the user.



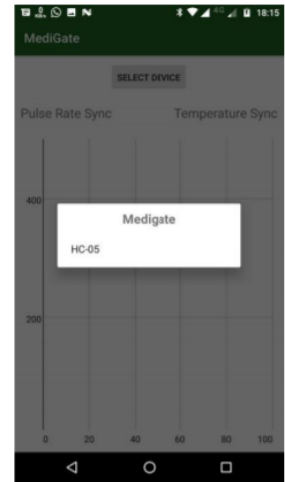
(a) Sign Up Page



(b) Form for Patient Login

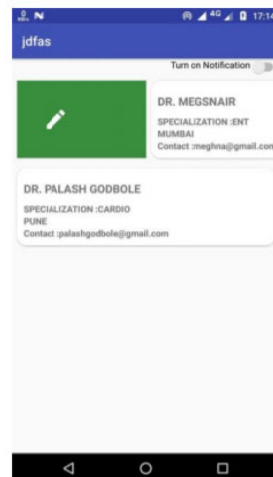


(c) Permission to turn on Bluetooth



(d) List of discovered devices

To access the list of doctors who are available in the hospital one can click on the doctor list and choose the doctor they want to consult by swiping right. On doing so the doctor receives a notification request which can accept if he has the bandwidth to consult the patient. To which he can respond by clicking on the add button.



(e) Doctor Request



(f) Doctor's Profile

When the request is accepted by the doctor, the patient receives a notification that the doctor has acknowledged his request and will provide him with the necessary treatment. We have also provided an alert system. In a case of emergency, the user can press the alert button. This will ring an alarm on the patient's phone alerting everybody around him. It also sends an alarm to notify every doctor who has accepted the patients request along with the patient's current location.

C. Web Server

The sensor data collected from the patient is sent from the app to the web server. The web server shows a logged view of the data values stored in a tabulated form for the different users.

Patient data	
Name	Email
megsnair	megsnair@gmail.com

Sensor data		
Time	Pulse rate	Temperature
May 13, 2018, 3:44 p.m.	98	103.0
May 13, 2018, 3:44 p.m.	100	101.0
May 13, 2018, 3:45 p.m.	95	98.0
May 13, 2018, 3:45 p.m.	96	102.0
May 13, 2018, 3:46 p.m.	96	102.0
May 13, 2018, 3:46 p.m.	98	101.0
May 13, 2018, 3:46 p.m.	99	104.0
May 13, 2018, 3:47 p.m.	93	95.0
May 13, 2018, 3:48 p.m.	91	99.0
May 13, 2018, 3:48 p.m.	88	100.0
May 13, 2018, 3:48 p.m.	98	102.0
May 13, 2018, 3:48 p.m.	100	104.0
May 13, 2018, 3:48 p.m.	101	103.0
May 13, 2018, 3:49 p.m.	102	98.0
May 13, 2018, 3:49 p.m.	96	97.0
May 13, 2018, 3:49 p.m.	99	101.0
May 13, 2018, 3:49 p.m.	96	102.0
May 13, 2018, 3:52 p.m.	100	103.0
May 13, 2018, 3:53 p.m.	88	99.0
May 13, 2018, 3:53 p.m.	97	106.0
May 13, 2018, 3:54 p.m.	89	95.0

Figure 29: Data from User1

Patient data	
Name	Email
vnmore	vnmore@gmail.com

Sensor data		
Time	Pulse rate	Temperature
May 13, 2018, 3:47 p.m.	81	95.0
May 13, 2018, 3:48 p.m.	82	98.0
May 13, 2018, 3:48 p.m.	81	97.0
May 13, 2018, 3:48 p.m.	79	98.0
May 13, 2018, 3:49 p.m.	81	98.0
May 13, 2018, 3:49 p.m.	81	97.0
May 13, 2018, 3:49 p.m.	79	97.0
May 13, 2018, 3:49 p.m.	78	96.0
May 13, 2018, 3:49 p.m.	79	98.0
May 13, 2018, 3:50 p.m.	81	98.0
May 13, 2018, 3:50 p.m.	79	98.0
May 13, 2018, 3:50 p.m.	78	97.0
May 13, 2018, 3:50 p.m.	81	98.0
May 13, 2018, 3:50 p.m.	81	98.0
May 13, 2018, 3:50 p.m.	81	100.0
May 13, 2018, 3:51 p.m.	81	98.0
May 13, 2018, 3:51 p.m.	81	101.0
May 13, 2018, 3:51 p.m.	81	98.0

Figure 30: Data from User2

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TARGETING WNT-PATHWAY IN CANCER STEM CELLS FOR ANTI-CANCER THERAPY

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Abstract - Cancer stem cells (CSCs) are a self-renewing sub-population of cancer cells which are believed to be integral to the development and perpetuation of cancer. Numerous studies show that CSCs play a pivotal role in the development of metastasis and chemo-resistance. The Wnt/ Beta catenin signaling pathway is one pathway responsible for a variety of cell renewal, proliferation and repair processes and has shown to be a prominent regulator of CSCs. Targeting the proteins involved in this oncogenic pathway can prevent disease recurrence and act as a potential cure. In this review we discuss about the potential of targeting the Wnt pathway as a promising anti-cancer therapy, the challenges and future prospects of this approach.

Keywords - Cancer Stem Cells, Wnt/ Beta Catenin Signaling Pathway, Metastasis, Anti-cancer Therapy

I. INTRODUCTION

Cancer stem cells were first discovered in human acute myeloid leukemia cells in 1994 . They have the characteristic ability to self-renew and differentiate (both symmetric and asymmetric cell division). There is ambiguity regarding its origin with conflicting theories. Some believe they originated from stem cells which have acquired certain mutations and some believe they arise from somatic cells which acquire malignant characteristics through genetic alterations .They share multiple properties with regular stem cells like self-renewal, resistance to drugs, better DNA repair mechanism, apoptosis resistance etc

They possess high differentiation potential which is responsible for the heterogeneity in tumor cells and the subsequent failure of standard cancer treatments like chemotherapy and radiation therapy. However, it has been observed that pathways involved in normal stem-cell renewal mechanisms can be targeted for personalized anti-cancer therapy. CSCs survive and proliferate through the dysregulation of these pathways. Hence, we can utilize drugs that target certain proteins involved in these pathways thereby targeting the maintenance mechanisms of CSCs. In this review we discuss about the WNT signaling pathway which is involved in cell proliferation, polarity and tissue homeostasis

II. WNT/ B-CATENIN SIGNALING PATHWAY

As mentioned earlier, Wnt/ beta catenin pathway involves a family of proteins mainly responsible for vital cellular functions like embryonic development, cellular fate determination and tissue repair. It consists of 19 cysteine rich glycoproteins that act as ligands for a number of receptors. In canonical signaling pathway, these Wnt ligands bind to the seven-pass transmembrane Frizzled receptors and a

second type of LDP (low density lipoprotein) related receptor called LRP 5/6 which activates Dishevelled (Dsh) proteins . This Dsh polymer inactivates the (APC)/Axin/GSK-3 β destruction complex from phosphorylating beta-catenin which results in its accumulation and migration to the nucleus. Once reaching the nucleus, it forms a complex with TCF (T-cell factor) and LEF (lymphoid enhancer factor) which causes the transcription of target genes cyclin D, survivin and c-Myc which leads to the abnormal proliferation of tumor cells

There are 2 major non-canonical pathways - Planar Cell Polarity (PCP) and Wnt/calcium pathways. In the PCP pathway, Wnt ligands bind to the ROR-Fzd-Complex which further recruits and activates the Dsh protein. This activated Dsh binds the GTPase Rho which along with GTPase Rac1 trigger ROCK (Rho Kinase) and JNK . This alters cytoskeleton rearrangements and transcriptional responses .

In the Wnt/calcium pathway, G protein triggers phospholipase C which activates this pathway at the plasma membrane. This leads to intracellular Ca²⁺ fluxes which results in the activation of calcium dependent enzymes like PKC, calcium/calmodulin-dependent kinase (CAMK) which induces downstream Ca²⁺-dependent cytoskeletal and/or transcriptional responses [10].

III. CANCER AND WNT PATHWAY

Wnt signaling is one of the most important regulatory pathways for maintaining the characteristic stem cell properties and has been linked to cancer. It was first observed when the wnt1 (also int-1) gene was activated and overexpressed in mice which resulted in developing tumours and mammary hyperplasia . This was further supported when the cause of hereditary colon cancer was found to be mutated APC gene (adenomatous polyposis coli) involved in the Wnt Pathway. It has been reported that this signaling

pathway plays a key role in regulating growth and maintenance of colorectal cancer stem cells. There are several such evidences which point towards the association between dysregulated Wnt signaling and cancer.

The role of Wnt pathway in maintaining the functionality of cancer stem cells and normal stem cells has been established in lots of studies and is widely recognized. One such example is the increase in TERT expression (which is important in making telomeres that give stem cells and cancer cells their immortal lifespan) by the binding of beta-catenin protein involved in Wnt pathway which shows a link between the two. A study also shows de-differentiation of regular intestinal cells into stem cells and initiation of tumorigenesis upon the coactivation of both Wnt and NF κ B pathway in a mouse model.

One property of cancer that makes it particularly ineffective to treatments is its ability to metastasize. Metastasis is characterized by Epithelial to Mesenchymal Transition (EMT) which is the process by which epithelial cells lose their polarity and trans-differentiate into motile mesenchymal cells. SNAI2 is a transcriptional factor shown to be responsible for EMT and it is regulated by GSK3 β phosphorylation

and ubiquitinylation by β -TrCP10. It has been shown that Wnt pathway once activated stabilizes SNAI2 by the inhibition of GSK3 β kinase and hence induces EMT. Another study shows the inhibition of EMT by inhibiting Wnt by siRNA for long non coding UCA1. GOLPH3 (Golgi phosphoprotein 3) induces EMT through the Wnt/beta catenin Signaling in epithelial ovarian cancer. Wnt inhibitor IWR-1 suppresses metastasis by reversing EMT in Colorectal Cancer models and directly represses the expression of survivin.

IV. TARGETING CSCs BY INHIBITING WNT

As per clinical data, higher levels of Wnt signaling is associated with cancer initiation and/or progression. Given the plethora of evidence, it only makes sense to test Wnt inhibitors in inhibiting CSCs. The inhibitors that are undergoing trial include small molecules like monoclonal antibodies, beta-catenin inhibitors etc. These molecularly targeted agents can be divided into 5 major categories: β -catenin–TCF antagonists; drugs that bind the PDZ domain of DVL; other mechanism-based inhibitors that principally target enzymes (for example, Porcupine, tankyrase and kinase inhibitors); biologics; and drugs targeting WNT co-activators. Some of them are summarized in the following table:

Compound	Target/Mechanism	Tumor type	Highest phase	Ref
NSC668036	DVL		preclinical	i
LGK974	Porcupine Inhibitor	Melanoma; Pancreatic cancer; breast cancer	Phase I	10
IWR1	Tankyrases 1,2 inhibitors		preclinical	ii
OMP-18R5 (Vantictumab)	Frizzled Receptor	Metastatic Breast cancer, non-small cell lung cancer, pancreatic cancer	Phase I	27iii
CWP232291	Beta-Catenin	Acute Myeloid Leukemia	Phase I	iv27
Celecoxib	COX2	Colon, breast, lung, prostate, stomach, head and neck, familial adenoma polyposis	FDA approved	v
iCRT3	Beta-catenin- TCF	head and neck cancer stem cell (HNCSC) and hypopharynx cancer.	Preclinical	vi

Table 1: Wnt inhibitors in clinical trials for different cancer and their specific targets/ target mechanisms

V. CHALLENGES TO THIS APPROACH

There are several challenges to successfully target the Wnt/Beta-catenin cascade for alleviating cancer. This signaling pathway is extremely complex which consists of fifteen receptors and 19 ligands spread over 7 protein families. Studies show the protective role of high levels of beta-catenin as a result of active Wnt signaling in melanoma, which is in contrast to other cancers we've discussed. We have to make sure that the agents we use are effective and do not cause

deleterious effects to normal stem cell function of organogenesis, tissue repair, homeostasis, neural patterning, cell migration and polarity. This can be a major problem as Wnt pathway plays a key role in stem cell pool maintenance and tissue regeneration. We also have to keep into consideration the cross talk among the various pathways which could lead to unwanted side effects. This crosstalk could also potentially lead to escape which calls for multi-target inhibitors which can potentially deal with the problem of drug resistance of cancer stem cells. It has

also been observed that targeting a specific point in the pathway only targets a subset of the patients. E.g. LGK974 was only effective against tumor cells carrying RNF43 mutation 27.

VI. CONCLUSION

Despite extensive research into this extremely conserved pathway, there are still no approved Wnt inhibiting agents for therapeutic use. However, many promising small molecules have entered clinical trials. Preliminary results point towards combinatorial therapy in treating most cancers. In 3 Phase 1b trials, hepatocellular cancer with sorafenib, pancreatic cancer in combination with nab-paclitaxel and gemcitabine, and ovarian cancer combined with paclitaxel and carboplatin are being studied, among many others. We need to gain a better understanding of the cross talks among the various pathways to target particular molecules without affecting normal cellular functions. Further future studies are required to effectively recognize targets of these pathways that can modify their activities in a safe manner without compromising on normal cells, especially those with high mitotic activity including skin, gut epithelial cells, blood etc. Natural compounds are also being explored as a productive choice for future research.

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ROBOTIC PROCESS AUTOMATION FOR EV BATTERY SWAPPING STATIONS

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Abstract - This research paper deals with the Robotic Automation method to swap the batteries at Swapping Stations, considering location of the battery to be fixed. Battery Swapping Stations are designed in such a way that healthy batteries are always available and the drained batteries are compelled to charging premises as soon as they are removed from the Electric Vehicle.

Keywords - Electric Vehicles, Battery Swapping Stations, EV Companies, State of Charge (SOC)

I. INTRODUCTION

According to the 'Paris Climatic Agreement', India is going to sell only Electric Vehicles by 2030. The aim of this declaration is to control the greenhouse gases released by combustion vehicles.

In general, charging an Electrical Vehicle is time consuming process and this may be the reason that this generation is not switching to electric. People are moving towards Electric, but the number is less. This is the biggest reason that swapping the batteries has fascinated people. Battery swapping provides you fully charged battery, leaving no anxiety behind.

Battery Swapping Stations has Power grid systems which enables the battery to get charged in the short period of time. The electrical components of Battery Swapping Stations are mainly composed of a Distribution Transformers, AC to DC converters and Energy control modules.

Recent developments have proved that; this idea of battery swapping can be expanded up to any extent. The process of battery swapping was started with manual exchange of batteries and now the Robotic Automation has come into the picture which makes the whole process safer and less time consuming. However, there are several advantages of battery swapping but there are still some drawbacks of battery swapping such as the ownership of batteries, compatibility and battery pack designs.

II. MAIN CONTENT OF THE PROJECT

Battery Swapping: A pragmatic complement to Electric Vehicles. A process in which a drained battery is exchanged for a fully charged battery at the Swapping Stations. Battery Swapping Stations have their own storage of fully charged batteries where the health of the batteries is examined and then sent to the charging area. The battery swapping stations are designed in such a way that complete processing of

charging and discharging is done with the station premises. These stations have high power grid system which supply the power continuously and avail the batteries beforehand. EV users have the battery swapping stations service application by which they send the request to the station service management team and this helps in quick availability of the batteries.

Statement of Problem

In general, one battery swapping station can only serve a fixed number of EVs before obtaining fully charged replenishments. The time taken by the stations is still the major problem in this field. This paper deals with the different methods that can be applied to improve the current battery swapping stations and to make the process a bit faster and less time consuming. Also, we are focusing on introducing the robotic automation.

Description of the Existing Situation

A battery back lifts system includes a frame having nutrunners mounted there on according to the battery pack fastener pattern for a vehicle. A power lift configured to raise and lower the frame with regard to the vehicle. A robotic device comes then and finds the location of the battery. This device lifts up and open the screws and pull down the drained battery and the same process is done in reverse order when charged battery is placed.

Description of Potential Solution

This paper deals with the two methods of swapping the EV batteries. In the first method we have taken a single ramp plate which will help in removing the discharged battery and then relocating the fully charged battery. The discharged battery will be sent to the charging station and freshly charged batteries will be made ready for the next cars. Second method is using two ramp plates instead of one. When the first one will remove the discharged battery soon after

it, the second plate will be released from the different end loaded with fully charged battery. And in this way the battery will be exchanged. This later process is less time consuming.

III. MODELING SIMULATION/ DATA ANALYSIS

The Electric vehicle will be placed in some particular area where the structure of and the control of the car will be given to Swapping Station technicians. The diagram below (Fig 1) is the basic picture of the robotic arm which will unravel the battery or open the screws. As we have fixed the location of the battery, the robotic arm will primarily focus on the assumed location. It is assumed that battery is attached to the vehicle by these four lock nuts.

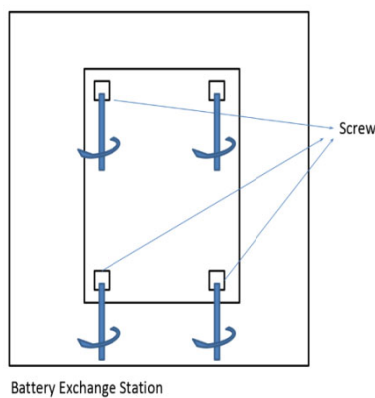


Fig 1

The Fig 2 depicts the overview of the Battery Swapping Stations. The used battery (discharged battery) is continuously sent to the charging stations and made available for the forthcoming Electric Vehicles.

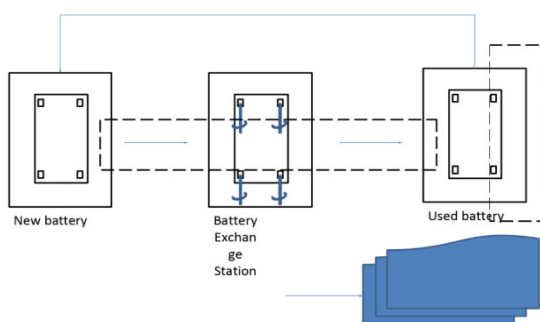


Fig 2

IV. INDSTRY TRENDS, BEST PRACTICES AND FITNESS GAP ANALYSIS

As we have discussed above about the different methods, here we are going to delineate the complete picture with the help of following diagrams. The first method in which only one ramp was used is in the Fig 3.

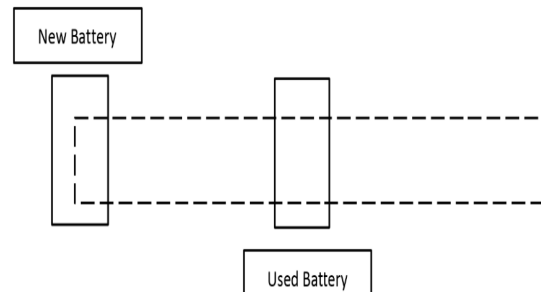


Fig 3.

The second method which is time efficient is mapped below in the Fig 4.

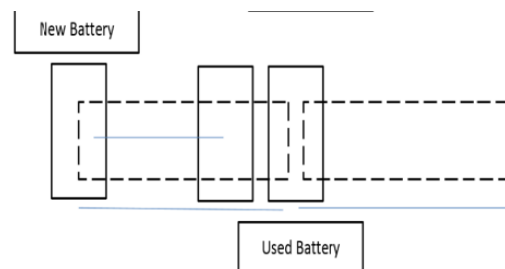


Fig 4.

V. CONCLUSION

Battery Swapping Stations are at a peak demand in the world. The above method proposed is a novel approach where hundreds of Electric Vehicles can get charged in span of an hour. As of now this method is based on some assumptions that is health of the battery and location of battery inside vehicle are not considered.

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CORPORATE SOCIAL RESPONSIBILITY OF HOTEL ESTABLISHMENT TOWARDS BUSINESS MANAGEMENT FOR ENVIRONMENTALLY FRIENDLY CASE STUDIES OF HOTELS IN RATTANAKOSIN DISTRICT

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Abstract - The important of Hotel Business in the tourism Industry plays an important role to the country's economy. At the same time, environmental problems and global warming are a major Global problem that organizations need to consider in order to achieve their business goals without sacrificing their Social responsibility. The research's objectives are as follows: 1. To study the basic information on corporate social responsibility of hotel establishments. 2. To study the factors affecting the corporate social responsibility of Hotel establishment to the business management for environmentally friendly. and 3. To propose a guideline for Social responsibility towards business management for environmentally friendly for hotel establishment in Rattanakosin District.

This Research collect Data, using of quantitative Research methods, from the sampling group of 120 employees and 3 Managements of hotel establishment in Rattanakosin District. To obtain information on environmentally friendly service, human resource development, public relation campaign of corporate social responsibility for environmental friendliness, environmentally friendly procurement, environmental and energy management, and the engagement of hotel establishment with local and community. The research data analyzed by descriptive and inferential statistics.

The research results were found that most of the hotel employees, in Rattanakosin district, are understanding and aware of social responsibility. While managements has policies and campaign for corporate social responsibility according to the guidelines set in the hotel operation plan.

Keywords - Corporate Social Responsibility, Environmentally Friendly, Business Management

THE IMPACT OF CAPITAL STRUCTURE ON THE PROFITABILITY OF OIL AND GAS INDUSTRY IN NIGERIA

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Abstract -

Optimum capital structure is a mix of debt and equity that maximize the firm's value and reduce the weighted average cost of capital (WACC). The survival, profit making and wealth creation of a firm depends on effective financing decision taken. This paper examines the impact of capital structure on the profitability of oil and gas firms in Nigeria. Secondary data was adopted for this research. The data were collected from the financial statements of seven oil and gas firms which are listed in the Nigeria stock exchange market. These data were analyzed using simple regression. The result of the research shows that capital structure is positively related to return on assets and shareholders' fund. The paper concludes that there is need for critical re-examination of the relationship between capital structure and profitability in the oil and gas industry in Nigeria. It is therefore recommended that management should give special attention to decisions on the financial structure of their organizations in order to maximize profit.

Keywords - Capital Structure, Profitability, Oil and Gas Firms

SEROLOGICAL AND MOLECULAR STUDY ON *Toxoplasma gondii* AMONG CANCER PATIENTS (LEUKEMIA AND LYMPHOMA)

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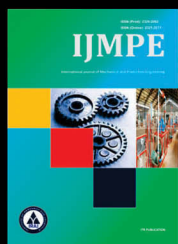
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Abstract -

Toxoplasma gondii is an intracellular protozoan parasite causes serious pathological effects in cancer patients, leading to great public health concern. The present study aimed to determine the prevalence of *T. gondii* among cancer patients (Leukaemia and Lymphoma) attending Basrah specialist children's hospital. Enzyme-linked immunosorbent assay (ELISA) was used to investigate the anti-antibodies against *T. gondii* type IgG and IgM. Blood samples were collected from 36 cancer patients and 15 healthy (non-cancerous individuals used as a control group) for comparison with the tested samples. All serum samples were tested for *T. gondii* immunoglobulin (IgG and IgM) antibodies and selected positive samples were examined by PCR. Significant differences were recognized between the ELISA test and PCR.

Keywords - Toxoplasma, Cancer, ELISA, IgG, IgM, Antibodies

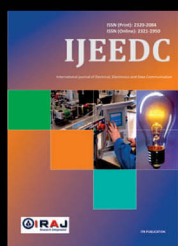
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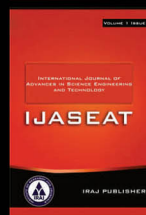
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