Open Science

Open Science Philosophy

Open science encompasses unrestricted access to scientific research articles, access to data from public research, and collaborative research enabled by information and communication technology tools, models, and incentives. Broadening access to scientific research publications and data is at the heart of open science. The objective of open science is to make research outputs and its potential benefits available to the entire world and in the hands of as many as possible:

- Open science promotes a more accurate verification of scientific research results. Scientific inquiry and discovery can be sped up by combining the tools of science and information technologies. Open science will benefit society and researchers by providing faster, easier, and more efficient availability of research outputs.
- Open science reduces duplication in collecting, creating, transferring, and re-using scientific material.
- Open science increases productivity in an era of tight budgets.
- Open science results in great innovation potential and increased consumer choice from public research.
- Open science promotes public trust in science. Greater citizen engagement leads to active participation in scientific experiments and data collection.

Open Science Index

The Open Science Index (OSI) currently provides access to over thirty thousand full-text journal articles and is working with member and non-member organizations to review policies to promote and assess open science. As part of the open science philosophy, and by making open science a reality; OSI is conducting an assessment of the impact of open science principles and restructuring the guidelines for access to scientific research. As digitalization continues to accelerate science, Open science and big data hold enormous promise and present new challenges for policymakers, scientific institutions, and individual researchers.

OSI is helping the global scientific research community discover, evaluate, and access high-quality research output. Renowned for its editorially curated and refereed collection of the highest-quality publications, OSI has always been and will remain free-of-charge.

OSI provides an efficient and thorough discovery process to the open science research database and provides links and free access to full-text articles. There are 50 open access journal categories that are curated and refereed by international scientific committees, the in-house editorial team, and trusted partners. Since its inception in 2007, OSI has made more than thirty thousand peer-reviewed open access full-text journal articles (PDF versions) freely available online without cost, barriers, or restrictions.

Open Science Access

With the Open Science Index, researchers can discover and access trusted peer-reviewed open access full-text scientific research articles with confidence. OSI helps researchers find appropriate non-profit open access journals to publish their work.

OSI gives one-click access to online full-text PDFs and expands the reach to global society by giving users free access from anywhere around the globe. Through cutting-edge open science collaboration, in an innovative public partnership, the non-profit OSI is devoted to making science open and reusable.

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Open Society

An open society allows individuals to change their roles and to benefit from corresponding changes in status. Open science depends to a greater or lesser extent on digital technologies and innovations in structural processes by an open society. When realized, open science research and innovation can create investment opportunities for new and better products and services and therefore increase competitiveness and employment. Open science research and innovation is a key component of thematic open science priorities. Central to the open science digital infrastructure is enabling industry to benefit from digital technology and to underpin scientific advances through the development of an open society. Open science research and innovation can also contribute to society as a global actor because scientific relations can flourish even where global relations are strained. Open science has a critical role across many areas of decision making in providing evidence that helps understand the risks and benefits of different open science choices. Digital technology is making the conduct of open science and innovation more collaborative, more global, and more open to global citizens. Open society must embrace these changes and reinforce its position as the leading power for science, for new ideas, and for investing sustainably in the future.

It is apparent in open society that the way science works is fundamentally changing, and an equally significant transformation is taking place in how organizations and societies innovate. The advent of digital technology is making research and innovation more open, collaborative, and global. These exchanges are leading open society to develop open science and to set goals for research and innovation priority. Open science goals are materializing in the development of scientific research and innovation platforms and greater acceptance of scientific data generated by open science research. Open science research and innovation do not need help from open society to come up with great ideas, but the level of success ideas ultimately reach is undoubtedly influenced by regulation, financing, public support, and market access. Open society is playing a crucial role in improving all these success factors.

Open Science

Open science represents a new approach to the scientific process based on cooperative work and new ways of diffusing knowledge by using digital technologies and collaborative tools. These innovations capture a systemic change to the way science and research have been carried out for the last fifty years. Science is shifting from the standard practice of publishing research results in scientific publications after the research and reviews are completed. The shift is towards sharing and using all available knowledge at an earlier stage in the research process. Open science is to science what digital technology is to social and economic transactions: allowing end users to be producers of ideas, relations, and services and in doing so, enabling new working models, new social relationships and leading to a new modus operandi for science. Open science is as important and disruptive as e-commerce has been for the retail industry. Just like e-commerce, the open science research paradigm shift affects the whole business cycle of doing science and research. From the selection of research subjects to the carrying out of research, to its use and re-use, to the role of universities, and that of publishers are all dramatically changed. Just as the internet and globalization have profoundly changed the way we do business, interact socially, consume culture, and buy goods, these changes are now profoundly impacting how one does research and science.

The discussion on broadening the footprint of science and on novel ways to produce and spread knowledge gradually evolved from two global trends: Open Access and Open Source. The former refers to online, peer-reviewed scholarly outputs, which are free to read, with limited or no copyright and licensing restrictions, while open source refers to software created without any proprietary restriction and which can be accessed and freely used. Although open access became primarily associated with a particular publishing

or scientific dissemination practice, open access already sought to induce a broader practice that includes the general re-use of all kinds of research products, not just publications or data. It is only more recently that open science has coalesced into the concept of a transformed scientific practice, shifting the focus of researchers' activity from publishing as fast as possible to sharing knowledge as early as possible. Open science is defined as the idea that scientific knowledge of all kinds should be openly shared as early as is practical in the discovery process. As a result, the way science is done in the future will look significantly different from the way it is done now. Open science is the ongoing evolution in the modus operandi of doing research and organizing science. This evolution is enabled by digital technology and is driven by both the globalization of the scientific community and increasing public demand to address the societal challenges of our times. Open science entails the ongoing transitions in the way research is performed, researchers collaborate, knowledge is shared, and science is organized.

Open science impacts the entire research cycle, from the inception of research to its publication, and on how this cycle is organized. The outer circle reflects the new interconnected nature of open science, while the inner circle shows the entire scientific process, from the conceptualization of research ideas to publishing. Each step in the scientific process is linked to ongoing changes brought about by open science, including the emergence of alternative systems to establish a scientific reputation; changes in the way quality and impact of research are evaluated; the growing use of scientific blogs; open annotation; and open access to data and publications. All institutions involved in science are affected, including research organizations, research councils, and funding bodies. The trends are irreversible, and they have already grown well beyond individual projects. Theses changes predominantly result from a bottom-up process driven by a growing number of researchers who increasingly employ social media in their research and initiate globally coordinated research projects while sharing results at an early stage in the research process.

Open science is encompassed in five schools of thought:

- the infrastructure school, concerned with technological architecture
- the public school, concerned with the accessibility of knowledge creation
- the measurement school, concerned with alternative impact assessment
- the democratic school, concerned with access to knowledge
- the pragmatic school, concerned with collaborative research

According to the measurement school, the reputation and evaluation of individual researchers are still mainly based on citation-based metrics. The h-index is an author-level metric that attempts to measure both the productivity and citation impact of the publications of a scientist or scholar. The impact factor is a measure reflecting the average number of citations to articles published in an academic journal and is used as a proxy for the relative importance of a journal.

Numerous criticisms have been made of citation-based metrics, primarily when used, and often misused, to assess the performance of individual researchers. These metrics:

- are often not applicable at the individual level
- do not take into account the broader social and economic function of scientific research
- are not adapted to the increased scale of research
- cannot recognize new types of work that researchers are performing

Web-based metrics for measuring research output, popularized as altmetrics, have recently received much attention: some measure the impact at the article level, others make it possible to assess the many outcomes of research in addition to the number of scientific articles and references. The current reputation and evaluation system has to adapt to the new dynamics of open science and acknowledge and incentivize

engagement in open science. Researchers engaging in open science have growing expectations that their work, including intermediate products such as research data, will be better rewarded or taken into account in their career development. Vice-versa, the use, and reuse of open data will require appropriate codes of conduct requiring, for example, the proper acknowledgment of the original creator of the data.

These ongoing changes are progressively transforming scientific practices with innovative tools to facilitate communication, collaboration, and data analysis. Researchers that increasingly work together to create knowledge can employ online tools and create a shared space where creative conversation and collaboration can occur. As a result, the problem-solving process can be faster, and the range of problems that can be solved can be expanded. The ecosystem underpinning open science is evolving very rapidly. Social network platforms for researchers already attract millions of users and are being used to begin and validate more research projects.

Furthermore, the trends towards open access are redefining the framework conditions for science and thus have an impact on how open innovation is produced by encouraging a more dynamic circulation of knowledge. It can enable more science-based startups to emerge thanks to the exploitation of openly accessible research results. Open science, however, does not mean free science. It is essential to ensure that intellectual property is protected before making knowledge publicly available in order to subsequently attract investments that can help translate research results into innovation. If this is taken into account, fuller and broader access to scientific publications and research data can help to accelerate innovation. Investments that boost research and innovation in open science would benefit society with fewer barriers to knowledge transfer, open access to scientific research, and greater mobility of researchers. In this context, open access can help overcome the barriers that innovative organizations face in accessing the results of research funded by the public.

Open innovation

An open society is the largest producer of knowledge, but the phenomenon of open science is changing every aspect of the scientific method by becoming more open, inclusive, and interdisciplinary. Ensuring open society is at the forefront of open science means promoting open access to scientific data and publications alongside the highest standards of research integrity. There are few forces in this globe as engaging and unifying as science. The universal language of science maintains open channels of communication globally. Open society can maximize its gains through maintaining its presence at the highest level of scientific endeavor, and by promoting a competitive edge in the knowledge society of the information age. The ideas and initiatives described in this publication can stimulate anyone interested in open science research and innovation. It is designed to encourage debate and lead to new ideas on what and open society should do, should not do, or do differently.

An open society can lead to a research powerhouse; however, open society rarely succeeds in turning research into innovation and in getting research results to the global market. Open society must improve at making the most of its innovation talent, and that is where open innovation comes into play. The basic premise of open innovation is to open up the innovation process to all active players so that knowledge can circulate more freely and be transformed into products and services that create new markets while fostering a stronger culture of entrepreneurship. Open innovation is defined as the use of purposive inflows and outflows of knowledge to accelerate internal innovation. This original notion of open innovation was primarily based on transferring knowledge, expertise, and even resources from one company or research institution to another. This notion assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they seek to improve their performance. The concept of open innovation is continually evolving and is moving from linear, bilateral transactions and collaborations

towards dynamic, networked, multi-collaborative innovation ecosystems. This means that a specific innovation can no longer be seen as the result of predefined and isolated innovation activities but rather as the outcome of a complex co-creation process involving knowledge flows across the entire economic and social environment. This co-creation takes place in different parts of the innovation ecosystem and requires knowledge exchange and absorptive capacities from all the actors involved, whether businesses, academia, financial institutions, public authorities, or citizens.

Open innovation is a broad term, which encompasses several different nuances and approaches. Two main elements underpin the most recent conceptions of open innovation: the users are in the spotlight and invention becomes an innovation only if users become a part of the value creation process. Notions such as user innovation emphasize the role of citizens and users in the innovation processes as distributed' sources of knowledge. This kind of public engagement is one of the aims of open science research and innovation. The term 'open' in these contexts has also been used as a synonym for 'user-centric'; creating a well-functioning ecosystem that allows co-creation and becomes essential for open innovation. In this ecosystem, relevant stakeholders are collaborating along and across industry and sector-specific value chains to co-create solutions for socio-economic and business challenges. One important element to keep in mind when discussing open innovation is that it cannot be defined in absolutely precise terms. It may be better to think of it as a point on a continuum where there is a range of context-dependent innovation activities at different stages, from research to development through to commercialization, and where some activities are more open than others. Open innovation is gaining momentum thanks to new large-scale trends such as digitalization and the mass participation and collaboration in innovation that it enables. The speed and scale of digitalization are accelerating and transforming the way one designs, develops, and manufactures products, the way one delivers services, and the products and services themselves. It is enabling innovative processes and new ways of doing business, introducing new cross-sector value chains and infrastructures.

Open society must ensure that it capitalizes on the benefits that these developments promise for citizens in terms of tackling societal challenges and boosting business and industry. Drawing on these trends, and with the aim of helping build an open innovation ecosystem in open society, the open society's concept of open innovation is characterized by:

- combining the power of ideas and knowledge from different actors to co-create new products and find solutions to societal needs
- creating shared economic and social value, including a citizen and user-centric approach
- capitalizing on the implications of trends such as digitalization, mass participation, and collaboration

In order to encourage the transition from linear knowledge transfer towards more dynamic knowledge circulation, experts agree that it is essential to create and support an open innovation ecosystem that facilitates the translation of knowledge into socio-economic value. In addition to the formal supply-side elements such as research skills, excellent science, funding and intellectual property management, there is also a need to concentrate on the demand side aspects of knowledge circulation, making sure that scientific work corresponds to the needs of the users and that knowledge is findable, accessible, interpretable and reusable. Open access to research results aims to make science more reliable, efficient, and responsive and is the springboard for increased innovation opportunities, e.g. by enabling more science-based startups to emerge. Prioritizing open science does not, however, automatically ensure that research results and scientific knowledge are commercialized or transformed into socio-economic value. In order for this to happen, open innovation must help to connect and exploit the results of open science and facilitate the faster translation of discoveries into societal use and economic value.

Open Science

Collaborations with global partners represent important sources of knowledge circulation. The globalization of research and innovation is not a new phenomenon, but it has intensified in the last decade, particularly in terms of collaborative research, international technology production, and worldwide mobility of researchers and innovative entrepreneurs. Global collaboration plays a significant role both in improving the competitiveness of open innovation ecosystems and in fostering new knowledge production worldwide. It ensures access to a broader set of competencies, resources, and skills wherever they are located, and it yields positive impacts in terms of scientific quality and research results. Collaboration enables global standard-setting, allows global challenges to be tackled more effectively, and facilitates participation in global value chains and new and emerging markets.

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Scholarly Research Review

The scholarly research review is a multidimensional evaluation procedure in which standard peer review models can be adapted in line with the ethos of scientific research, including accessible identities between reviewer and author, publishing review reports and enabling greater participation in the peer review process. Scholarly research review methods are employed to maintain standards of quality, improve performance, provide credibility, and determine suitability for publication. *Responsible Peer Review Procedure:* Responsible peer review ensures that scholarly research meets accepted disciplinary standards and ensures the dissemination of only relevant findings, free from bias, unwarranted claims, and unacceptable interpretations. Principles of responsible peer review:

• Honesty in all aspects of research
• Accountability in the conduct of research
• Professional courtesy and fairness in working with others
• Good stewardship of research on behalf of others

The responsibilities of peer review apply to scholarly researchers at all stages of peer review: Fairness, Transparency, Independence, Appropriateness and Balance, Participation, Confidentiality, Impartiality, Timeliness, Quality and Excellence, Professionalism, and Duty to Report.

Scholarly Research Review Traits:
• Scholarly Research Review Identities: Authors and reviewers are aware of each other's identity

• Scholarly Research Review Reports: Review reports are published alongside the relevant article

• Scholarly Research Review Participation: The wider academic community is able to contribute to the review process

• Scholarly Research Review Interaction: Direct reciprocal discussion between author(s) and reviewers, and/or between reviewers, is allowed and encouraged

• Scholarly Research Pre-review Manuscripts: Manuscripts are made immediately available in advance of any formal peer review procedures

• Scholarly Research Review Final-version Reviewing: Editorial revision of the language and format is conducted on the final version of the manuscript for publication

• Scholarly Research Review Platforms: The scholarly research review process is independent of the final publication of the manuscript and it is facilitated by a different organizational entity than the venue of publication

All submitted manuscripts are subject to the scholarly research review process, in which there are three stages of evaluation for consideration: pre-review manuscripts, chair-review presentation, and final-review manuscripts. All submitted full text papers, that may still be withstand the editorial review process, are presented in the conference proceedings. Manuscripts are tracked and all actions are logged by internal and external reviewers according to publication policy. External reviewers' editorial analysis consists of the evaluation reports of the conference session chairs and participants in addition to online internal and external reviewers' reports. Based on completion of the scholarly research review process, those manuscripts meeting the publication standards are published 10 days after the event date.

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Open Science Award

The International Research Conference (IRC) is an open science research organization dedicated to promoting advancement of science, engineering, and technology. The IRC's open science award program is pleased to announce research awards which are available to distinguished researchers who are currently based at or affiliated with a research university.

The purpose of this award is the recognition of open science research and publications. The award program coordinates and develops high impact scholarly research which seeks to promote multiscience approaches. The open science originates with the premise that universal scientific knowledge is a product of collective scholarly efforts. The social collaboration involves all stakeholders and knowledge belongs to the global society. Scientific outputs generated by public research are public good that should be available to all at no cost and without any barriers or restrictions.

The open science award is granted annually for outstanding achievements and excellence in scientific research. Any researcher who is interested in this award can submit their own and /or the colleagues' scholarly research articles for consideration for this honor. All respected researchers are warmly welcome to submit their research works for potential award consideration and evaluation. Qualitative and quantitative assessment of the open access articles submitted and published for consideration will be evaluation criteria for the award. The award emphasizes open science contributions, collaborations and communication, and the open publication of scholarly research knowledge.

This annual award will be given to one and up to three honorees (or research groups) in recognition of exceptional contributions to open science in the following three distinct research categories: Social Sciences, Life Sciences, and Physical Sciences. The selection committees (waset.org/Committees) are responsible for selecting the recipient(s) of the named award. The members of the open science award committee will promote excellence and transparency, allow broad input, recognition, diversity and commitment to equity so that the open science award is sufficiently representative of distinguished research groups.

Assignment of the open science award committee is performed primarily through the online submission and review system. The annual event is held to present awards and to celebrate distinguished researchers for their open science contributions.

Open Science Award Deadlines

Online Nomination Deadline: January 01, 2020 - December 31, 2020

Scoring Deadline: January 01, 2021 - March 31, 2021

Selection Deadline: April 30, 2021

Award Ceremony Date: June 30, 2021

Application Procedure

Applicants must submit the following to https://waset.org/profile/messages with the email subject line reading "OSA_surname_given name," e.g., OSA_Smith_John.

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Please include the following attachments to your email application:

1. Applicants should hold, at a minimum, a Ph.D. or its equivalent degree.

2. Cover letter to the Award Committee indicating interest in the award.

3. Curriculum vitae.

4. Research statement. Please include a description of your research accomplished (not more than two pages, single spaced), and published full text original research article in pdf format.

5. Two letters of recommendation. The applicant must request the letters (or the dossier service).

6. High-quality copies or scans of transcripts showing degrees (Bachelor, Masters, and Doctoral) and coursework.

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Postdoctoral Fellowship Award

The International Research Conference (IRC) is an open science research organization dedicated to promoting the advancement of science, engineering, and technology. The IRC's postdoctoral fellowship award is pleased to announce Fellowships which are available for postdoctoral researchers who are currently based at or affiliated with a research university. The postdoctoral fellowship award coordinates and develops high impact scholarly open science research which seeks to promote multiscience approaches. In addition, the fellowship award presents a unique opportunity for researchers who want to influence the future of open science through collaboration, communication, publication and data sharing within the global science community.

This postdoctoral fellowship award is looking for researchers with a passion for open science, open sources, open publications and data sharing. Applicants should already be working to promote research practices in a more collaborative, iterative and open dimension. Fellows will spend four months starting in June of 2020 as community catalysts at their own institutions creating, disseminating, and mentoring the next generation of open scientists, open data practitioners and researchers. The goal is to build lasting changes in the global open science community. Throughout the fellowship term, Fellows will receive training and support from the open science postdoctoral Fellowship award to develop and hone their skills around open science, open sources, data sharing, open science policy and licensing. Fellows will also craft policies and codes, write curriculum, teach their institutional peers, and be engaged in helping their local open science communities learn about open sources and open data practices.

Expectations: The open science postdoctoral Fellowship award anticipates applicants who:

- Create change within their university or other institution throughout open science, research, data sharing, and article publications.
- Create knowledge, policies and codes, curriculum and educational resources to promote open science.
- Participate in open science research workshops, symposia, conferences, and other activities.
- Participate in and help to lead regular open science research community call for proposals or papers.
- Serve as open science mentors and leaders within their research communities.
- Serve as reviewers for submitted open science abstracts and research papers for scholarly journals and conferences.
- Promote open science by communicating, publishing and sharing their high impact peer-reviewed research on an ongoing basis.

Note: Fellows are encouraged to continue their personal research for up to 20% of their time during the course of their fellowship (i.e., one day a week). Fellowship applicants must have buy-in from their advisors in advance and include their advisors' contact information on the application. The applicant's advisors will be interviewed should the applicant move on to the second round, and their support will be a critical consideration for the awarding of Fellowships.

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Fellowship Terms and Conditions

Award Scholarship Description

Application Deadline: April 30, 2020

- Fellowships are awarded to enhance the concept of open science and are open to scholars from all fields of science, engineering, and technology.

- The selected Fellow will receive a monthly stipend of $500.00 for four months during 2020 (June, July, August, and September). Fellows are responsible for remitting all applicable taxes and other government charges as required by their country of residence and by law.

Nationality: Fellowships are available to postdoctoral researchers in any country.

Requirements:

Fellows must:

• At a minimum, hold a Ph.D. or its equivalent by June 1, 2020, and should not have received the degree before 2018.

• Applicants should have working proficiency in the English language and should demonstrate their ability to read, write, and speak English.

• Applicants should be full-time academics or affiliated with a research university or institute.

• Funding will be direct to the Fellow and not distributed through their institution.

• Be able to travel.

• Obtain support from their advisors. Fellows will be based at their home institutions. Please note that a letter of support from the advisor is mandatory for consideration.

• Have experience participating in open science research.

Application Procedure:

Applicants must submit the following to https://waset.org/profile/messages with the email subject line reading "Postdoc_surname_given name," e.g., Postdoc_Smith_John.

Please include the following attachments to your email application:

1. Cover letter to the Search Committee indicating interest in the position.

2. Curriculum vitae.

3. Dissertation abstract.

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4. Research statement. Please include a description of your proposed research that would be accomplished during the fellowship (not more than two pages, single spaced).

5. Two letters of recommendation. The applicant must request the letters (or the dossier service).

6. High-quality copies or scans of transcripts showing degrees (Bachelor, Masters, and Doctoral) and coursework.

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COVID-19 Demographic Distribution, Clinical Physiognomics and Therapeutic Measures in Pakistan

Aneeqa Naz

***Abstract*—** Introduction

COVID-19 affected the whole globe. The disease pattern varied from one population to other.

Objective

To observe the demographic disease pattern, clinical presentation, effective treatment strategy and outcome of COVID-19 in native population.

Methods

A total of 2186 subjects with the suspicion of COVID-19 were enrolled in this study from 26thMarch till 14th August 2020. The diagnosis was confirmed by Reverse transcriptase Polymerase chain reaction (RT-PCR). We divided the subjects into four groups to treat them according to their clinical presentation. SPSS-23.00 was used to measures the frequencies. Chi-square test was used to observe the significant difference in disease distribution.

Results

Of total, 779 were found positive for COVID-19. Of 779, 47.11% were symptomatic. Of All positive subjects, no significant difference of disease spread was observed in young (<40 years) Vs. old age (>40 years) population [X2 = 3.14; P=0.076). There were 72.27% male with positive PCR. However, there were more asymptomatic female carriers than male (X2 = 11.68; P=0.001). Patients presented with one, two or multiple signs and symptoms (S/S) simultaneously. The most prominent S/S were Sever body aches (85%), Fever (80.9%), and loss of taste & smell (66.8%). Panadol and azithromycin proved effective to treat the disease symptoms. The average recovery time was 11±5 days. Overall mortality rate was 3.98%.

Conclusions

Significant information was gathered about COVID-19 disease pattern in Pakistani population. The observed frequency of morbidity/mortality, age and gender distribution the effective drugs and disease outcome will help in policy making to combat COVID-19 in this region.

***Keywords*—** COVID-19, Pakistan, transmission, immunity, herd.

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Rifampicin Resistant Paediatric Tuberculosis: Prevalence and Risk Factors

Bhavana Patil[1], Swapna Kanade[2], Gita Nataraj[3]

Abstract— Incidence of paediatric tuberculosis is rising in India. Rifampicin resistant paediatric tuberculosis reflects the intensity of ongoing transmission. Understanding the common risk factors for transmission of tuberculosis (TB) is important from epidemiological point of view. Hence this study was undertaken to determine the prevalence of rifampicin resistant tuberculosis and the common risk factors in pediatric patients.

Institutional ethics committee permission was obtained. Consecutive 210 clinically suspected pediatric tuberculosis cases referred to the mycobacteriology lab were enrolled in the study. Patients already on anti-tuberculosis treatment were excluded. Pulmonary and extrapulmonary specimens were processed for fluorescent microscopy, solid culture using Lowenstein-Jensen medium and Xpert MTB/RIF assay (Xpert assay). Clinical details, investigational details and risk factors with respect to close contact with tuberculosis case, malnutrition and environmental conditions were noted.

Of the 210 specimens, 12 specimens were excluded from study either due to unsuccessful results in Xpert assay or contamination on culture. Specimen was considered as positive for TB if any of the above tests was positive. Of the 198, 22(11.11%) children were microbiologically confirmed positive cases for tuberculosis. Positivity in male and female children was 10.81% and 11.49% respectively. On categorization of specimens, 154 were found to be pulmonary and 44 were extrapulmonary with positivity of 3.89% and 27.27% respectively. As a standalone test, microscopy, culture and Xpert assay detected MTB in 8 (4.04%), 19 (9.59%) and 20 (10.10%) of the cases respectively. Discordance between culture results and Xpert assay was observed in five specimens. Three specimens (two cerebro-spinal fluids and one gastric lavage) were culture negative and Xpert assay positive whereas two (pleural fluids) were culture positive and Xpert assay negative. Seven (31.81%) cases were resistant to rifampicin by both solid culture drug susceptibility test and Xpert assay.

Of 22 confirmed cases, 11 had history of close contact with tuberculosis case, 6 were suffering from malnutrition, four were living in overcrowded and inadequately ventilated area. Univariate analysis of these risk factors showed contact with sputum positive cases, malnutrition, overcrowding and inadequate ventilation (all having p value less than 0.05) were associated with acquisition of TB. Whereas, multivariate analysis showed only contact with sputum positive cases (p value 0.001, Odd's ratio 11.77, confidence interval 2.7 to 51.27) and malnutrition (p value 0.007, Odd's ratio 21.29, confidence interval 2.3 to 194.98) to be associated risk factors. Among seven children diagnosed with RRTB, risk factors such as close contact with sputum positive case, overcrowding and inadequate ventilation were found significant.

High prevalence of rifampicin resistant tuberculosis detected in pediatric cases is alarming. Greater emphasis on modifying risk factors such as close contact and malnutrition will help the TB program to prevent transmission in community.

Keywords— Paediatric tuberculosis, prevalence, rifampicin resistance, risk factors.

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The *in vivo* Nanoparticle Vaccination

Thomas V. Prevenslik

***Abstract*—**The Covid-19 *in vivo* nanoparticle vaccination proposed to BARDA in mid-2020 offered a practical alternative to the CDC vaccination paradigm of the past century. Instead of the long development time of a vaccine for everyone which is unacceptable for Covid-19 because of attendant social unrest and economic collapse, the Nanoparticle Treatment is limited to only patients already tested positive for Covid-19, the treatment provided a near term practical and economic alternative comprising an injection of a low dose of nanoparticles (NPs). Antigens including mRNA are excluded. Since UV radiation only needs be sufficient to inactivate a few of the Covid-19 virus in the patient to elicit immunity, the UV is produced from the injected NPs based on the Planck law which denies atoms in NPs the heat capacity to conserve heat by an increase in temperature, and instead EM radiation is produced. The CDC is requested to initiate a test program for the Nanoparticle Treatment as a backup to the current Covid-19 vaccination approach and future pandemics.

***Keywords*—**Covid-19, Planck law, nanoparticles, treatment.

I. INTRODUCTION

The CDC approach to the Covid-19 virus was to quickly develop a vaccine which even if successful in the near term would be impossible to implement for the ~8 billion people in the world, let alone unacceptable because of attendant social unrest and economic collapse.

II. ALTERNATIVE

In mid-2020, a new treatment for Covid-19 was proposed to BARDA. Unlike the traditional vaccine approach applicable to everyone, the treatment targeted only the relatively small number of patients who tested positive for the virus, an approach which can be reasonably be implemented world-wide. Moreover, biotics and messenger mRNA including externally prepared antigens of the Covid-19 virus having yet unknown side effects were excluded. Moreover, Covid-19 antigens are thought known, but may not be the same as the mutated form in the individual patient. The ideal antigen would therefore be the inactivated Covid-19 virus within the individual patient.

Inactivation of the specific patient's Covid-19 virus may proceed as in Ultraviolet Blood Irradiation (UBI) by irradiating blood externally from the patient by UV laser, but there is no known source of UV in the human bloodstream.

III. PROPOSAL

Implement the Nanoparticle Treatment comprising injecting the tested positive Covid-19 patient with biodegradable lipid nanoparticles (NPs) in saline, the NPs producing UV radiation to inactivate the actual live Covid-19 virus in the patient.

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IV. THEORY

The Nanoparticle Treatment is not strictly a vaccine, but may be considered an *in vivo* vaccine using UV to inactivate the live Covid-19 virus in the patient to produce inactivated virus that act as the antigen to elicit immunity to current and future Covid-19 infections of the patient. The injection of NPs need not inactivate all virus in the patient as only a few inactivated viruses are necessary to elicit Covid-19 immunity.

The UV is produced by the simple QED theory of nanoscale heat transfer finding basis in the Planck law which denies atoms in NPs the heat capacity to conserve heat by an increase in temperature. Instead, heat from the surroundings is conserved by creating EM radiation at a wavelength depending on the NP size, e.g., 80 nm lipid NPs emit UVC (254 nm) radiation.

V. DISCUSSION

Today, the Pfizer-BioNTech vaccine and others having over 95% efficacy are found to lose immunity prompting re-vaccinations. Instead, the Nanoparticle Treatment offers a simple and economic solution to further vaccinations. In this regard, future development in the delivery of the NPs by inhalers or pills avoiding undesirable injections would provide Covid-19 immunity as required.

Of importance, the NP induced UVC inactivates the Covid-19 virus, but also causes collateral DNA damage which if in the brain can cause neurological symptoms in the patient. By controlling the NP dose; however, the UVC is held to low levels allowing recovery by our extraordinary DNA repair system as was the case for the survival of organisms during the UV intense primitive Earth. The CDC is requested to conduct experimental verification of the allowable NP dose levels to avoid neurological symptpms.

VI. CONCLUSIONS

The CDC conduct a thorough testing and verification program for the development of the Nanoparticle Treatment as an alternative to traditional vaccination previously requested from BARDA in mid-2020.

Elucidating the Role of the Overexpressed Protein Convertase 9 in Colon Cancer Stem Cells

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Protein convertases (PC) is a large family of serine proteases PC9, belongs to a family of 9 members of serine proteases involved in limited proteolysis of secretory protein precursors that are involved in various biological functions, such as embryo development, reproduction, immune response, and in numerous pathologies, including neurological disorders, infectious diseases, dyslipidemias, and even cancer.

In this work, in order to know its possible involvement in tumor malignancy, we have measured the expression by qPCR (polymerase chain reaction) a WB (wester-blot) of the several PC convertases and stem cell markers in colon cancer cell lines. We found overexpression of this PC9, among others. This protein is known to lead to the dysregulation of numerous pathways, including those that regulate the cell cycle, apoptosis, and inflammation. However, its role in tumor progression is yet to be elucidated.

To study PC9 role in Cancer Stem Cells (CSC), we transfected SW620 PC9 siRNA, confirmed by western blotting. SW620 cells with PC9 depleted were dedifferentiated to colonospheres (also known as CSC). The size of the spheres was measured after taking the pictures at different times.

Finally, to better understand this PC's mechanism of action and its substrates, in vitro overexpressed PC9 with a His-tag was purified from genetically modified cells and analyzed by mass spectrometry. One hundred twenty-three proteins were detected and expressed in a tree diagram depending on the protein ontology and literature information. The 123 proteins detected five were selected for deeper study related to stemness and differentiation in different cellular pathways: TGF-BR2, PDGFR2, SOX2, ALDHL12, EpCAM.

An Investigation into Kenyan Teachers' Views of Children's Emotional and Behavioural Difficulties

Fred Mageto

***Abstract*—**a great number of children in mainstream schools across Kenya are currently living with emotional, behavioural difficulties. This study aims to explore teachers' perceptions of children's emotional and behavioural difficulties (EBD) and their attributions of the causes of EBD. The relevance of this area of study to current educational practice is illustrated in the fact that primary school teachers in Kenya find classroom behaviour problems one of the major difficulties they face. The information presented in this study was gathered from 182 teachers that responded back to the survey, of whom 27 teachers were later interviewed. In general, teachers' perceptions of EBD reflect personal experience, training, and attitudes. Teachers appear from this study to use words such as indifferent, frightened, withdrawn, aggressive, disobedient, hyperactive, less ambitious, lacking concentration, and academically weak to describe pupils with emotional and behavioural difficulties (EBD). The implications of this study are envisaged as being extremely important to support teachers addressing children's EBD and shed light on the contributing factors to EBD for a successful teaching-learning process in Libyan primary schools.

***Keywords*—**Teachers, Children, Learning, Emotional and Behaviour Difficulties.

I. Introduction

THERE has been a growing concern with children's behaviour in mainstream schools in Kenya and with the number of children excluded from quality education due to their emotional and behavioural difficulties [1]-[4]. In fact, teachers over the world seem to use interchangeably similar words to describe the same phenomenon of EBD, despite differences in educational context, philosophy, belief and practices. Similarly, teachers often feel challenged by their pupils' behaviour and puzzled to find proper ways to address pupils' EBD (e.g. Kenya, [5], [6]; England, [7]-[10]; America: [11]; Canada: [12], [13]; Jordan: [14]). It is widely acceptable in Libyan society's common sense view of schools that teachers are currently spending more time managing difficult behaviour than actually teaching [6], [15]. Similar concerns have been expressed by educators in the United Kingdom [16].

II. The Term Emotional and Behavioural Difficulties (EBD)

It is fair to begin by saying that the notion 'emotional and behavioural difficulties' (EBD) is not straightforward; rather it ranges across a continuum. EBD are manifested in a variety of different forms and severities. In fact, the complexity to define the notion of emotional and behavioural difficulties (EBD) is well highlighted in the literature, reflecting a range characteristics which may appear less obvious e.g. a phobia of school or deteriorating emotional well-being or behaviour can also signal emotional behavioural difficulties. Children with these problems exhibit unusual problems of adaptation to a range of physical, social and personal situations. They may set up barriers between themselves and their learning environment through inappropriate, aggressive, bizarre or withdrawn behaviour [17].

All through this study the term "EBD" is used to cover all children for whom behaviour in the widest sense is a source of concern. This, however, is not constrained to aggressive and disruptive children alone; disturbed children, e.g., anxious or withdrawn children are also included in this term. There are many children who may have experienced, to a large degree, emotional difficulties without showing any sign of behavioural difficulties. Therefore, the focus should be on both extrovert and introvert behaviour. In recent years, children's EBD has been front-page news reflecting an increasing public concern toward antisocial behaviour, street fighting, the spread of weapons and war between communities, besides the lack of educational provision to fix the problem. Drawing upon this crisis in Libyan schools, it is often argued by the Libyan Teachers' Union that the needs of classroom teachers have not been addressed in government policies. More recently I echoed the teachers' union concerns (e.g. [1], [18]) unless the demands of teachers are considered, children's behaviour and literacy standards would decline. In line with this, Al-Shapani (2001) [6] perceived the removal of personal and social education from the national curriculum as a major factor in the growing antisocial behaviour at schools. Additionally there is statistical evidence in the National Report for Development of Education (2008) [2] suggests significant proportion of EBD children have failed academic promotion over the years.

Having reviewed the western literature it is obvious that much work on the problem of children's EBD and its origins has been undertaken [7]-[10], [19], however, very few studies have focused on the effect school organisation may have on its pupils, particularly in relation to the school climate, system of rewards and punishment, assessment, attitudes and actions of teachers and other professionals towards pupils' academic, personal and social needs [20], [21]. There is also a need to scrutinise professionals' conflicting accounts of children's EBD in the assessment process. Similarly, there is a considerable need to listen to children's and parents' accounts in regard to issues which pertain directly to them [6], [18], [22], [23]. Yet, despite the current plethora of literature on EBD, and

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despite the recognition in the literature of the effect of the wider context on children's EBD, the focus of remedial procedures remains on the individual pupil or the teacher's reaction to the behaviour of the individual pupil (see for instance, [7]).

Furthermore, research in the Arab literature concerning special education in mainstream schools (e.g. [1], [6], [14]) has highlighted the need to clarify the area of special education in the Arab world in order to effectively address children's learning, emotional and behavioural difficulties within mainstream settings. There is also a general consensus among these researchers that the current atmosphere of primary classrooms is chaotic, and hence classroom discipline becomes challenging and an unbearable experience for many teachers. In a similar way, these researchers found the role of the school and national curriculum in originating children's special educational needs to be significant factors.

Evidence from the above body of research tells us that adults' perceptions, e.g., teachers' and parents' of children's behaviour can influence the children's attitudes toward their education. Children perceived to have emotional and behavioural difficulties (EBD) are often treated differently from children perceived to not have such 'problem'. Likewise, children with EBD are at higher risk for developing adjustment problems. In Kenya, for instance, we know that school professionals' perceptions of children's behaviour are important, not least because they play a major role in shaping the child's life, yet we know very little, if anything, about how teachers view children's EBD and how these views influence the level of support given to such children. Thus, it is essential to explore how far and how successfully theory has been translated into practice by teachers in their work with children displaying EBD in mainstream schools.

Drawing on previous research findings e.g. Gadour (2006) [15] and work experience with children encountered with enormous behaviour difficulties both in Kenya and the United Kingdom, I become very interested in how the term 'EBD' is construed by school teachers. In a previous research (e.g. [15]) I found troublesome pupils in mainstream schools in Kenya, particularly boys, are very often excluded from schools or alternatively left to their own devices until they eventually give up and leave schools. The dilemma perceived by teachers that pupils' behaviour more often than not let them down with the schools' rules and regulations, though there was evidence which held the school system responsible for pupils' failing to accommodate to the discipline procedures, e.g., corporal punishments which provoke pupils to challenge them (see for instance, [1], [15]). In relation to this, the United Nations Office in 1998 [23] (see also, [2]-[4]) underlined the growing concern with the number of pupils excluded from mainstream schools because of their behaviour. Following the publication of the United Nations Report in 1998 [23] , the National Educational Report (2008) [2] has also confirmed the dramatic increase in the number of those who left education before the school leaving age between 1990–2000, though this does not necessarily reflect pupils' behaviour problems. However, the report indicates a significant association with low academic achievement reflecting the pressure imposed by the national curriculum upon pupils to score high marks for promotion, and large class sizes that make individualised attention very difficult, leading teachers to look for consistency of pupils rather than diversity. Away from the family and within child explanations of children's EBD, Lund (1990) [24] states that:

> "most workers now see the child's difficulties as a function of inappropriate curriculum content and this view has been strengthened by the Elton Report."

Similarly, teachers in Kenya appeared to work under extreme pressure because of a rigid national curriculum in which they are instructed to pass on a great deal of academic knowledge in a very short period ([2]-[4]), [6], [18])This required teachers to tackle pupils' academic problems more readily compared with pupils' EBD. Drawing upon the current intervention procedures used in schools to handle pupils' antisocial behaviour in Kenya, the United Nations Office in Geneva (1998) [23] expressed concerns with the increasing use of corporal punishment in schools. The report also suggested that despite the civil law (in Kenya) which prohibits adults, e.g. teachers from using any physical punishment with children, this does not guarantee children are not violated [23]. In this respect, nothing has been done by the present Kenya government to address the educational needs of children and provide them with appropriate support. Unfortunately there are as yet a great number of children who are segregated because they fail to conform to school standards, e.g., failing the academic requirements [school's exams] or their behaviour is found intolerable by teachers [18]. As a result, many of those children end up going to vocational training sectors or military services against their wishes and is perceived as too ambitious to carry on in further education. In contrast to the views of the school professionals in the assessment process, children's opinions, like parents, are given much less weight [1], [25].

III. Study Method

This study began by sending questionnaires out to primary school teachers at different Local Education Authorities in Kenya with the aim of identifying pupils with EBD. A total of 225 questionnaires were distributed to school teachers according to the number of teaching staff provided by the heads of the schools involved. Of the total number of teachers 182 responded back, of whom only 27 agreed to be interviewed. Following the return of the questionnaires, semi-structured interviews were prepared for further investigation. The formulation of the interview questions was based on the findings of the teachers' questionnaires and observation notes; this was with the aim to respond to the following major area of inquiry:

The characteristics of pupils identified as having emotional and behavioural difficulties. Therefore a triangular method was applied in this study to construct a rich picture of the children's EBD and get comprehensive perspective of the factors which contribute to their difficulties in primary classrooms. Denzin

(1989) [26], described this type of method as fruitful and reliable to generate more sound accounts.

Hence, teachers were asked in the questionnaire for information on actual and more recent cases in their classrooms rather than hypothetical examples as it was felt that this would present a more accurate picture of children's EBD. General data was also requested concerning the resources available to teachers to support children with special educational needs. In short, the questionnaire was the focal point in which this study was based. Following the return of the questionnaires, preliminary analysis of the questionnaire was made to identify the number of teachers who gave their consent to be interviewed about the information in the questionnaire. Further analysis of the responses of those who agreed to take part in the interview was also made to identify children with EBD and later observe them within their classrooms where the problem occurred naturally. Meanwhile teachers were also observed and interviewed. Thus, the broad and overruling aim of this study was to investigate the primary school teachers' views of children experiencing EBD special in classroom, and in doing so it looked at teachers' attributions of the causes of children's EBD.

IV. Discussion

The findings of this study suggest that there is a need for more personal and social education in schools, reflecting that of Al-Shapani (2001) [6], to support children with learning, emotional and behavioural difficulties. It appears from this study that teachers are working under extreme pressure to pass on academic knowledge rather than actually enhancing children's self-belief and confidence so that they can use their education more effectively. In line with the National Report for Development of Education (2008) [2] this study showed there is a strong link between pupils' behaviour and learning difficulties, implying that the focus should be on both rather than training teachers merely to reduce pupils' academic failure. In a similar way, the National Report for Development of Education showed that pupils were held back not only because of their learning difficulties but also due to behaviour problems (See also [5]). In like manner the report described the number of children who gave up school as unprecedented and alarming, reflecting children's accumulated frustrations to comply with the schools' expectations. Equally, although the report showed a tendency to portray children's behaviour as indifferent, it stressed children's disruption behaviour to classroom routine [5]. In actual fact, the association between low attainments and emotional and behavioural problems is evident from this study. The results suggest that there is a steadily increasing number of children with EBD whose failure to comply with the school's rules and regulations reflects a considerable amount of learning pressures imposed by a restricted national curriculum. Thus, this suggests that programme implemented is too formal and that there is a need for a more flexible educational programme to be implemented in primary schools in order to boost children's confidence.

In general, teachers' perceptions of children's EBD reflect multiple factors of school professionals and children, including children's behaviour and backgrounds, and professionals' personalities, backgrounds, attitudes and levels of experience. Various terms and definitions have been used by teachers in this study to describe the same phenomena (EBD), though discrepancies exist among teachers reflecting the complexity of the term EBD. In fact, the lack of consensus among teachers to reach one common definition of EBD in this study verifies the dominant view in the literature that this term is unavoidably subjective (see, for example, [8], [10], [19], [27]-[31]). Whilst this can be explained in part by different theoretical views of how such behaviour develops and is interpreted by different individuals, it should be noted that children (in Kenya) are taught from an early age to behave and react in various ways with different individuals e.g. parents, relatives, teachers and other people. Indeed, the motives of a child to behave appropriately towards parents and other relatives may differ from those towards school professionals and other children (see, [15]). Strictly speaking, children are required to be more polite and respectful in the presence of parents, relatives and older people, reflecting the traditional belief and duty towards these people [32]. Taking this into consideration, children may have to play different roles merely to satisfy their parents' feelings or those of relatives, disguising their own emotions toward certain incidents or difficulties that face them in life. To exemplify this, children in Kenya are brought up to accept teachers' decisions, particularly those who come from the same family background (relationship), though they may disagree with them strongly. Thus, in Kenya behaviour is quite often interpreted in cultural terms.

In a similar way, teachers' assessments of children's behaviour are often guided by the level of relationship they have with children, attitudes and the academic performance of children in the classroom – factors such as family ties and tribe-hood are significant (within the Kenyan community) in influencing teachers' views and opinions with regard to children's overall development. In fact, teachers know that parents' expectations of them as professionals vary from one parent to another. While traditional parents (older parents) are more keen to see teachers discipline children (i.e. they value personal and social education), modern parents appear preoccupied with children's promotion to the next year (concern with academic achievement). However, it should be stressed that the stronger the relationship with teachers, the greater the expectation of parents for teachers to respond to children's special educational needs. In a similar way, children know that their behaviour is under more scrutiny when they are taught by teacher relatives compared with non-relative teachers. While the same can be said of teachers' performance and attitudes toward pupils, it is often the other way around. Although this remains an unexplored area, particularly in traditional societies like Kenya where children's behaviour tends to be very much influenced by the level of relationship they have with the school's staff, it is one which should be taken into account when interpreting pupils' learning, emotional and behavioural difficulties. This should not imply that teachers in this study reacted unprofessionally towards pupils' behavioural problems, but rather draw attention to the expectations of the culture concerned. What appears significant, however, from this study,

is that teachers in general seem to explain pupils' EBD according to their level of experience and training. Within the teacher groups in this study (e.g. less experienced teachers and experienced teachers), EBD children are perceived differently, reflecting the backgrounds that underpin teachers' expertise and knowledge. There seem to be two main groups of teachers: newly experienced teachers and experienced teachers whose education and training represent two different educational systems. The former appear to represent the current educational system, which is frequently perceived by the public as being generally weak for neglecting personal and social education, while the latter represent the traditional educational system which is highly thought of by people in Kenya for considering the overall education of pupils' personal, social and academic education. In line with this division, more pupils are reported by the newly experienced teachers to have special educational needs compared with the experienced teachers, who have identified far less pupils with learning, emotional and behavioural difficulties. Although this endorses the dominant opinion highlighted in previous studies (e.g. [15]) of the newly qualified teachers as inexperience and lack of ability to handle pupils' learning and behaviour problems, this should not lessen the responsibility of the Ministry of Education and Local Educational Authorities (LEAs) for the current lack of relevant teacher training and support required to cope with children's EBD, and hence manage day-to-day classroom difficulties.

V. Conclusion

In conclusion, no major differences were found in defining EBD from the literature, apart from that this term was repeatedly explained by teachers' level of experience, training, characteristics and relationships with children. The complexity of defining EBD appears evidenced from this study too, reflecting the subjectivity of the term, though teachers, particularly newly qualified teachers, seem to portray children's EBD as often intolerable and unacceptable behaviour which should not be allowed to continue within the classroom. However, even though children allegedly were often referred to school social services because of emotional and behavioural difficulties, their problems appeared to be learning based. In contrast, experienced teachers appear to accept children's behaviour as part and parcel of childhood and allow room for conciliations with children and parents.

Once again, the results of this study suggested that the factors responsible for children's special educational needs in general were not dissimilar from those already in the literature, though some can be attributed to traditional constraints and the social changes that took place over the last two decades within the culture concerned, reflecting an invasion of western media to the Arab culture. Three major sources for the child's EBD were found: teachers and school, home and parents and within child factors. All of which appear from this study interrelated. Regardless of the origins of EBD, school remains the place where children frequently display behavioural problems.

The study also showed increasing lack of school and government policies with regard to special educational needs in general. This, in many respects, appeared to expose teachers to overwhelming pressure from the public. In a similar way, the results confirm the old anecdote in which schools were more ready to address pupils' academic difficulties as opposed to their emotional and behavioural ones. In line with this, individual intervention with children's special educational needs appeared dominant from this study, though teachers claimed to move away from these practices toward a more consultative approach with school professionals. Traditional use of sanction in the form of corporal punishment appeared widespread among teachers to discipline children as opposed to complement and praise. This is often attributed to children's failure to meet the school's standards and expectations - whether this is a result of exam failure on behalf of the children. There is growing concern that learning in primary schools in Kenya is still led by assessment which may fall far short of children's and parents' expectations of how education should be. Therefore, there should be a move towards a more inclusive curriculum, responding to the wider needs of children in primary schools, reducing the pressure of traditional assessment, while making sure that education at this stage is an enjoyable experience for all children.

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Utilizing Topic Modelling for Assessing Mhealth App's Risks to Users' Health before and during the COVID-19 Pandemic

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***Abstract*—** BACKGROUND: Software developers utilize automated solutions to scrape users' reviews to extract meaningful knowledge to identify problems (e.g., bugs, compatibility issues) and possible enhancements (e.g., users' requests) to their solutions. However, most of these solutions do not consider the health risk aspects to users. Recent works have shed light on the importance of including health risk considerations in the development cycle of mHealth apps to prevent harm to its users.

PROBLEM: The COVID-19 Pandemic in Canada (and World) is currently forcing physical distancing upon the general population. This new lifestyle made the usage of mHealth applications more essential than ever, with a projected market forecast of 332 billion dollars by 2025. However, this new insurgency in mHealth usage comes with possible risks to users' health due to mHealth apps problems (e.g., wrong insulin dosage indication due to a UI error).

OBJECTIVE: These works aim to raise awareness amongst mHealth developers of the importance of considering risks to users' health within their development lifecycle. Moreover, this work also aims to help mHealth developers with a Proof-of-Concept (POC) solution to understand, process, and identify possible health risks to users of mHealth apps based on users' reviews.

METHODS: We conducted a mixed-method study design. We developed a crawler to mine the negative reviews from two samples of mHealth apps (my fitness, medisafe) from the Google Play store users. For each mHealth app, we performed the following steps:

- The reviews are divided into two groups, before starting the COVID-19 (reviews' submission date before 15 Feb 2019) and during the COVID-19 (reviews' submission date starts from 16 Feb 2019 till Dec 2020).

For each period, the Latent Dirichlet Allocation (LDA) topic model was used to identify the different clusters of reviews based on similar topics of review

The topics before and during COVID-19 are compared, and the significant difference in frequency and severity of similar topics are identified.

RESULTS:

We successfully scraped, filtered, processed, and identified health-related topics in both qualitative and quantitative approaches. The results demonstrated the similarity between topics before and during the COVID-19..

***Keywords*—** natural language processing (NLP), topic modeling, mHealth, COVID-19, software engineering, telemedicine, health risks.

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Fresh Myopic Corneal Lenticule Implantation in Keratoconus Disease with Relex Smile Surgery 12 Months-Long-Term Results

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***Abstract*—** Purpose: Our study aims to examine the effectiveness and feasibility of fresh myopic lenticule implantation using VisuMax Femtosecond Laser Smile surgery in patients diagnosed with keratoconus disease and to demonstrate that it provides long term corneal thickness and visual acuity by decreasing the K values.

Methods: All the recipient patients were clinically diagnosed with progressive keratoconus. 20 myopic eyes underwent SMILE surgery (first group), and 20 eyes underwent fresh lenticule implantation (lenticule group). Visual acuity, corneal topography, and anterior segment optical coherence tomography were analyzed.

Results: The central corneal thickness considerably increased on the same day of the implantation surgery, and the visual acuity started to improve 1-week postoperatively. The central corneal thickness was still preserved after 1-year follow-up without any signs of rejection. Corneal topography showed a statistically minimal decrease in the anterior K1 and K2. All the grafts were visible by anterior segment optical coherence tomography observation with a positive connection between donor and recipient cornea. No complications were observed during the long-term follow-up.

Conclusion: Our study shows that the implantation of fresh myopic lenticule, which contains live stromal stem cells and live keratocytes, effectively and safely increases the central corneal thickness and the vision with long term sustainability with no adverse effects in keratoconus eyes. Thus, the results state that the fresh myopic lenticule implantation in keratoconus patients is a new reliable technique.

***Keywords*—** Fresh Myopic Lenticule Implantation, Keratoconus, Small Incision, Smile Surgery, Stromal Stem Cells.

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Digital Health During a Pandemic: Critical Analysis of the COVID-19 Contact Tracing Apps

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***Abstract*—** Virologists and public health experts have been predicting potential pandemics from coronaviruses for decades. The viruses which caused the SARS and MERS pandemics, and the Nipah virus led to many lost lives but still the COVID-19 pandemic caused by the SARS-CoV2 virus surprised many scientific communities, experts and governments with its ease of transmission and its pathogenicity. Governments of various countries reacted by locking down entire populations to their homes to combat the devastation caused by the virus which led to loss of livelihood and economic hardship to many individuals and organizations. To revive national economies and support their citizens in resuming their lives, governments focused on the development and use of contact tracing apps as a digital way to track and trace exposure. Google and Apple introduced the Exposure Notification Systems (ENS) framework. Independent organizations and countries also developed different frameworks for contact tracing apps. The efficiency, popularity and adoption rate of these various apps have been different across countries. In this paper, we present a critical analysis of the different contact tracing apps with respect to their efficiency, adoption rate and general perception, and the governmental strategies and policies which led to the development of the applications. When it comes to the European countries, each of them followed an individualistic approach to the same problem resulting in different realizations of a similarly functioning application with differing results of use and acceptance. The study conducted an extensive review of existing literature, policies and reports across multiple disciplines, from which a framework was developed and then validated through interviews with six key stakeholders in the field, including founders and executives in digital health startups and corporates as well as experts from international organizations like The World Health Organization. A framework of best practices and tactics is the result of this research. The framework looks at three main questions regarding the contact tracing apps; how to develop them, how to deploy them, and how to regulate them. The findings are based on the best practices applied by governments across multiple countries, the mistakes they made, and the best practices applied in similar situations in the business world. The findings include multiple strategies when it comes to the development milestone regarding establishing frameworks for cooperation with the private sector and how to design the features and user experience of the app for a transparent, effective and rapidly adoptable app. For the deployment section, several tactics were discussed regarding communication messages, marketing campaigns, persuasive psychology and the initial deployment scale strategies. The paper also discusses the data privacy dilemma and how to build for a more sustainable system of health-related data processing and utilization. This is done through principles-based regulations specific for health data to allow for its avail for the public good. This framework offers insights into strategies and tactics that could be implemented as protocols for future public health crises and emergencies whether global or regional.

***Keywords*—** Contact Tracing Apps, COVID-19, Digital Health Applications, Exposure Notification System.

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Jump Height, Single-Leg Stability, and Whole-Body Stability Performance in Young Cross-Country Skiers

Author: Frank Rizzo

***Abstract*—** The purpose of this study was to investigate if a 9-week training intervention composed of different mobility and stability exercises intending to improve jump height, whole-body stability, and single-leg stability of junior cross-country skiers. It was also of interest to see if the test equipment could determine the study participants' potential risk of injury with a built-in injury predictor measurement, Musculoskeletal Health (MSK). A total of 16 cross-country skiers aged 16-20 years, 8 man and 8 women, performed the following tests on a force plate; Jump Scan (i.e., to characterize an individual's dynamic movement strategy), Plank Scan (i.e., to measure the individual's ability to control global static stability across each extremity), and Balance Scan (i.e., the individual's ability to maintain their center of mass over their center of pressure). After the initial scan, participants were assigned to the same 9-week intervention program. Group 1 performed the program 3 times each week and Group 2 once each week before performing a post-intervention scan. Using two-way ANOVA showed no significant between-group differences. There was no significant difference when using three-way ANOVA within both intervention groups, except higher CMJ Load scores ($p=0.032$) and reduction in Plank scores, Plank Left ($p=0.024$) in male participants. Using logistic regression tests to determine the correlation between jump height (CMJ) outcomes effect on MSK injury risk between groups and within gender, a significant correlation in females was shown ($p=0.0280$, $R=0.46$). The present study's results suggest that a 9-week training intervention is not sufficient when training either one or three times per week for improving jump height, whole-body stability, and single-leg stability in junior cross-country skiers.

***Keywords*—** Balance, core stability, full-body test, olympic winter sport, rate of force development, vertical ground-reaction forces.

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Beyond Recognition: Beliefs, Attitudes, and Help-Seeking for Depression and Schizophrenia in Ghana

Peter Adu

***Abstract*—**Background: There is a paucity of mental health research in Ghana. Little is known about the beliefs and attitudes regarding specific mental disorders in Ghana. Method: A vignette study was conducted to examine the relationship between causal attributions, help-seeking, and stigma towards depression and schizophrenia using lay Ghanaians (N = 410). This adapted questionnaire presented two unlabelled vignettes about a hypothetical person with the above disorders for participants to provide their impressions. Next, participants answered questions on beliefs and attitudes regarding this person. Results: The results showed that causal beliefs about mental disorders were related to treatment options and stigma: spiritual causal attributions associated positively with spiritual help-seeking and perceived stigma for the mental disorders, whilst biological and psychosocial causal attribution of the mental disorders was positively related with professional help-seeking. Finally, contrary to previous literature, belonging to a particular religious group did not negatively associate with professional help-seeking for mental disorders. Conclusion: In conclusion, results suggest that Ghanaians may benefit from exposure to corrective information about depression and schizophrenia. Our findings have implications for mental health literacy and anti-stigma campaigns in Ghana and other developing countries in the region.

***Keywords*—**stigma, mental health literacy, depression, schizophrenia, spirituality, religion.

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Imaged-Based Characterization of Powder Flow

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***Abstract*—** Powder flowability plays an important role in die filling during tablet manufacturing. The present study introduces a novel small-scale measuring technique for powder flow. Based on image analysis, the flow was defined depending on the variation of luminous intensity and the movement of powder inside the measurement cuvette. Using quantities around 100 mg it was possible to characterize a wide range of common pharmaceutical powders, especially in distinguishing subtle differences in flow caused by minor changes in samples characteristics. The method was compared with powder rheometry, which is widely used in the pharmaceutical literature, and showed a significant improvement in predicting the success of pharmaceutical tablet manufacture. Tablet weight variation (RSD) was defined as the most efficient way to assess relevant powder flow behaviour in tablet production when using the novel device. The proposed method was distinguished from others by its ability to classify different grades of microcrystalline cellulose in the die-filling process. Subsequently, eight common pharmaceutical powders, both excipients and APIs, were properly ranked as a function of flowability based on their physical properties. The method showed a high repeatability, with a relative standard deviation not more than 10%. The effect of colloidal silicon dioxide (CSD) on powder flow properties of poor-flowing excipient lactose 200 M was also investigated. Binary mixtures of different ratios of CSD as glidant were examined using a modern imagebased flow measuring technique. Special attention was placed to subtle variations in powder flow from small changes in glidant concentration (0.025% w/w). Understanding the modes of interaction of particles and their effects on flowability using the method predicted the die filling performance during tablet manufacture. In addition, the importance of moisture content on powder flow properties was empirically underlined. A more efficient range of CSD was detected from 0.10 to 0.50% w/w in most of the tested conditions, which revealed a significant improvement in powder flow performance compared to higher amounts typically handled in the pharmaceutical industry.

***Keywords*—** Powder flow, Colloidal silicon dioxide, Moisture, Cohesive powders, Image analysis, Small scale, Tablet manufacture.

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Metabolic Syndrome Monitoring during Clozapine Initiation – a Quality Improvement Project

Irene Hadjioannou, Lowri Hughes, Thomas Davies, Emily Jones

***Abstract*—**

Background: Metabolic syndrome is a cluster of factors which increase one's risk of cardiovascular disease. When these factors are adequately managed metabolic syndrome can be prevented. We are aware that psychotropic medication, in this case Clozapine, may have a negative impact on these factors. It is therefore our responsibility as prescribers to adequately monitor our patients regarding this and intervene early if necessary.

Aim: The aim was to assess compliance with our organisation's guidance pertaining to the monitoring of the metabolic syndrome factors during Clozapine initiation. Additionally, we were interested in any potential emerging trends.

Methodology: The sample consisted of all the patients on Clozapine across our medium secure unit and forensic step down unit on a particular date. We collected data on the following parameters at baseline and at three months into treatment, as outlined by our organisation's policy: blood pressure, HbA1c, Body Mass Index (BMI) and lipid profile. We also checked whether appropriate action was taken if any of these parameters were abnormal. The data was collected via our electronic record systems.

***Results*:** We identified fifteen patients. Overall, compliance with the Trust guidance appeared to be poor. One fifth of the patients did not have a baseline BMI reading, almost half of the patients did not have a recent baseline HbA1c and only two patients had a baseline lipid profile. At three months into treatment almost a third did not have a BMI measurement, almost two thirds did not have a HbA1c and again only two patients had a lipid profile. Of note, was the difficulty in locating this information within the patient records due to the lack of a standardised method of documenting this. In view of the significant absence of data, it was difficult to comment on any trends observed. It is noteworthy though that almost all patients had an increase in their BMI, with four patients moving to the next BMI category. There were also two patients who at three months into treatment with Clozapine met the diagnostic threshold for prediabetes, while their HbA1c was previously within normal range. It was not possible to accurately identify information regarding any action taken if the results were abnormal and therefore we are unable to comment on this.

Conclusions: This piece of work highlighted the importance of standardising the way physical health parameters and their management is recorded and documented. We have introduced a short template, which provides a quick and easy way to record the above parameters. This will hopefully aid compliance with our organisation's guidance regarding the monitoring of metabolic syndrome during Clozapine initiation and in turn improve quality of care for our patients. We will be reassessing compliance once this intervention is established. With better compliance, we should be in a better position to comment on common trends in respect to how these parameters change during Clozapine initiation.

***Keywords*:** cardiovascular risk, clozapine, metabolic syndrome, physical health monitoring.

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The Effect of Substitution of CaO/MgO and CaO/SrO on *in vitro* Bioactivity of Sol-Gel Derived Bioactive Glass

Zeinab Hajifathali [a,*], Moghan Amirhosseinian [a]

Abstract:-This study had two main aims: firstly, to determine how the individual substitution of CaO/MgO and CaO/SrO can affect the *in vitro* bioactivity of sol-gel derived substituted 58S bioactive glass (BG) and secondly, to introduce a composition in the $60SiO_2$–(36-x)CaO–$4P_2O_5$–(x)MgO and $60SiO_2$–(36-x)CaO–$4P_2O_5$–(x)SrO quaternary systems (where x= 0, 5, 10 mol.%) with enhanced biocompatibility, alkaline phosphatase (ALP) activity, and more efficient antibacterial activity against MRSA bacteria.
Results showed that both magnesium- substituted bioactive glasses (M-BGs) and strontium- substituted bioactive glasses (S-BGs) retarded the Hydroxyapatite (HA) formation. Meanwhile, magnesium had more pronounced effect. The 3-(4, 5dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) and alkaline phosphatase (ALP) assays revealed that the presence of moderate amount (5 mol%) of Mg and Sr had a stimulating effect on increasing of both proliferation and differentiation of MC3T3-E1 cells. Live dead and Dapi/actin staining revealed both substitution of CaO/MgO and CaO/SrO resulted in more biocompatibility and stimulation potential of the MC3T3 cells compared with control. Taken together, among all of the synthesized magnesium substituted (MBGs) and strontium substituted (SBGs), the sample 58- BG with 5 mol% CaO/MgO substitution (BG-5M) was considered as a multifunctional biomaterial in bone tissue regeneration field with enhanced biocompatibility, ALP activity as well as the highest antibacterial efficiency against methicillin-resistant staphylococcus aureus (MRSA) bacteria.

Key words-, Apatite, Alkaline earth, Bioactivity, Biomedical applications, Sol-gel.

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I. Introduction

Bioactive glasses (BGs) are silica-based synthetic biomaterials firstly discovered by Hench in $46.1SiO_2$-$24.4Na_2O$-$26.9CaO$-$2.6P_2O_5$ (mol%) system in the early 1970s [1]. BGs have capability of bonding directly to the surrounding living bone through the formation of a hydroxyapatite (HA) interface layer on their surface inside a human body [2]. Moreover, BGs are biodegradable and can stimulate the bone regeneration by the action of their dissolution products on cells [2,3]. Hence, because of the aforementioned unique properties, they can used as a promising biomaterials in bone tissue engineering [3,4].
BGs can be synthesized by two different routes: conventional melt-quenching or sol-gel methods. The sol-gel technique requires considerably much lower temperature and has advantages of compositional purity compared with melt-quenching method [5]. Sol-gel derived BGs have higher dissolution rate and followed by increased HA formation rate with respect to melt-quench derived BGs due to higher specific surface area [6]. In addition, sol-gel derived BGs also have high silanol (Si-OH) groups on their surfaces which act as active sites for further functionalization [7].
Synthesis, characterization and biological behavior of 58S-BG (60% SiO_2-36% CaO-4% P_2O_5 (in mol. pct.) have been reported in several studies [6,8,9]. Various amounts of modifier such as magnesium (Mg) [10,11], strontium (Sr) [12,13], zinc (Zn) [14], copper (Cu) [15], silver (Ag) [16,17] and , lithium (Li) [18] are incorporated in BGs composition to improve their particular properties such as osteoconductivity [19,20], angiogenicity [15] and antibacterial [21].
A bacterial infection mostly leads to a surgical failure and following second operations or removal and replacement of implanted biomaterial components [22,23]. Therefore, prevention against bacterial infection is vital in orthopedic surgery [23]. The idea of using the BGs as antibiotic-free antibacterial biomaterials was previously mentioned [5,24]. Moreover, BGs can prevent and reduce the risk of post-

operative bacterial infections [25]. Despite recent confirmation of the antibacterial properties of the BGs [26], But, the exact mechanism of action is still unknown [27].

The Gram- positive methicillin-resistant Staphylococcus aureus (MRSA) is a type of staph bacteria that which resistant to several antibiotics [28]. Incorporation the specific metallic ions in BG's composition such as M-BG and S-BG has been investigated for the antibacterial properties [11,22].

Magnesium, one of the alkaline earth element, is the fourth most abundant cation in the human body [29]. The most of the body's Mg (approx. 65%) is present in bone and teeth. Furthermore, on one hand, Mg plays a major role in bone metabolism and can induce new bone formation due to direct interaction with osteoblast cells which are responsible for cell adhesion and stability [30] and on the other hand, its deficiency is directly associated with osteoporosis, causing decreased bone growth and increased bone resorption [31].

Strontium (Sr), another alkaline earth element, has attracted attention like other two important divalent metals calcium and magnesium in human biology [32]. Moreover, Sr plays a similar role as calcium (Ca) in bone formation [33] and also Sr has been clinically used for treatment of osteoporosis [34,35].

Despite some studies on the individual effect of Mg or Sr ions on BG bioactivity, the effect of these ions on in vitro bioactivity has not been stated exactly up to now. On the other words, there are many controversial results were reported regarding the influence of Mg/Ca or Sr/Ca substitution on HA formation for MBGs or SBGs, respectively. For example, some claims have been reported that either Mg [36–39] or Sr [40–47] increased the BG bioactivity by reduction of the bone resorption and formation of a new bone. While, the complete reverse effect of Mg [11,48–50] or Sr [46,51–55] on BG bioactivity were reported. Meanwhile, Moya et al. and Christi et al. respectively showed that substitution of CaO with Mg [56] or SrO [57] in BG had an insignificant effect on HA formation rate and the bioactivity remained constant. Furthermore, the optimal amount of substituted Mg/Ca or Sr/Ca in BG composition which has the highest positive effect on cell proliferation and activity has not been elucidated exactly.

Table 1. Compositions of the BG-0, M-BGs and S-BGs (in mol %)

Bioactive glasses	Label	SiO_2	CaO	P_2O_5	MgO	SrO
58S-0%MgO-0%SrO	BG-0	60	36	4	0	0
58S-5%MgO-0%SrO	BG-5M	60	31	4	5	0
58S-0%MgO-5%SrO	BG-5S	60	31	4	0	5
58S-10%MgO-0%SrO	BG-10M	60	26	4	10	0
58S-0%MgO-10%SrO	BG-10S	60	26	4	0	10

This study had two main aims. The first was to compare how *in vitro* bioactivity was affected by substitution of either Mg^{2+} or Sr^{2+} in place of Ca^{2+} in 58S-BG; and the second was to introduce the best candidate in the $60SiO_2$–(36-x)CaO–$4P_2O_5$–(x)MgO and $60SiO_2$–(36-x)CaO–$4P_2O_5$–(x)SrO quaternary systems (with x=0, 5, 10 mol%) in bone repair/regeneration, mainly in stimulating the proliferation, differentiation, ALP activity of osteoblastic MC3T3-E cells as well as the most efficient antibacterial activity against MRSA bacteria.

II. Materials and method

A. Materials

Magnesium and strontium substituted 58S ($60SiO_2$-36CaO-$4P_2O_5$, mol%) were synthesized with tetraethyl orthosilicate (TEOS, Merck), triethyl phosphate (TEP, Merck), calcium nitrate tetrahydrate ($Ca(NO_3)_2.4H_2O$, Merck), strontium nitrate ($Sr(NO_3)_2$, Merck) and magnesium nitrate hexahydrate ($Mg(NO_3)_2.6H_2O$, Mreck), using the sol–gel technique. The details of the chemical composition of the synthesized BGs used for the present study are given in Table 1.

In addition, in vitro study was carried out in SBF solution was synthesized by using NaCl, KCl, K_2HPO_4, $3H_2O$, $MgCl_2$.$6H_2O$, $CaCl_2$, Na_2SO_4 reagents, tris (hydroxymethyl) aminomethane $(HOCH_2)_3CNH_2$, and HCl based on the Kokubo's procedure as described in the literature [58].

A mouse osteoblast-like cell line (MC3T3-E1, Sigma-Aldrich), was selected for biological investigation. Cells were cultured in α-MEM supplemented with 10% fetal bovine serum (FBS), (Sigma-Aldrich, UK), 1% antibiotic, 2 mM glutamine and 0.1% penicillin-streptomycin under standard conditions (at 37 °C in a humidified atmosphere of 95% air and 5% carbon dioxide) with a change of culture medium every other day. The confluent cells were dissociated with trypsin and subcultured to three passages were used for biological experiments.

B. Bioactive glass synthesis

TEOS, distilled water, and 0.1 M nitric acid were vigorously mixed for 1 h by a magnetic stirrer at room temperature to ensure complete hydrolysis of TEOS. Afterwards, TEP, $Ca(NO_3)_2.4H_2O$, and $Mg(NO_3)_2.6H_2O$ or $Sr(NO_3)_2$ (for M-BGs and S-BGs, respectively) were added sequentially with time intervals of 45 min. The resultant sol then poured into Pyrex container and kept sealed at 37 °C for 3 days and followed by calcination of the dried gel in a furnace at 700 °C for 3 h to ensure elimination the nitrates and organic substances. Finally, calcined powders were compressed into tablet (Ø10×3 mm) with hydraulic press under 9 MPa pressure in order to *in vitro* studies.

C. Characterization of formed HA on substituted BGs surfaces

C.1. X-ray Diffraction Analysis

After 7 and 14 days immersion in SBF, BG-0, MBGs and S-BGs surfaces were analyzed by X-ray diffraction (XRD, INEL-Equinox-3000, France) to investigate the HA formation on their surfaces. Instrument works with voltage of 40 kV and uses Cu-Kα radiation source (λ =1.5405 A°) and XRD diagrams were recorded in the interval $20°\leq 2\theta \leq 50°$.

C.2. FTIR Analysis

The BG-0, MBGs and S-BGs surfaces were performed after 7 and 14 days immersion in SBF by Fourier transform infrared spectroscopy (FTIR, Nicolet Avatar 660 (Nicolet, USA)) to investigate the HA formation on the MBGs surfaces. For this purpose, 1 mg of material scarped from MBG surface was mixed with 100 mg of KBr and palletized under vacuum. Then the pellets were analyzed in the range of 400–4000 cm^{-1} with a resolution of 8 cm^{-1}.

C.3. Inductively coupled plasma-atomic emission spectroscopy

For *in vitro* evaluation, the disk-shaped BGs were soaked in the SBF at 37 °C for 1, 3, 7 and 14 days. The ratio of the MBG surface area to the SBF volume was approximately 0.1 cm^2 mL^{-1}. At the end of each time period, disk-shaped BGs were removed from the SBF and the reacted solution was analyzed. The concentrations of Ca, Si, P, Mg and Sr ions were investigated by using inductively coupled plasma atomic emission spectroscopy (ICP-AES; Varian Vista Pro, Palo Alto, USA).

C.4. pH measurement

The variation of pH with immersion time in SBF was recorded after 1, 3, 7 and 14 days with a calibrated pH meter (Corning pH meter 340, USA).

C.5. SEM analysis

The bioactivity of BG was confirmed by investigating the changing in morphology of its surfaces [59]. For this purpose, BG-5M and BG-5S were selected for SEM observation as a samples with the highest MTT and ALP activity among all synthesized MBG and S-BGs, respectively. Scanning electron microscope (SEM, Philips XL30, Netherland) was applied to evaluate the morphology of the formed HA on the surface of BG-5M and BG-5S after immersion in the SBF up to 14 days. Before examination, the surfaces of BGs were coated with a thin layer of gold (Au) by sputtering (EMITECH K450X, England) to prevent charges accumulation at its surface.

D. Biological Evaluation

D.1. Biocompatibility of the synthesized BGs

For cytotoxicity evaluation, the proliferation of the MC3T3 cells on BGs was determined using the MTT (3-{4,5-dimethylthiazol-2yl}-2,5-diphenyl-2H-tetrazolium bromide) assay [60]. For this purpose, cells were seeded on samples into a 96-well plate at a density of 6×10^3 cells per well with regular DMEM medium and incubated for 1, 3 and 7 days. At the end of time periods, the medium was removed and 100 µL of 5 mg mL^{-1} MTT solution (Sigma Aldrich) was added to each well. After incubation at 37 °C in a humidified atmosphere (95% air, 5% CO_2) for 72 h, the medium was removed and precipitated formazan was dissolved by adding dimethylsulfoxide (DMSO). The optical density (OD) value of the solution was read with multi-well microplate reader (EL 312e Biokinetics reader, Biotek Instruments) at a wavelength of 570 nm. The MC3T3-E1cells growing in the absence of MBGs was used as control.

D.2. Alkaline phosphatase (ALP) activity

The osteoblast activity was assessed by measuring the alkaline phosphatase (ALP) production of MC3T3 cells as an early marker [61]. For this purpose, the cells were seeded on the BGs under the same culturing condition and at the end of each time period, the supernatant fluid was removed gently and the cell layer was rinsed well with PBS, followed by homogenizing with 1 mL Tris buffer and sonicating for 4 min on ice. Aliquots of 20 µl were placed in equal volumes of 1ml of a p-nitrophenyl phosphate solution (pNPP, Sigma, 16 $mmol.L^{-1}$) and were incubated at 30 °C for up to 5 min.

D.3. Live-dead assay

The Live/Dead (viability/cytotoxicity) assay was used to qualitatively assess cell viability and to determine whether BGs were cytotoxic. For this purpose, MC3T3-E1 cells were cultured in the presence of BG-0 (control sample) and BG-5 (sample with the highest cell proliferation based on MTT results) for 7 days and then incubated with 4 mM ethidium homodimer-1 (EthD-1) and 2 mM calcein-acetoxymethyl ester (calcein-AM) at 37 °C in a humidified atmosphere of 5% CO_2- 95% air for 15 min in dark. Then, cells were washed again with PBS to stop staining reaction. The

stained cells (Live cells: green stain, Dead cells: red stain) were examined under fluorescence microscope (Olympus, USA) also representative images were captured using a Zeiss AxioCam digital camera.

D.4. Actin staining of MC3T3-E1 cells

Dapi/Actin staining applied for visualizing the cytoskeleton and nuclei of MC3T3-E1 cells in presence of BG-0 (control sample), BG-5M and BG-5S (selected samples respectively for MBGs and S-BGs with the highest cell proliferation based on MTT results). For this purpose, the F-actins of MC3T3-E1 cells were stained in green with Alexa Fluor-594 phalloidin (Invitrogen), while the cells nuclei were stained in blue with 4,6-diamidine-2-phenylindole (DAPI) solution (Invitrogen). According to the manufacturer's procedure, after 1 and 7 days of incubation, cell-seeded BGs were rinsed with PBS twice and followed by fixation with 4% paraformaldehyde (Sigma-Aldrich, UK) solution for 30 min at room temperature. Afterward, samples soaked in 0.1% (v/v) Triton X-100 (Sigma)/PBS solution for 30 min. Finally, cells were washed three times with PBS and then were blocked in 1% (v/v) bovine serum albumin (BSA)/PBS solution for 1 h. The green fluorescence images of cytoskeleton and blue fluorescence images of nuclei of MC3T3-E1s were captured.

D.5. Antibacterial evaluatiion

The individual effect of Mg and Sr substitution up to 10 mol.% in 58S-BG on antibacterial activities against MRSA bacteria was investigate. The bactericidal percentages were calculated according to the following formula by counting the final colony-forming units per milliliter (CFU mL^{-1}) [25,26]. The procedure was illustrated in details in our previous work [18].
Bactericidal fraction = 1- (number of survived bacteria/number of total bacteria).

E. Statistical analysis

The GraphPad Prism software package, version 3.0 (GraphPad Prism, USA) was used to statistical analysis. Each elemental analysis was performed with at least three samples and results were presented as means ± standard deviations (SD). Moreover, P-value was considered statistically significant when *P<0.05 and P -values were more highly statistically significant when **p < 0.01, ***p < 0.001 and ****p < 0.0001.

III.

IV. Results and Discussion

A. XRD analysis

The XRD patterns of the BG-0 (control), M-BGs and S-BGs after 7 and 14 days of immersion are shown in Fig. 1(a) and Fig. 1(b), respectively. As it seen in Fig. 1(a), after 7 days of immersion, all the samples except BG-10M showed characteristic peak of crystalline HA according to the standard JCPDS (No. 09-432) [62] assign to (211) plane at 2 theta equal to 31.8°. Moreover, BG-0 showed another HA characteristic peak assign to (200) (plane) at 2 theta equal to 25.8° which confirmed substitution of Ca with Mg or Sr in 58S-BG resulted in a decrease in HA formation. This retarding effect was more pronounced in high amount of Mg (BG-10M) compared to Sr (BG-10S). With increasing the immersion time to 14 days, the intensities of detected peaks increased due to the growth of the formed HA. Additionally, on day 14th, XRD patterns of all samples except BG-10M exhibited HA characteristic peak corresponding to (211) plane. Also, two more peaks corresponding to (112) and (300) planes were observed respectively at 2 theta equal 32.18° and 32.86° on XRD pattern of BG-0 which confirmed the HA maturity on BG-0 surfaces [63].
Previously, Ma et al. claimed that the higher substitution of MgO for CaO in SiO_2–CaO–MgO–P_2O_5 Bioglass, decreased its bioactivity due to blocking of active calcium phosphate growth sites by Mg^{2+} [49]. Roy et al. [64] reported the same reason for lower bioactivity in Na_2O–MgO–SiO_2 glass system. In addition, Hesaraki et al. [51] suggested that like Mg^{2+} [65], Sr^{2+} can also block the nucleation active sites of calcium phosphate nucleation active sites in sol–gel derived CaO–SrO–SiO_2–P_2O_5 BG and retarded the HA formation.
XRD results showed that both Mg/Ca and Sr/Ca substitution in BGs composition lowered the in vitro HA formation ability of the M-BGs and S-BGs. Moreover, high substitutions (BG-10M and BG-10S) had more retarding effect on HA formation with respect to moderate substitutions (BG-5M and BG-5S).

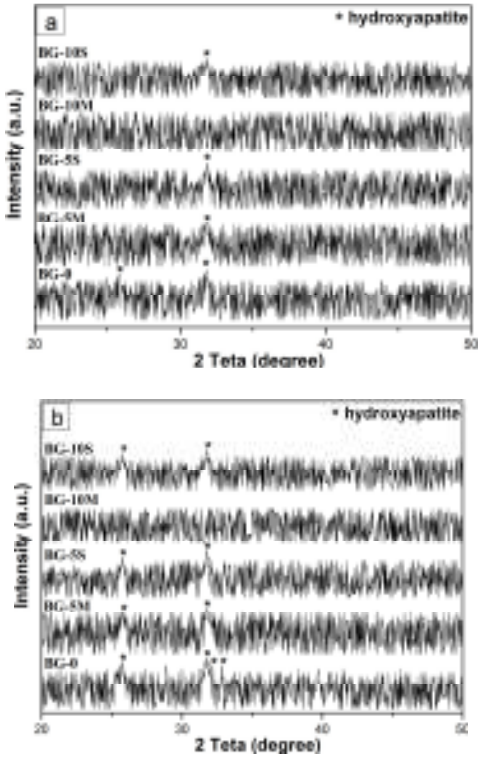


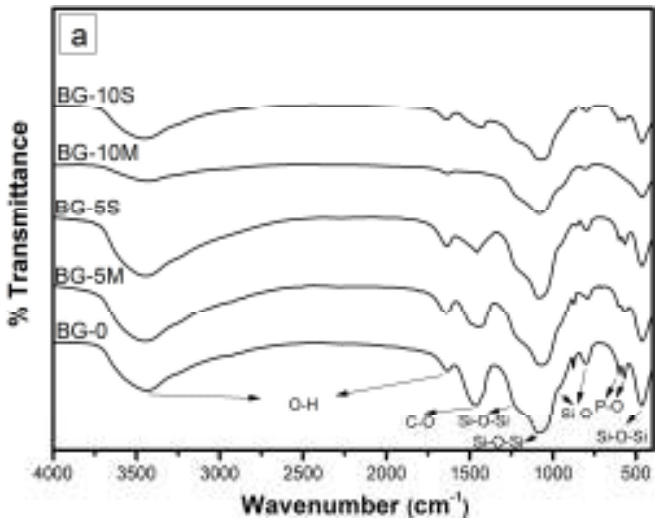
Fig. 1. The XRD patterns of BG-0, BG-5M, BG-5S, BG-10M and BG-10S after 7 and 14 days of soaking in SBF.

B. Structural groups

Fig. 2(a) and Fig. 2(b) show the FTIR transmittance spectra of the synthesized BGs after 7 and 14 days of immersion in SBF, respectively. According to the literature [66–68], the main absorption bands attributed to the Si–O–Si bending, the Si–O symmetric stretching of bridging oxygen atoms between tetrahedrons, Si–O stretching of non-bridging oxygen atoms, Si–O–Si symmetric stretching and the Si–O–Si asymmetric stretching are located respectively at 470, 790, 922, 1066 and 1250 cm^{-1}. Additionally, the asymmetric vibrations of PO_4^{3-} are detected by band located at 570 and 603 cm^{-1} which confirm the formation of calcium phosphate on BGs surface and also the absorption bands at 1455 cm^{-1} and 870 cm^{-1} are revealed due to C–O stretching in carbonate groups substituted for phosphate groups in HA lattice. Furthermore, the stretching mode of hydroxyl was determined by observing the band at 1651 cm^{-1}. Eventually, the stretching mode of OH group (hydroxyl) is determined by observing the band at 1651 cm^{-1}.

According to the Fig 2(a), after 7 days of immersion, all the samples except BG-10M exhibited P-O and C–O bands which was in good agreement with XRD results (Fig 1(a)). With increasing the immersion period to 14 days, the intensities of observed peaks increased. But, still BG-10M did not show any phosphate or carbonate peaks.

By considering the appearance of P-O and C–O bands in ftir spectra it could be understood that in moderate amount of Mg and Sr (5 mol%), HA was formed on BG-5M and BG-5S surfaces after 7 days and more substitution of Mg and Sr up to 10 mol% retarded HA formation. Results indicated that Mg had more pronounced retarding effect in comparison with Sr. In other words, BG-10M had the lowest bioactivity among all synthesized BGs.



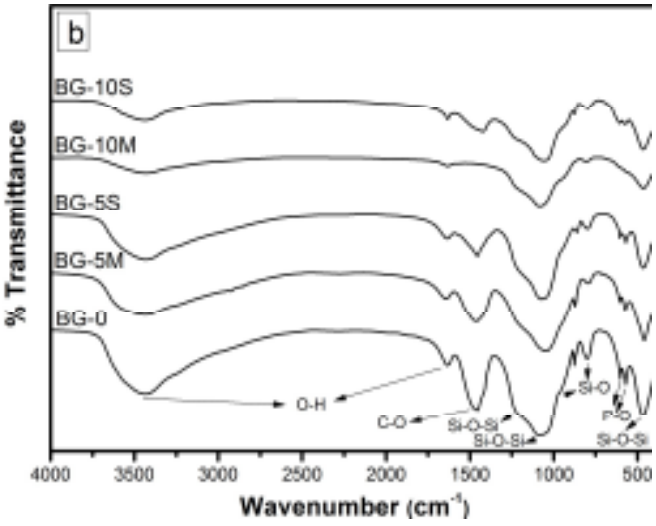
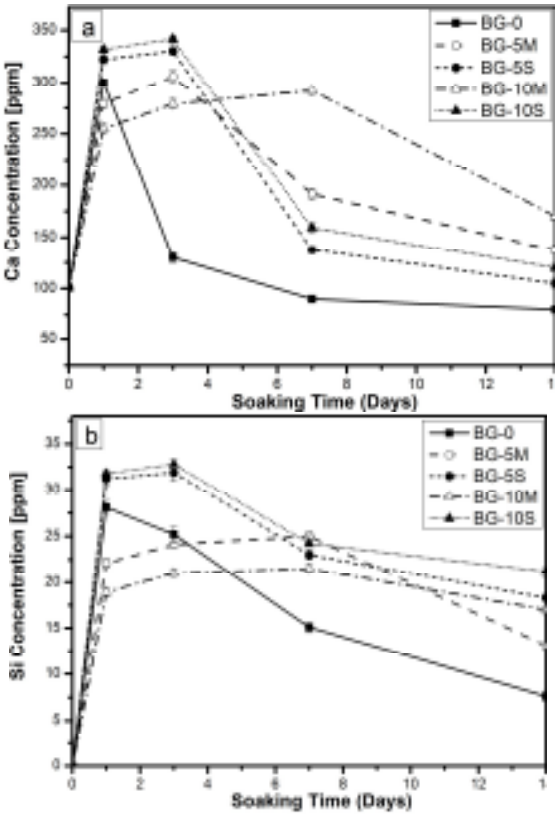


Fig. 2. FTIR spectra of BG-0, BG-5M, BG-5S, BG-10M and BG-10S after 7 and 14 days of soaking in SBF.

C. Ion chemistry of SBF solution

In order to investigate the ions concentration variations after immersed in SBF for different time periods of 1, 3, 7 and 14 days, the reacted SBF was examined by ICP-AES. Fig. 3 (a)-(e) exhibits the variations of Ca, Si, P, Mg and Sr concentration in the SBF solution.



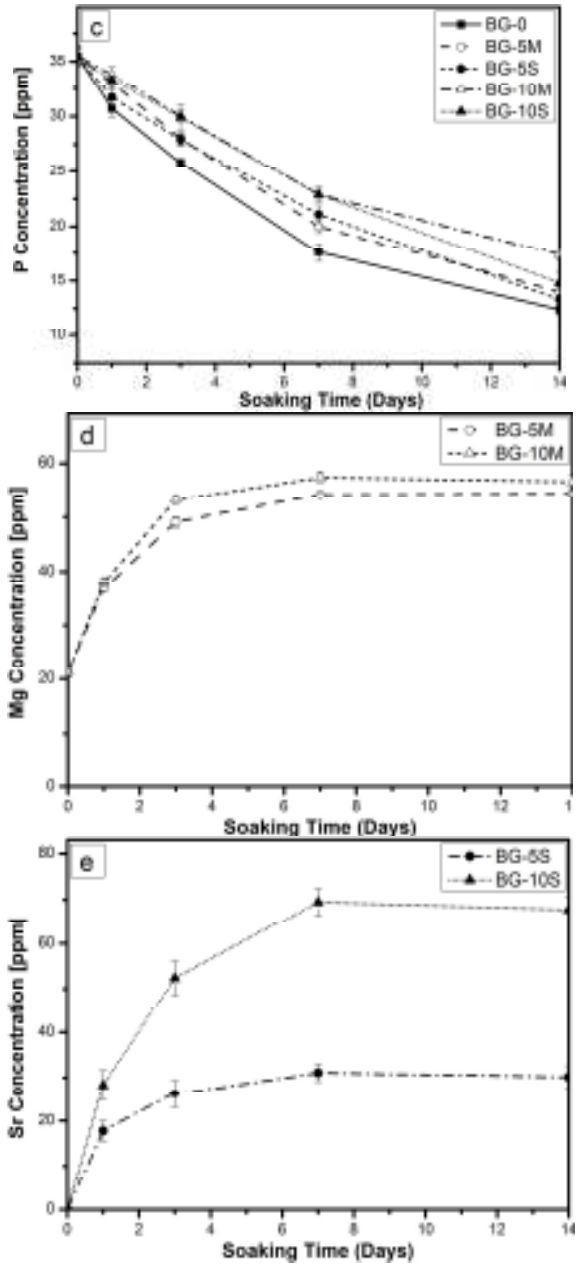


Fig. 3. Calcium (a), silicon (b), phosphorus (c), magnesium (d), strontium (e) ions concentrations in the SBF solution monitored over immersion time.

According to the Fig. 3 (a), despite the primary concentration of Ca (approx. 100 ppm), Ca concentration [Ca^{2+}] was increased instantly for all BGs. Additionally, after 1 day immersion, it seen that M-BGs and S-BGs had minimum and maximum Ca concentration, respectively. After 3 days immersion, [Ca^{2+}] for BG-0 decreased while for other BGs increased gradually. Finally after 3 days of immersion, [Ca^{2+}] for BG-5, BG-5S and BG-10S were decreased. But BG-10M showed reverse trend.

The dissolution/precipitation of Ca^{2+} ions between BG surfaces and SBF during the crystallization of HA is monitored by change of Ca concentration [69]; i.e. the decrease of [Ca^{2+}] was indicative that the release of Ca^{2+} from BG surface into the SBF was lower than its precipitation from SBF on BGs surface. Fig. 3 (a) confirmed that BG-0 and BG-10M had respectively the highest and the lowest precipitation rate of Ca^{2+} for calcium phosphate formation.

Fig3 (b) demonstrated that Si had similar trend like Ca and after immersion for 1 day, the Si concentrations were in the order S-BGs > BG-0 > M-BGs. Previously, Ma et al. reported the addition of Mg in BG resulted in a decrease in rate of magnesium-doped BG dissolution [59]. As SBF has no Si ions, the concentration of Si ions in SBF after immersion was investigated for BG's solubility. Sr^{2+} has larger ionic radius than Ca^{2+} (113 pm vs. 100 pm) and its substitution in BG composition results in a disruption of the BG network and causes network disorder in S-BG compared to BG-0. On the other hand, Mg^{2+} has smaller ionic radius than Ca^{2+} (72 pm vs. 100 pm) [70]. So, M-BG has more structural compactness (more ionic field strength) which prevents readily penetration of SBF inside the M-BGs structure. Table 2 shows the oxygen density values for BG-0, M-BGs and S-BGs. Therefore, according to Table 2, the main reason for more solubility of S-BG compared to M-BG was its lower oxygen density due to less structure compactness.

Table 2. The oxygen density values for synthesized BGs

Glass	BG-0	BG-5M	BG-5S	BG-10M	BG-10S
Oxygen density	0.756± 0.001	0.769± 0.007	0.741± 0.005	0.772± 0.006	0.736± 0.004

According to the Fig3 (c), P concentration was decreased by increasing the immersion time up to 14 days for all BGs. Moreover, the rate of change in the P concentration revealed that an increase in the Mg and Sr contents resulted in a decrease the rate of HA precipitation.

Fig. 3 (d) and 3 (e) showed the Mg and Sr release in the SBF were higher for BG-10M and BG-10S compared to BG-5M and BG-5S because of their more content in BG composition.

BGs exhibited a rapid increase in the Mg and Sr ion content until day 3rd and then reached a plateau on day 7th. The decreases in the dissolution rate of Mg and Sr in M-BGs and S-BGs by increasing the immersion time were due to the formation of silica rich and HA layers on the BG surfaces.

D. pH measurement

By considering the pH variations with immersion time (Fig. 4), it could be observed that M-BGs and S-BGs had higher pH values in comparison with BG-0 due to the presence of alkaline earth elements. At first 7 days, the initial pH was rapidly increased from 7.4 to 7.81 and 7.85 for BG-10M and BG-10S, respectively. It could be explained by rapid ionic exchange between Ca^{+2} and alkaline earth elements form BGs and H^{+} from SBF solution. Then, by precipitation and consumption of Ca ions for HA formation, the increasing rate of pH decreased and finally reached a plateau.

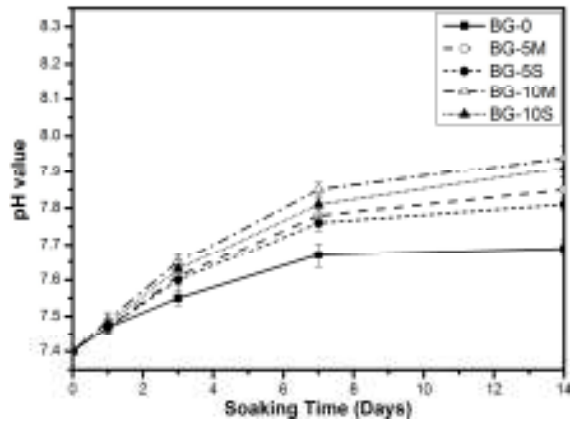
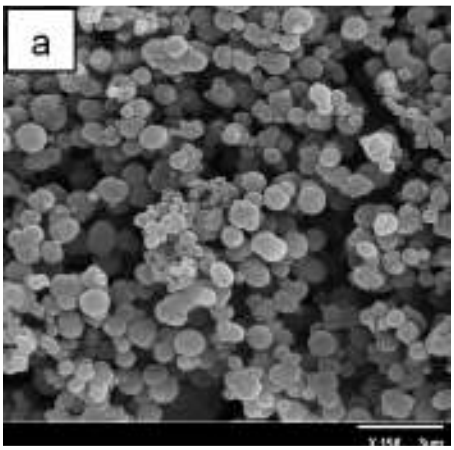


Fig. 4. pH variation of the SBF solution over immersion time up to 14 days

E. SEM analysis

To study the morphology of the formed HA, the surfaces of the BG-5M and BG-5S (as selected samples of M-BGs and S-BGs, respectively with the highest bioactivity based on XRD and FTIR results) were observed under SEM after 14 days of immersion (Fig. 5 (a)-(d)). Fig. 5 (a) showed that the surface of BG-5M was fully covered by spherical calcium phosphate particles after 14 days of immersion. While, rod-shaped calcium phosphate were formed on BG-5S (Fig. 5 (b)). The same rod-like HA was previously reported by Taherkhani et al. [55] in sol-gel derived 60%SiO_2–36%(CaO/SrO)–4%P_2O_5 bioglass.
Based on SEM investigation, both BG-5M and BG-5S exhibited a promising bioactivity after 14 days of immersion in SBF.



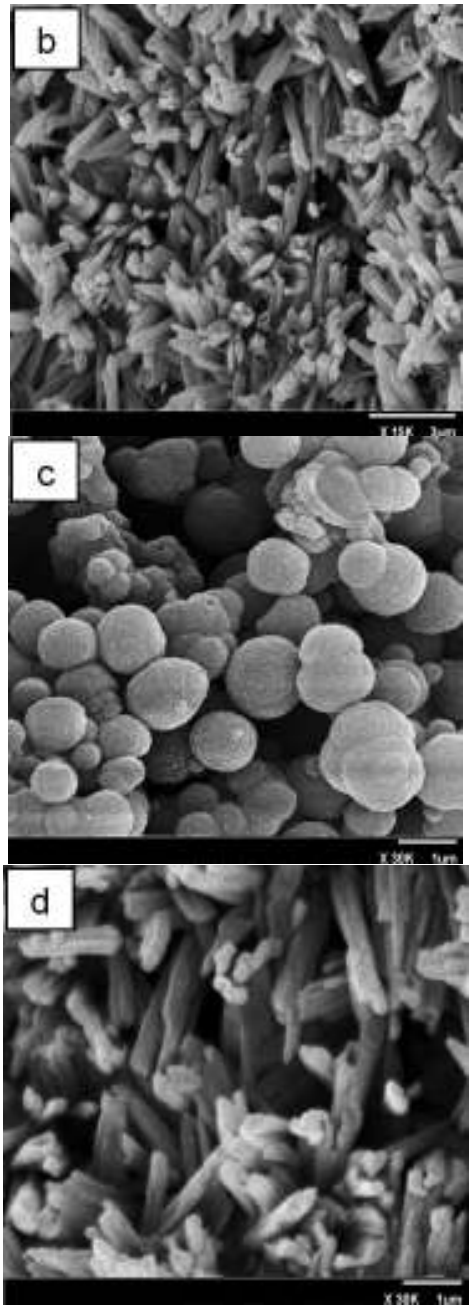


Fig. 5. SEM images of BG-5M (a and c (higher magnification)) and BG-5S (b and d (higher magnification)) after 14 days of immersion in the SBF solution.

F. In vitro biological evaluation

F.1. MTT evaluation

The MC3T3-E1 cells proliferation on BG-0, M-BG and S-BG for 1, 3 and 7 days was studied in order to assess the cytocompatibility of the synthesized BGs (Fig. 6). As it seen

in Fig. 6, after first day of culture, BG-5M and BG-5S showed significant increase in cells proliferation compared with BG-0 ($^{*}p<0.05$). But, more substitution of Mg^{2+}/Ca^{2+} and Sr^{2+}/Ca^{2+} up to 10 mol% resulted in no significant increase ($^{*}P>0.05$). With increasing the culture time to 3 day, all the optical density (OD) values increased and the highest cell proliferation attributed to the BG-5Sin comparison with BG-0 ($^{**}p<0.01$). On 7th day of culture, both BG-5M and BG-5S exhibited the highest cell proliferation with respect to BG-0 ($^{**}p<0.01$) while BG-10M and BG-10S showed significant decrease ($^{*}p<0.05$) in optical density (OD) values. Previously, the effect of Mg and Sr in BGs on proliferation of cells were studied [71,72]. Saboori et. al [71] claimed that 64% SiO_2-26% CaO-5% MgO-5% P_2O_5 (based on mol%) BG increased cell proliferation of human fetal osteoblast cells (hFOB 1.19). Moreover, the positive influence of Sr in moderate amount between 1% and 5% on proliferation and differentiation of osteoblastic ROS17/2.8 cells was reported by Qiu et al. [72]. MTT results suggested that substitution of 5 mol% Mg or Sr in BG 58S, significantly enhanced the MC3T3-E1 cells proliferation ($^{**}p<0.01$). Additionally, More substitution up to 10 mol% not only had no positive effect but also, significantly enhanced the MC3T3-E1 cells proliferation compared with BG-0 ($^{*}p<0.05$).

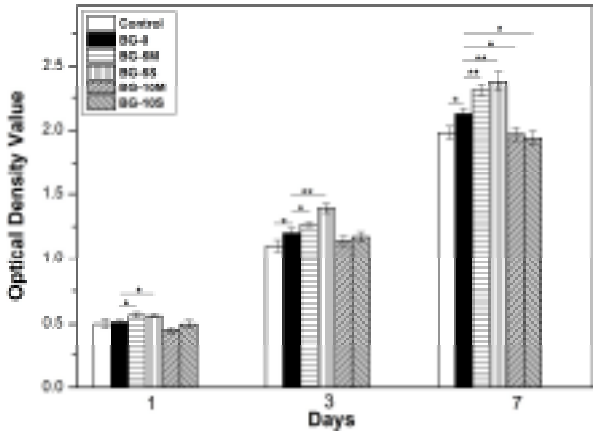


Fig. 6. Osteoblast-like cell line proliferation (MC3T3-E1), cultured on the synthesized BGs for 1, 3 and 7 days. ($^{*}p < 0.05$ and $^{**}p < 0.01$).

F.2. Cell activity

After 1, 3 and 7 days of culture, MC3T3-E1 cells differentiation was considered as ALP activity. Fig. 7 demonstrates the ALP activity of MC3T3-E1 cells treated with BG-0, M-BGs and S-BGs. As it seen in Fig. 7, after 1day of culture, BG-5M significantly increased the MC3T3-E1 cells activity, while BG-10M showed the reverse effect. In other words, the substitution of Mg in moderate (5 mol %) and high (10 mol %) level led to significantly increase and decrease of MC3T3-E1 cells activities, respectively. Furthermore, the moderate substitution of Sr resulted in significant increase of MC3T3-E1 cells activity ($^{*}p<0.05$). But, more substitution (10 mol %) had no positive effect ($^{*}P>0.05$). By increasing the culture time, substitution of Sr in a moderate amount (5 mol %) caused higher ALP activity compared with Mg; i.e., BG-5S exhibited highly significant increase of ALP activity with respect to BG-5S.

The ALP activity study revealed that M-BG and S-BG with 5 mol% substitutions showed higher activity in comparison with 10 mol% substitutions and BG-5S had the highest ALP activity level among all synthesized BGs.

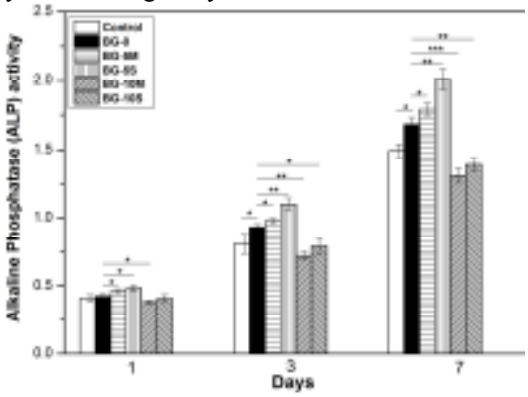


Fig. 7. ALP activities of osteoblast-like cell line (MC3T3-E1) cultured on synthesized BGs for 1, 3 and 7 days. (*p < 0.05 and **p < 0.01).

F.3. Live-dead and Dapi/Actin assays

In order to qualify study of the MC3T3-E1 cells viability in presence of Mg or Sr in BG composition, Live/Dead staining was performed for BG-0 (control), BG-5M and BG-5S after 1 and 7 days of culture (Fig. 8). After 1 day of culture, samples BG-5M (Fig. 8-a) and BG-5S (Fig. 8-b) showed better proliferation with relatively lower dead cells (red spot) compared with the control (Fig. 8-a) and also with increasing the culture time to 7 days, BG-5M and BG-5S showed more proliferation (almost confluence) with relatively lower dead cells in comparison to the BG-0.

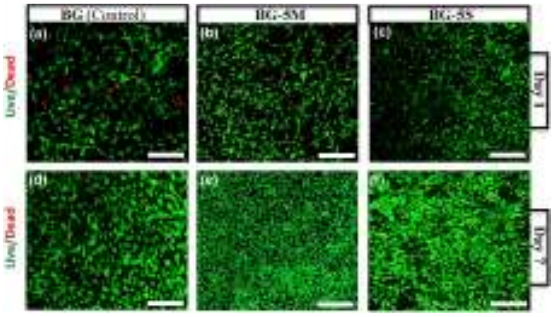


Fig. 8. Two dimensional (2D) MC-3T3 cells cultured in presence of BG-0, BG-5M and BG-5S. Representative live/dead fluorescence images of MC-3T3 cells cultured on BG-0 (a, d), BG-5M (b, e) and BG-5S (c, f) after 1 and 7 days of culture respectively. Green fluorescent cells are alive and red Fluorescent cells indicate dead cells. Scale bar represents 100 μm in all images.

Fig. 9 shows the F-actin-labeled cytoskeleton and nuclei of MC3T3-E1 treated with BG-0, BG-5M and BG-5S. By

investigation the uniform spindle-like shape of MC3T3-E1 cells with random orientation, it could be undrestood that the mean number of DAPI-labelled nuclei treated with BG-5M and BG-5S were significantly increased in comparision to the control after 1 and 7 days of culture. The Dapi/Actin staining study was in a reasonable agreement with Live/dead results.

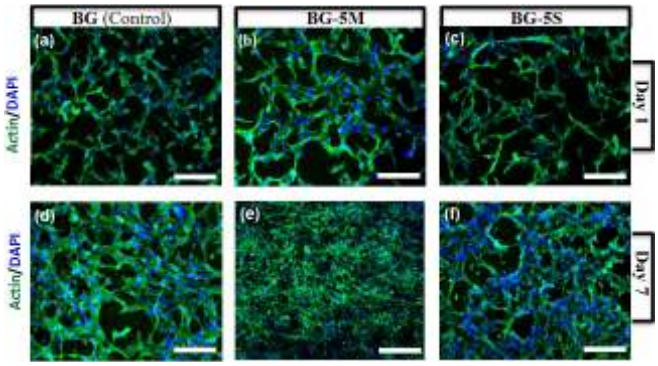


Fig.9. Two dimensional (2D) MC-3T3 cells cultured in presence of BG-0, BG-5 and BG-10. Representative ACTIN/DAPI fluorescence images of MC-3T3 cells cultured on BG-0 (a, d), BG-5M (b, e) and BG-5S (c, f) after 1 and 7 days of culture respectively. Cell filaments are stained by Actin (green) and nuclei stained by DAPI (blue). Scale bar represents 100 μm in all images.

Results indicated that the MC3T3-E1 cells were random orientation with relatively spindle-like shape. The same shapes of mesenchymal stem cells (rMSCs) were seen by He et al. [73] on the calcium carbonate ceramics. In addition, it was previously reported that biological response of the cells their metabolic activity were affected by ions dissolution from BGs [74] and pH change [75]. Previously, He et al. observed the spindle-like shape of rat bone mesenchymal stem cells (rMSCs) cultured on the calcium carbonate ceramics [73].

Live dead and Dapi/actin results revealed that the moderate concentration of Mg and Sr in culture medium resulted in a better cell proliferation in BG-5M and BG-5S, respectively.

It may be suggested that a moderate concentration of Mg and Sr in culture medium and pH values between 7.4 and 7.9 (Fig 4 (d)-(e) and Fig 5) led to a better cell proliferation. Consequently, the live and dead staining assay revealed that both BG-5M and BG-5S had the higher cell viability and proliferation compared to the control which was in a good agreement with MTT results (Fig. 6).

F.4. Antibacterial studies

The effect of Mg and Sr in BG 58S composition on antibacterial activity of BG-0, M-BG and S-BG against MRSA bacteria is present in Fig. 10. It was seen that Mg had more pronounce effect than Sr. In other words, in the fixed concentration of 10 mg/ml BG in bacterial suspension, M-BGs showed significantly higher bactericidal efficiency against MRSA bacteria and the highest bactericidal efficiency was attributed to BG-5M since, BG-5M showed no significant increase compared to BG-0 ($^{*}P>0.05$). Antibacterial investigation demonstrated that substitution of both magnesium (in moderate 5 mol% and high amount 10 mol%) and strontium (in high (10 mol %) resulted in a significant increase in bactericidal efficiency against MRSA. The exact mechanism for the bactericidal activity of BGs is not known [27], but some studies claimed that release of some ions such as Ca [27], P [27], Mg [76] and Sr [22] from BGs has responsible for the antibacterial property of BGs. Moreover, pH has another factor that may effect on antibacterial property [25]. According to the ICP-OES and pH study, the release of Ca (Fig. 3a), P (Fig. 3b) and alkaline earth (Fig. 3 e and Fig. 3f) ions led to increasing the pH values which were probably the main reasons of M-BGs and S-BGs antibacterial effect.

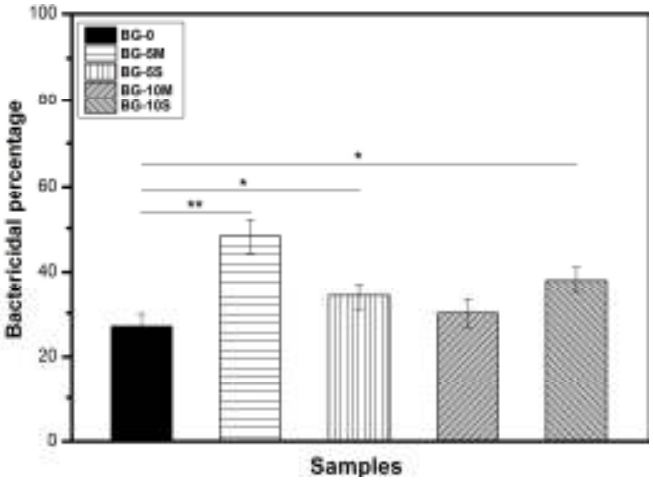


Fig.10. The bactericidal percentages of 10 mg/mL of BG-0 (control), BG-5M, BG-5S, BG-10M and BG-10S. (*p < 0.05, **p < 0.01, ***p < 0.001 and ****p < 0.0001).

Results showed that Mg exhibited dose-dependent antibacterial activity, while Sr had dose-independent behavior and BG-5 showed the highest antibacterial effect against MRSA bacteria among all synthesized BGs.

V. Conclusions

A series of quaternary 60SiO2–(36-x)CaO–4P_2O_5–(x)yO (where x=0, 5 and 10; y= Mg or Sr) BGs were successfully synthesized through sol-gel method and the effects of Mg and Sr individual substitution with Ca in BG on in vitro HA formation, cytotoxicity, ALP activity and antibacterial efficiency were investigated. The in vitro bioactivity evaluation showed that the formation of HA on M-BGs and S-BGs was dose dependent and BG-5M and BG-5S had higher bioactivity compared with BG-10M and BG-10S due to less blocking of the active growth sites of calcium phosphate by alkaline earth ions. The ICP-OES results confirmed that replacement of Ca^{2+} with Mg^{2+} and Sr^{2+} caused a decrease and an increase in the solubility of M-BG and S-BG, respectively by changing the oxygen density.

Additionally, both BG-5M and BG-5S significantly increase the MC3T3-E1cells proliferation and activities with respect to the control ($^{*}p<0.05$).

Antibacterial study revealed that M-BG and S-BG had dose-dependent and dose-independent bactericidal effect against MRSA bacteria. Meanwhile, BG-5M exhibited the highest antibacterial efficiency among other BGs. Taken together, according to *in vitro* bioactivity, biological and antibacterial investigations, 5 mol% was presented as an optimal substitution of Mg/Ca and Sr/Ca in M-BGs and S-BGs; meanwhile, BG-5M is suggested as a promising multifunctional biomaterial in bone tissue regeneration engineering field.

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Foreign Policy of Poland Towards the Eastern Partnership States

Tigran Ohanyan

***Abstract*—** The initiators of Eastern Partnership were Poland and Sweden. The EaP was initiated as a structured policy to support regional cooperation and facilitate closer relations between the EU and Eastern European partners. Presented at the European Council summit in June 2008, the initiative met with support from the European Commission and EU Member States. The program was officially launched on 7 May 2009 in Prague at a summit of heads of state and government from the EU and Partner countries. In 2019, the Eastern Partnership policy turns ten. The Polish side is committed to use this occasion for intensive promotion of the EaP through cultural, political, and expert events and to undertake in-depth reflection on the future of the EaP beyond 2020. Main directions of Eastern partnership are: Strengthening state institutions and good governance, Economic development — taking advantage of market opportunities, Expanding connectivity, energy, and environmental issues. Better mobility and people-to-people contacts. In 2015 there took place Presidential and parliamentary elections in Poland, where ruling party Civic Platform lost and won party Law and Justice. The Foreign Policy of Poland towards the Eastern Partnership states has been changed partially. Poland has geopolitical interests towards Georgia after the Rose Revolution. Since 2014, after "Maydan," Ukraine also has been under the geopolitical interests of Poland. These were main changes, but the role of Poland as a bridge between Europe and Eap states has not been changed.

***Keywords*—** Poland, eastern partnership, foreign policy, geopolitical interests.

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Autism: A Sign of Natural Social Evolution

Asia Dimitrova

***Abstract*—** There are many hidden dynamics unfolding in a relationship between parents, teachers, and autistic children, and they play a big part of the unnoticeable changes in our society.

As our world and theirs are like sliding doors, narrowly close together but always missing each other, both longing for love and connection, both disappointed and hurt, we have started implementing adjustments in education and social life.

With the highest regard for the professionals, carers and relatives of people with autism I do believe that, if there will be any change in society it is starting with them. They instinctively figure out the lessons our children are teaching them and implement them daily into their outside world. The inflexibility of autistic perceptions forces parents and educators to look for new models of teaching, communicating, and relating resorting to open-mindedness even against their own beliefs and judgment. Teachers and parents are core elements in social paradigms and for our autistic's sake they are becoming increasingly more tolerant, understanding, patient and explaining, fun, original and able to see potential behind the surface of symptoms.

In my work I look not for a therapy but a philosophy, a way to see Autism as a new set of abilities and transmitting the new framework back to parents and educators.

By introducing the neurotypical mind to a spectrum of enriching possibilities, new models of communication and an understanding of different means in which one can experience the world, the outcomes achieved are inspiring and promising even for the most challenging cases. Working at schools and as a consultant for families and young adults I could witness the positive changes first-hand.

- Awareness on Emotional Hygiene brought a better quality of life in the families and classrooms.
- Awareness of family energy dynamics resulted in better understanding needs and tolerance, changing the focus onto an internal reflection.
- Understanding better the nature of the struggles naturally leads to better solutions
- Recognising the sign of an overload facilitates the coping strategies before the crisis begins, preventing it.
- Expanding the special interest and discovering every individual hidden qualities and validating their experiences, supports their learning and integration.

When a parent was able to look at the world though their child's eyes marked a turning point in their paradigm. It lead to discovering their own practical tools for dealing with daily situations which provided overall improvement of everyone's wellbeing, communications and increased willingness to learn for both parties. Not only that but they started transferring the skills of connecting with an autistic child into other areas in their lives, thus affecting their social circles as well.

***Keywords*—** autism, communication, innovation, integrity, society.

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Asiret Mektebi: Sultan Abdulhamid's School for Tribes, 1892-1907

Mehmet Ali Neyzi

***Abstract*—** Please revise your paper title as it should be more specific and informative. The reader should be able to tell what your research is about and what methodology you mainly used by looking at your title.

***Keywords*—** integrating the frontiers, Ottoman education, Sultan Abdulhamid II, tribes, Turks and Arabs.

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Addressing Three Popular Philosophic Myths about Karl Popper's Demarcation Criteria

Nathan Oseroff-Spicer

***Abstract*—** Three popular philosophic myths about Karl Popper's demarcation criteria are: (1) the criterion of falsifiability is the sole criterion of demarcation; (2) the criterion sets out the boundaries of the natural sciences from non-science (or pseudo-science); (3) the criterion applies solely to singular theories. Consequently, (1)-(3) are almost universally thought to lead to the following objection: Popper's criteria are either too broad or too narrow (or both) (an objection from ill-fit). I show all three myths are false, thus the objection from ill-fit does not target Popper's criteria. I then develop one explanation for the origin of (1)-(3).

***Keywords*—** Karl Popper, problem of demarcation, demarcation problem, philosophy of science.

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The Relationship between Transcendence and Psychological Well-Being: A Systematic Scientific Literature Review

Monir Ahmed

***Abstract*—** The main purpose of this literature review was to investigate the existing quantitative clinical studies on the relationship between transcendence and psychological well-being. The primary objective of the literature review is to determine whether the existing studies adequately demonstrate the relationship between transcendence and psychological well-being, including spiritual well-being. A further objective of this literature review is to see if the 'creatio ex nihilo' doctrine is necessary to understand transcendence and its relationship with psychological well-being. Systematic literature review methods including studies identified from search engines, extracting data from the studies and assessing their quality for the planned review were used. The outcome of this literature review indicates that self-transcendence (STa), spiritual transcendence (STb) are positively related to psychological well-being. However, such positive relationships present limited scope for understanding transcendence and its relationship with well-being. The findings of this review support the need for further research in the area of transcendence and well-being. This literature review reveals the importance of developing a new transcendence tool for determining an individual's ability to transcend and the relationship between his/her ability for transcendence and psychological well-being. The author of this paper proposes that the inclusion of the theological doctrine ('creatio ex nihilo') in understanding transcendence and psychological well-being is crucial, necessary and unavoidable.

***Keywords*—** transcendence, psychological well-being, self-transcendence, spiritual transcendence, 'creatio ex nihilo'.

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Transcendence, Spirituality and Well-Being: A Cognitive-Theological Perspective

Monir Ahmed

***Abstract*—** This paper aims at discussing transcendence, spirituality, and well-being in light of the psychology of religion and spirituality. The main purpose of this paper is i) to demonstrate the importance of cognitive psychological process (thoughts, faith, and beliefs) and the doctrine of creation ('creatio ex nihilo') in transcendence, spirituality, and well-being; ii) to discuss the relationships among transcendence, spirituality, and well-being. Psychological studies of spiritual and religious phenomena have been advanced in the decade, mainly to understand how faith, spiritual and religious rituals influence or contribute to well-being. Psychologists of religion and spirituality have put forward methods, tools, and approaches necessary for promoting well-being. For instance, Kenneth I. Pargament, an American psychologist of religion and spirituality, developed spiritually integrated psychotherapy for clinical practice in dealing with the spiritual and religious issues affecting well-being. However, not much progress has been made in understanding the ability of transcendence and how such ability influences spirituality and religion as well as well-being. A possible reason could be that well-being has only been understood in a spiritual and religious context. It appears that transcendence, the core element of spirituality and religion, has not been explored adequately for well-being. In other words, the approaches that have been used so far for spirituality, religion, and well-being lack an integrated approach combining theology and psychology. The author of this paper proposes that cognitive-theological understanding involving faith and belief about the creation and the creator, the transcendent God is likely to offer a comprehensive understanding of transcendence as well as spirituality, religion, and their relationships with well-being. The importance of transcendence and the integration of psychology and theology can advance our knowledge of transcendence, spirituality, and well-being. It is inevitable that the creation is contingent and that the ultimate origin, source of the contingent physical reality, is a non-contingent being, the divine creator. As such, it is not unreasonable for many individuals to believe that the source of existence of non-contingent being, although undiscoverable in physical reality but transcendentally exists. 'Creatio ex nihilo' is the most fundamental doctrine in the Abrahamic faiths, i.e., Judaism, Christianity and Islam, and is widely accepted scriptural and philosophical background about the creation, creator, the divine that God created the universe out of nothing. Therefore, it is crucial to integrate theology, i.e., 'creatio ex nihilo' doctrine and psychology for a comprehensive understanding of transcendence, spirituality and their relationships with well-being.

***Keywords*—** transcendence, spirituality, well-being, 'creatio ex nihilo' doctrine.

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Adapting Strategies of Subaltern Counterpublics under Coronavirus-related Restrictions

Alisa Sheppental

***Abstract*—** The focus of this paper is the impact of coronavirus-related restrictions on the legitimacy and efficacy of subaltern counter publics and political resistance. Both difficulties and alterations of strategies needed to be considered by modern political movements within the counter-public sphere will be illustrated based on recent examples of protests in Hong Kong, Thailand, Belarus, Poland, and France. The dynamics of the modern globalized world have previously required a high level of adaptability, which resulted in a number of new features of modern political resistance in contrast with previous decades including digitalization of protests and higher involvement of previously fewer active citizens (women, elderly, people with disabilities, etc.) However, a global pandemic situation along with massive restrictions of daily lives provide new input for both theoretical and empirical analysis. The following paper represents an attempt to summarize coping and adapting strategies of subaltern counter publics and activist groups under coronavirus-related restrictions.

***Keywords*—**citizenship, political activism, subaltern counterpublics, discourse ethics

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Stochastic Approach on Large scale data for Graph-based Text Classification

Hyeyeon Kim, Eunju Park, Olalekan Olayemi

***Abstract*—**Text classification is one of classic problems in Natural Language Processing(NLP), which has lots of applications such as news filtering, spam detection, opinion mining and so on. With the development of deep learning, Convolutional Neural Networks(CNN) or Recurrent Neural Networks(RNN) are widely used to better represent text sequence. Recently, a new sort of neural network named Graph Neural Network(GNN) has been used in many NLP task including text classification, sequence labeling, relational reasoning and so on. Graph Convolutional Neural Network(GCN) which employed GNN has attracted wide attention in text classification tasks.

GCN model has been used widely as it captures global word co-occurrence information. It considers a large and heterogeneous text graph which contains word and document nodes. It builds edges among nodes based on word occurrence in documents and word co-occurrence in the whole corpus by calculate the term frequency-inverse document frequency(TF-IDF) or point-wise mutual information(PMI) as weights between nodes. As feeding the graph into a two layer GCN, it aggregates feature information from all neighbors to return output, which is class for a document. GCN model is a popular choice because guarantees promising results by outperforming state-of-the-art methods, even with partially labeled documents.

However, the GCN model builds one heterogeneous word document graph for a whole corpus which means that all nodes in the graph are present during training of embedding. Though it outperforms baseline models, it is faced with the practical problem coming from building and feeding the whole corpus graph which causes high memory consumption in practice for very large and densely connected graph datasets. Moreover, it does not generalize to unseen nodes.

We propose a new graph-based text classification model with stochastic learning process to address the problems of GCN model for text classification. Our model not only extract local features but also reduce the number of edges which removes burden computation for feeding all features. We build a single graph containing word and document nodes for a whole corpus like GCN model. However, it aggregates feature information from a fixed size of neighbors. It samples neighbors uniformly and non-uniformly instead of feeding features from all neighbors. With aggregated information, it predicts context and label.

To evaluate our stochastic model, we use large datasets to compare our model with GCN model because our model makes more sense in large datasets for the goal pursing less computational time. We run our experiments on three large real-world benchmark datasets, Amazon Review Data(2018), Open Library Data Dumps, Yelp dataset. Amazon Review Data(2018) consists of 233.1 million reviews gathered in the range May 1996 to October 2018. It includes product information, e.g. clolr(white or black), size(large or small) and text reviews by users. It is pre-categorized into 29 different categories, e.g. fashion, beauty, appliances and so on. Open Library has collected book information from the Library of Congress, other library and Amazon.com, as well as from user contributions. It provides dumps of records of 6 million authors, 20 million books including title, subtitle, published date, description, subjects, genres and so on. Yelp dataset has 5.2 million reviews on 17.4 thousand businesses which are categorized into 22 different categories such as Automotive, Education, Food and so on.

From experiments, our model achieves the state-of-the-art level performance and a significant advantage in memory consumption comparing with GCN model. It shows trading off performance and runtime depending on a fixed number of neighbors. Moreover, it aggregates feature information from closer neighbors that others by non-uniform sampling, which lead superior performance.

In conclusion, we introduce a novel approach for text classification tasks that outperforms state-of-the-art baselines especially in memory resources. It concludes that a text classification problem can be learnt by local graph structures with satisfactory results.

***Keywords*—** Large and dense dataset, Sample feeding, Stochastic approach, Text Graph Neural Networks

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The Attitudes of Palestinian Students, Parents and Teachers towards Participation in E- Learning: Challenges, Constrains and Aspirations

Rajaa H. A. Abumarahil

***Abstract*—** This study investigated the attitudes of Palestinian students, parents and teachers towards participation in e- learning. It also discussed the challenges, constraints and aspirations towards successful e-learning. 120 students from the ninth class participated in this study. A questionnaire for students was designed in the light of the research questions. The statistical program SPSS was used to obtain different types of descriptive statistics. Qualitative analysis included 20 students, 15 teachers and 15 parents. The perceptions of the participants were explored through semi-structured interviews to identify positive or negative responses about participation in e-learning. The topics included in the instruments were; the level of expected participation; factors that may affect participation; activities to increase participation; the role of teachers, parents and family social status in developing participation. The findings of the study reveal that there is an urgent need to highlight the importance of e- learning for both students and parents. Furthermore, the family social status and family construction are considered among the challenges against active participation. On the part of schools and teachers, the study showed their readiness to adopt e- learning even as one option stream in urgent cases and in parallel with classroom education as a long term strategy.

***Keywords*—** attitudes, e learning, parents, students, teachers**.**

I. INTRODUCTION

The debate for or against electronic learning is no longer applicable in the first half of 2020 as most countries adopted this style of learning as an urgent alternative to the face-to-face learning in the second semester of the academic year 2019/ 2020. Due to corona virus pandemic, most of the people around the world were forced to live under quarantine measures for several months. As a result, suddenly and without warning, the world had to go through an e-learning experience in order to save the academic year with minimal loss. Technology, knowledge and equipment could save the time and effort for successful education. E-learning is described as a successful method and preferable option by researchers because it uses up-to-date technologies in the process of teaching and learning [14]. In comparison with face-to-face learning, [4] stated that e-learning is more effective than face-to-face learning because it motivates students to learn and gain knowledge as well as facilitates communication between them and their teachers.

II. LITERATURE REVIEW

E-learning is not only about incorporating technology in learning, but it is also a comprehensive approach for faster and successful learning where students can learn easier and better. As stated by [15], "E-learning has been widely defined as the mode of knowledge transmission which combines the principles of learning with the systematic application of information technology." Worth noting here is that teachers are not replaced by technology, but their performance is enhanced to help them address the teaching materials to their students. E-learning provides a visualization of most of the things [1]. Additionally, unlike face-to-face learning, students are much more autonomous and have better and easy access to unlimited sources of information. Not to mention the learning and teaching process in the face-to-face learning is constrained by a pre-determined objectives and lesson plan which not only gives students a limited knowledge access, but also constrains teachers from adjusting the teaching material to suit all styles and needs of the learners. Furthermore, given the availability and ubiquity of technology, students exposure to knowledge is not limited to the duration of the lesson and their attendance at schools and libraries. They, however, can access it individually at their own pace without being supervised by the presence of their teachers. [8] pointed to one of the strong aspects of e-learning with respect to students being the decision makers of their own learning and being in control of their learning process. Furthermore, flexibility is one of the observable aspects of the e-learning because it does not only offer the learning materials in a mesmerizing and joyful way, but also it offers myriad ways of giving feedback and evaluating students' performance [3].

[12] stressed to the suitability of e-learning to different students' personalities. For example, e-learning offers an effective alternative for apprehensive students to participate and speak their opinions as the focus of the teacher is scattered on all students, instead of being focused only on those students who are not shy to participate. [16] estimates the reduced time by e-learning compared to traditional classroom by 15 to 20 percent. In addition, he summarizes the benefits of e-learning in the following; avoiding wasting time on initiating and wrapping the sessions, students learn on their own pace, save time, money and effort of travel and finally students focus on the content they enjoy and suits their interests. Also, supporters of learner-centered approach find technology enhance teaching methods, promote learning and make the learning process more meaningful. The learners are the center of the process and they can achieve their goals from homes even without seeing their teachers [2]**.**

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Technology has become an essential part of our daily lives because it plays a key role in the digital age and its effect is stretched over all aspects of life in society from elderly to babies [7]. It also now provides new means of communications between people inside the educational institutes. Technology can solve the constrains of the traditional teaching by improving relationships between teachers and learners, making teaching a collaborative process, narrowing long- standing gaps and modifying learning experiences according to the learners' needs [5]. The major benefits of technology on brain development were identified by [13] "Firstly, digital technology can help children to visualize difficult concepts. Secondly, new interactive technologies facilitate the creation of an environment in which children can learn through action, providing them with the opportunity to create and explore". As described by [11**], "**Technology and schooling are indivisible, all of which should be coordinated". Similarly, [17] stress the important role of technology in providing various teaching, learning and assessment tools that enable tailors to construct courses for different levels of learners. [10] stated that nowadays ineffective learning occurs due to the lack of exposure to technological tools by both teachers and learners.

To make the e-learning a fruitful process and render it successful, parents should be made aware of the benefits of e-learning on the development of their children. In other words, parents must accept the fact that e-learning provides a quick tool for achieving more and better learning in less time [6]. Furthermore, students, parents as well as teachers should have favorable attitude towards technology and e learning. Also, students and teachers should not mind spending more time on using technological means to interact with each other and gain knowledge [1]. In fact, different factors influence learners' attitudes towards e-learning including age, gender, level of education, computer use, internet experience, and professional status [9].

III. Statement of the Problem

Traditional learning is the dominant type of learning and teaching at Palestinian schools. Recently and due to the Covid 19, Palestinian schools are forced to use e-learning as an alternative to the face-to-face learning in compliance with the quarantine measures enforced by the Palestinian government and keeping the distance recommendations by the World Health Organization(WHO). Therefore, this study is an attempt to investigate the attitudes of Palestinian students, parents and teachers towards participation in e-learning in addition to explore challenges, constrains and aspirations for effective digital education. The study focuses on the Palestinian students in the prep stage in the Gaza Strip. The study tried to answer the following questions:

What are the attitudes of Palestinian students towards participation in e- learning at the prep schools in Gaza?

What are the attitudes of parents towards participation in e-learning at the prep schools in Gaza?

What are the attitudes of teachers towards participation in e-learning at the prep schools in Gaza?

How to overcome problems and difficulties that face effective and exciting e-learning?

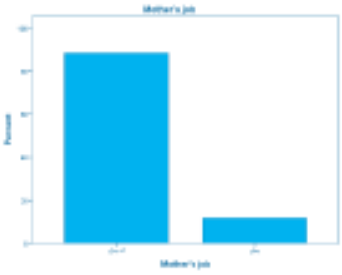
IV. Methodology

The study used a mixture of quantitative and qualitative analysis. A structured questionnaire was developed to explore the attitudes of students. It was designed in light of the research questions. It consists of two sections. The first deals with students' background information including the following points; parents' jobs, family members and family economic status. The second part covered the main topics of the study and included 22 items measured on a 4-point Likert scale, where 1 = strongly disagree and 4 = strongly agree. The items of the questionnaire were reviewed by a number of specialists in the field and their comments were taken into consideration. Reliability of the questionnaire was examined by Cronbach' alpha coefficient and it proved acceptable level of consistency (r= 0.779). The statistical program SPSS was used to obtain different types of descriptive statistics. Qualitative analysis included 20 students, 15 teachers and 15 parents. A semi-structured interview was used to collect the responses about participation in e-learning. Students were asked about the role of different parties in encouraging participation, overcoming obstacles and solving problems. The family social status was analyzed to indicate its effect on the students' participation. Furthermore, interviews with teachers dealt with their readiness for training and proposing activities to stimulate students' participation in e-learning. A sample of ninth class students (120) from a school in the middle governorate was used. 15 of the students' parents were informed to participate in the research. In addition, 15 teachers from the same school volunteered to participate in the study. Also, the interviews were conducted with 20 students at the school time.

V. Results

This section handles the results of the instruments of the study. Figures and tables are presented and followed by analysis of their contents.

Fig. 1 mothers' jobs



Starting with family situation, fig. (1) presents the percentages of students whose mothers work outside home. Only (11.7%) of students confirmed that their mothers have jobs while (88.3%) of mothers are housewives.

Fig. 2 fathers' jobs

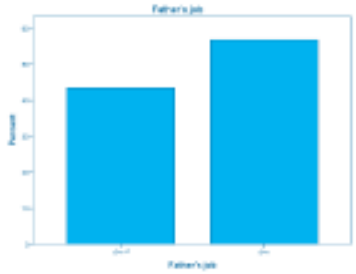


Fig. (2) represents the percentages of the fathers' jobs. students whose fathers have jobs are (56.7%) while those who don't have jobs are (43.3%).

Fig. 3 Family members

Fig. (3) represents the percentages of the members of families. (97.5%) of students agreed that the number of their family members is above five persons.

Commenting on the family information, (43.3%) of students' fathers and (88.3%) of their mothers are jobless which means that these families are not able to afford basic needs or technological means for their children. The economic situation of the families is not determined by the availability of jobs for their parents, but also by the number of the family members as (97.5%) of students' families have more than five members. Being a big family adds more responsibilities on the parents' shoulders and makes it difficult to afford the needs of children.

TABLE 1
FREQUENCIES AND PERCENTAGES OF STUDENTS' INFORMATION

Question	Answer	Frequency	Percent
Is there a computer at your home?	Yes	82	68.3
	No	38	31.7
Do you have your own room?	Yes	92	76.7
	No	28	23.3
Do you have a mobile phone?	Yes	83	69.2
	No	37	30.8
Do you have Facebook account?	Yes	62	51.7
	No	58	48.3

Table (1) presents information about students at home to determine the economic situation of the family. (68.3 %) of students have a computer at home for the whole family while (31.7%) do not have computers. While only (23.3%) of students have their own rooms, most of students (76.7 %) share other members of the family in one room. Percentage of having mobile phone could be better as (69.2%) have mobiles and (51.7%) have Facebook accounts. This analysis predicts the economic situation and social status of most of students' families. Therefore, there is an urgent need to improve the socio-economic situation in order to prepare students for successful e-learning process.

TABLE 2
PERCENTAGES OF STUDENTS' ATTITUDES TOWARDS E-LEARNING

Statement	4	3	2	1
1	15.8	7.5	54.2	22.5
2	21.7	15.8	43.3	19.2
3	26.7	14.2	47.5	11.7
4	14.2	7.5	55.0	23.3
5	9.2	15.0	57.5	18.3
6	24.2	35.0	31.7	9.2
7	38.3	48.3	10.0	3.3
8	48.3	38.3	12.5	0.9
9	26.7	32.5	27.5	13.3
10	19.2	30.8	36.7	13.3
11	25.8	23.3	29.2	21.7
12	39.2	37.5	20.8	2.5
13	30.0	27.5	12.5	30.0
14	25.8	28.3	28.3	17.5
15	17.5	36.7	30.0	15.8
16	40	39.2	8.3	12.5
17	48.3	39.2	10.0	2.5
18	26.7	27.5	29.2	16.7
19	45.0	38.3	10.0	6.7
20	40.0	22.5	17.5	20.0
21	15.8	53.3	15.1	15.8
22	41.7	19.2	27.5	11.7

Table (2) presents the students' responses to the items of the questionnaire. The first four items were about expectations of the students' participation in e-learning in the future. (62.5%) are allowed to use the computer and mobile freely and (59.2%) are encouraged by their parents to participate in all school activities. However, (76.7%) of students think that they will not be able participate in e-learning effectively and approximately the same percentage expect some difficulties in interacting with some teachers.

The items five to ten presents the attitudes of students towards benefits of e-learning. Luckily most students (75.8%) believe that e-learning provides students with many benefits. (59.2%) consider e-learning a fast and easy way of learning and they are interested in participating in its activities. Therefore, (86.6%) show interest in learning more about mobiles and computers. However, (86.6%) of students prefer learning with their classmates in the classroom and only half of students think that e-learning is an enjoyable and comfortable experience. Responses to item twelve support this idea as (76.7%) think that e-learning should be used only in urgent times.

The availability of the internet, the students' ability to use technological means and communication skills were presented in the three statements eleven, thirteen and fourteen. Internet is available for (49.1%) of students, (57.5%) share the mobile with their sisters and brothers and (54.1%) can use electronic communication means easily. On the other hand, the students'

opinions about the role of internet in their lives were discussed in the statements fifteen to eighteen. (54.2%) of students use the internet to communicate with their classmates. (69.2%) enjoy searching the internet for their study. (87.5%) think that the internet makes our lives easier. Finally, (54.2%) believe of the important role of e-learning as an alternative to save education for their future.

The last four statements deal with the school and teachers efforts for making e-learning a successful process. (83.3%) of students agree that their teachers respond very quickly to solve problems and explain any difficulties. (62.5%) confirmed the regular communications between the school and parents. (69.1%) are satisfied with the direct connections between teachers and families. (60.9%) believe that e-learning strengthens communication skills with classmates and teachers as well.

In the interviews, the students are satisfied with the support they receive from home and school. They also express their worries about the difficulties that may affect their participation in any future e-learning courses. They are sure that the problems and obstacles are too great for school or family to solve. Therefore, most students hope that they will not have to use e-learning in the current situation for any reason because that will not provide them with equal opportunities to get education.

However, in the interviews parents support the students' preference of traditional learning over e-learning for its direct connection and instant feedback. "There is a big difference between e-learning and traditional learning. The second is better because the students have to follow with the teachers while this is not available in e-learning.". According to parents, students' involvement in e-learning is controlled by the availability of electricity and internet which both are unavailable due to the lack of supplies in the two services. Parents also expressed their concerns about the potential dangers arising from their children' use of modern technology. Therefore, parents as well as students do not prefer e-learning.

For teachers, e-learning is essential and could be the only available option nowadays as a result of corona pandemic which they described as "not expected at all". Teachers commented that this pandemic showed how important to be well-versed in technology because they were suddenly asked to start teaching over the internet, something which they were neither expected nor prepared to do. Comments from teachers, learners as well as parents indicated the importance of being literate technologically in order to be prepared to use technology permanently. Teachers expressed their will and readiness to take training courses on how to use technology and incorporate e-learning in their teaching.

VI. DISCUSSION

The results of the current research indicate the importance of e-learning which must be taken into consideration by all participants of the study; students, teachers and parents. The findings prove that one of the major challenges to using e-learning is the lack of awareness of its importance among parents. This is due to their concerns regarding exposing their children to technology at this young age. The study invites parents to be responsible for encouraging the students to participate in e- learning, allocating enough time for education and providing the appropriate physical and psychological environment for effective e-learning. For students, there is a clear contradiction between the students' positive attitudes towards modern technology means and their preference of traditional learning. This discrepancy may be attributed to the students' fear of lack of resources which may lead their education to danger if the e-learning is adopted. For teachers, unfamiliarity with modern methods of teaching is reflected on their concerns about using technology, therefore, the study proposes providing teachers with digital skills and helping them adopt e-learning besides face to face teaching. In addition, the school is invited to build a strong relationship with parents for making e-learning successful. Recommendations for active participation include workshops and seminars to help students and parents understand the importance of e-learning for future achievement.

VII. Conclusion

Despite all social and economic difficulties, no one can deny the importance of e-learning and the role of technology in our life nowadays. Therefore, achieving better educational outcomes is connected with using modern methods and electronic tools for competitive education in the light of the continuous changes in life in general in education in particular. All stakeholders must make all efforts to help both teachers as well as learners to acquire more skills, and overall get better outcomes and make knowledge accessible to all students. Schools and teachers in this study showed their readiness to adopt e- learning as a long-term strategy that goes in parallel with the face-to-face learning and teaching. They also expressed their readiness to provide all necessary support for helping students use online tools, managing their time effectively and designing suitable content meeting the needs of all students.

Recommendations of this study focus on two main directions; positive attitudes towards e-learning and use of technology. It is worth mentioning that having positive attitudes by students and their parents makes the school and teachers' mission easier. They can collaborate to take organized procedures and well prepared plans for the sake of both students and institutions. E-learning may be an inevitable future of learning and so it must be accepted by the whole society [15]. For technology, being competent in using technology is the first step towards successful e-learning. However, technology should be used to support existing developmental and educational goals instead of replacing them or distort them [13].

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APPENDIX 1

QUESTIONNAIRE

ATTITUDES OF STUDENTS TOWARDS PARTICIPATION IN E-LEARNING

SECTION **(1)**

Background information

GPA: …….
Father' job: ……
Mother's job: …….
Family members: ……

Is there a computer at your home?	Yes	No
Do you have your own room?	Yes	No
Do you have a mobile phone?	Yes	No
Do you have Facebook account?	Yes	No
Have you participated in E learning?	Yes	No

SECTION (2)

No.	Statement
1	I intend to participate in the E learning platform effectively
2	I am allowed to use the computer and the mobile freely.
3	My parents always encourage me to participate in the school activities.
4	I expect some difficulties in interacting with some of my teachers.
5	I think there are no benefits of participating in the E learning platform
6	E learning is a fast and easy way of learning.
7	I need to learn more about using mobiles and computers.
8	I understand better from learning with my classmates at class.
9	I am interested in participating in e learning
10	E learning is an enjoyable and comfortable experience.
11	The internet is available all the time.
12	E learning should be used in urgent times only.
13	The time of using the mobile is distributed between me and my brothers and sisters.
14	I can use electronic communication means easily.
15	I communicate with my classmates to discuss the topics of e learning.
16	I enjoy searching the internet for information relating to my study.
17	The internet makes our lives easier and more comfortable.
18	No need to worry about our education in the future as E-learning is a good alternative.
19	Teachers response very quickly to solve problems and explain any difficulties.
20	The school always communicates with my family.
21	My teachers have direct connections with my parents all the time.
22	E-learning strengthens my communication skills with my classmates and my teachers as well.

Physical Stores Adapting to Online Selling during the Pandemic in San Fernando City of La Union

Rav Lacuata, Danniela Co, Lyrica Ordoñez, Jasjeet Kaur, Jashen Tatunay

***Abstract*—** Abstract: Understanding the online selling trend most people have started adapting to the trend later understanding what the biggest differences they have compared to what most businessmen and women are used to which is physical selling. Away from the past wherein consumers were able to go out of their houses to buy what they want regularly, due to the present COVID-19 pandemic the customers were not able to do so. The researchers devise the following queries: 1. How did the physical store adapt to online selling amidst the pandemic? and 2. What are the challenges faced by the physical stores in terms of sales, customer relation, and technological challenges. The research design that was utilized in the study is Descriptive Research Design and purposive sampling have been utilized such that a set of questionnaires were also used in conducting the online survey through a form. With the study region, San Fernando City, La Union, the researchers interviewed 15 business owners or entrepreneurs to assess the biggest differences in online selling and physical selling and to analyze how the physical stores adapted to online selling during the pandemic. Results show that the physical store adapts to online selling amidst the pandemic in making the procedures like the deliveries, high quality products, and hygiene. The challenges faced by the physical stores in terms of sales is the generation of income, the customer relation encountered are technological advancement, opportunity, and the technological challenges are the plugging, transactions and competitions. With the researchers' realization, these factors are needed for the aspiring entrepreneurs and entrepreneurs that are still not into online selling, as it is helpful and beneficial for them.

***Keywords*—** Physical Stores, Adapting, Online Selling, Pandemic, Entrepreneurs.

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Case Study: Sexuality Education Pre- service Kindergarten Teacher Training Programme in Hong Kong

Ka Man CHIM

***Abstract*—** This case study is based on the Bronfenbrenner's Ecological Theory, to investigate the interrelationships between multiple contextual factors surrounding preschoolers' sexuality learning process. It reveals that teacher' attitudes, comfortable and confidence levels are mutually dependent and mutually influential in affecting the child's sexual learning process. One of the research gaps in sexuality education field is a lack of research in listening to the voices of the users (pre- service kindergarten teachers) of the training programme in Hong Kong.

This case study addresses the question of what the nature of sexuality teaching and learning in the early childhood teacher training programme should be in Hong Kong by inviting three pre- service teachers and explore their readiness and willingness to become an early sexual educator. They are invited to complete a questionnaire before and after the sexuality training sessions. Researcher then did classroom observations in their practicum kindergartens after the sexuality training sessions; and they are invited for a focus group interview after their practicum.

ASK (Attitude, Skill, Knowledge) teaching model is suggested in this paper. ASK model proposes three basic ideas: (1) positive attitudes towards early sexuality education (preschoolers' curiosity about sexual matters is the foundation for sexual learning); (2) teaching skills in preparing and delivering a developmentally appropriate sexual learning activity for preschoolers (preschoolers with the appropriate guidance from teachers, in which young children can use and develop the skills to establish their own knowledge about body image, interpersonal relationships and gender roles in their lifetime); and (3) correct sexual knowledge in helping preschoolers to establish their own sexual schema.

It concludes with a discussion of implications for the teacher training provider and preschool management in preparing a developmentally appropriate and culturally sensitive method to deliver actual and unprejudiced sexual information to pre- service teachers in Hong Kong.

***Keywords*—** ASK Model, preschool, sexuality education, teacher training

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Embracing Digital Technologies in Response to COVID – 19 in Teaching & Learning

Ameema Mahroof

***Abstract*—** The present study aimed to explore the possibilities and opportunities education sector can use in response to COVID-19. During the COVID-19 Lockdown, regular teaching & learning isn't possible, which is a huge loss to the students. Access to education is not possible anymore without the IT. The objective of this study is to assess the usage of IT interventions in response to COVID-19 and challenges in implementing those IT technologies. Data were taken from different school principals via semi-structured interviews to know their strategies for embracing digital interventions. Convenient sampling techniques were used. The findings of the study revealed that there are different online educational platforms are being used by schools to continue teaching & learning, i.e., virtual classrooms, Learning Management System, video conferencing, student self-service system, online discussions board, and online examination systems. Collaborating in an online environment is a challenge for both teachers and a student. For its implementation following things needs to be considered a) access to devices b) IT Infrastructure c) Training, and d) balanced digital activities with screen-free activities. It is recommended by the researcher to have a further study on deployed IT interventions success and failures for improvement.

***Keywords*—** Covid-19, information technology, teaching, learning.

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Next Generation of European Nanomaterial Regulation – The Way Forward

Maria B. Nielsen, Lauge W. Clausen, Steffen F. Hansen

***Abstract*—** Materials obtain unique properties when at the nanoscale and multiple application possibilities. This has caused a rapid development in the field of nanotechnology and an increase in the production and societal use of nanomaterials since the 2000s. Due to the inevitable release of nanomaterials from the increasing production and uses, concerns have been raised about the potential risks that nanomaterials might pose to human health and the environment and whether existing regulations is adequate. Numerous health and environmental regulations exist in Europe, with the aim to secure safe use and production of chemicals and consumer products. Implementation of nano-specific provisions in these regulations has increased substantially in the recent years. There is, however, a need to evaluate the sufficiency and suitability of these regulations to properly incorporate nanomaterials. The aim of this study is to analyze and compare key features of European regulations relevant to nanomaterials, identify strengths and weaknesses, and provide recommendations for future efforts to overcome identified regulatory challenges related to nanomaterials. Eurlex was used to identify relevant legislation and each Directive, Regulation, etc. identified as relevant was subjected to an in-depth analysis with regard to definitions used, information, risk management procedures and monitoring requirements as well as stakeholder views. It was found, that many regulations have been revised to explicitly cover nanomaterials. Despite these efforts, limitations evidently still exist. Cross-cutting limitations include the lack of a common nanomaterial definition among the regulations and unclear terminology used. Specific challenges exist for the individual regulations and include challenges related to the grouping of nanomaterials in the European Chemical legislation, identification of treated articles and conduction of ecotoxicological testing in the Biocidal Product Regulation and challenges of pre-market safety assessment of cosmetics in the Regulation on Cosmetic Products.

***Keywords*—** Common definition, European legislations, Grouping, Nanomaterials, Test methods

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The Trafficking in Person of Indonesia Migrant Workers: Case Study of Domestic Workers Agencies in Malaysia

Btari Kinayungan

***Abstract*—** Indonesia Government has been campaigning for safe migration through legal entry and legal stay; to ensure the safety of migrant workers from transnational crimes of smuggling and trafficking in person. However, there have been emerging patterns of migrant workers, especially for those who work in the domestic sector in Malaysia, become victims of trafficking in person despite following the safe migration process stipulated by the government. There is a difference in this pattern compared to previously known patterns of trafficking in person of migrant workers: legal entry and illegal stay, where the migrant workers enters the country with proper documents, but employed without working permit; and illegal entry and illegal stay, where the migrant workers usually smuggled into the country, and did not have valid documents to reside in the country. The research method used is a qualitative method with a juridical-empirical approach. The data used comes from primary and secondary data. Data collection techniques using interview and literature study methods. The result shows that migrant workers agencies utilize Malaysia's strict immigration law to gain leverage of the migrant workers. The migrant workers enter the designated country legally with proper documents, and later reside illegally because their migrant workers agencies filed a different working permit from the actual job written in the contract they've signed before the migrant workers' departure. This difference between the working permits that the agencies provide to the actual jobs that the same agencies employ them to do, render the migrant workers as illegal workers. This status put the migrant workers in a vulnerable position in which the agencies will be able to exploit their labor. These findings further support the academic notion that the vulnerability of Indonesia migrant workers are not only stemmed from procedural-bureaucratic matters.

***Keywords*—** immigration, migrant workers, trafficking in person, work agency.

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Introducing Mnemosyne: The Role of the Holistic Documentation in the VR/AR Applications for Cultural Heritage Tourism

Eleanna Avouri, Francesco Ripanti

***Abstract*—** The development of Information and Communication Technologies (ICT) has created new opportunities for the management, protection and promotion of Cultural Heritage. In particular, VR and AR technologies can provide a unique opportunity for the visualization of archaeological site and the urbanscape of historical cities, merging the tangible and the intangible elements as well as unveiling the unseen layers of their history. Moreover, mobile apps based on VR/AR have become popular educational and entertainment tools in the field of the Cultural Heritage Tourism; their portability allows the user to interact at the same moment with the virtual and the real world and the VR/AR environment can become interactive when combined with guided tours and serious games.

However, dealing with VR/AR mobile apps as the product of research and documentation projects, emerges the need to evaluate their construction process. Do these tools exploit the full potentialities of the available data resources? Do they process them in the best way to build accurate 3D models? Do they manage to make the most of the historical contents according to the needs of the users? Do they match the provisions for the long-term e-preservation and the connection with international infrastructures such as Europeana? In other words, do these outputs meet the criteria of a holistic documentation process to ensure an engaging but also high-quality Cultural Heritage Tourism experience?

This paper presents a quantitative research that compares the creation process and the output of a set of VR/AR mobile applications that focus on the visualisation of monuments and historical building units of European cities, looking if they follow the criteria of holistic documentation and if they manage to effectively address the needs of a sustainable model for the Cultural Heritage Tourism sector.

This critical approach introduces the Mnemosyne research programme and allows to clearly demonstrate our future project's contribution in this domain, locating the absence of the essential common guidelines and standards. The EU ERA Chair in Digital Cultural Heritage, project "MNEMOSYNE", is structured as a three-phase research programme that has as objective the holistic documentation of the Digital Cultural Heritage life cycle in support of existing and potential user needs. In an effort to establish sustainable paradigms in socio-economic areas of Digital Cultural Heritage impact, a holistic approach will ensure the presence and the quality of each documentation step and will assure maximum quality and engagement for Cultural Heritage Tourism.

***Keywords*—** cultural tourism, digital heritage, holistic documentation, VR/AR technologies.

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Effectiveness of Habit Reversal Treatment on Craving,Assertiveness and Emotion Regulation of Addicts Treated with Methadone

Samin Khorrami

***Abstract*—** Objectives: The purpose of this study was to investigate the effectiveness of habit reversal treatment on craving, assertiveness, and emotion regulation of addicts treated with methadone. Method: The research design was a semi-pilot pre-test-post-test, together with the control and experimental group. The statistical population was formed of all addicts referred to addiction treatment centers in district 7 of Tehran in the second half of 1396 and the first half of 1397. In an available sampling method, 20 drug addicts treated with methadone with a history of at least 6 months of treatment as a sample of the experimental group, as well as 20 addicts with a history of at least 6 months of non-use as a control group were selected. Craving questionnaires, assertiveness, and emotional regulation strategies were used to evaluate variables and multivariate analysis of covariance analysis in order to analyze the data. Results: The results of this study showed that the use of methadone therapy with habit reversal treatment in comparison with methadone therapy alone has a significant effect on craving, assertiveness, and emotion regulation of addicts. Conclusion: According to the results, it seems that accompanied by methadone therapy, the use of systematic reversal training increases the possibility of success in treatment and decreases the possibility of slipping and returning to re-use of drug.

***Keywords*—** habit reversal treatment, craving, effectivenes, emotion regulation, methadone-treated addicts.

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Human Centred Design Approach for Public Transportation

J. Kuys and K. Day

***Abstract*—** Improving urban transportation systems require an emphasis on users' end-to-end journey experience; from the moment the user steps out of their home to when they arrive at their destination. In considering such end-to-end experiences, Human Centred Design (HCD) must be integrated from the very beginning to generate viable outcomes for the public. A HCD approach will encourage innovative outcomes while acknowledging all factors that need to be understood along the journey. We provide evidence to show that when designing for public transportation it is not just about the physical manifestation of a particular outcome; moreover, it's about the context and human behaviours that need to be considered throughout the design process. Humans and their behavioural factors are vitally important to successful implementation of sustainable public transport systems. Through an in-depth literature review of HCD approaches for urban transportation systems, we provide a base to exploit the benefits and highlight the importance of including HCD in public transportation projects for greater patronage, resulting in more sustainable cities. A HCD approach is critical to all public transportation projects to understand different levels of transportation design; from setting of transport policy, to implementation, to infrastructure, vehicle and interface design.

***Keywords*—**Human centred design, public transportation, urban planning, user experience

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Influence of Low and Extreme Heat Fluxes on Thermal Degradation of Carbon Fibre-Reinforced Polymers

Johannes Bibinger, Sebastian Eibl, Hans-Joachim Gudladt

***Abstract*—**This study considers the influence of different irradiation scenarios on the thermal degradation of carbon fibre-reinforced polymers (CFRP). Real threats are simulated, such as fires with long-lasting low heat fluxes and nuclear heat flashes with short-lasting high heat fluxes. For this purpose, coated and uncoated quasi-isotropic samples of the commercially available CFRP HexPly® 8552/IM7 are thermally irradiated from one side by a cone calorimeter and a xenon short-arc lamp with heat fluxes between 5 and 175 W/cm2 at varying time intervals. The specimen temperature is recorded on the front and back side as well as at different laminate depths. The CFRP are non-destructively tested with ultrasonic testing, infrared spectroscopy (ATR-FTIR), scanning electron microscopy (SEM) and microfocused computed X-Ray tomography (μCT). Destructive tests are performed to evaluate the mechanical properties in terms of interlaminar shear strength (ILSS), compressive and tensile strength. The irradiation scenarios vary significantly in heat flux and exposure time. Thus, different heating rates, radiation effects and temperature distributions occur. This leads to unequal decomposition processes, which affect the sensitivity of the strength type and damage behaviour of the specimens. However, with the use of surface coatings thermal degradation of composite materials can be delayed.

***Keywords*—**CFRP, one-sided thermal damage, high heat flux, heating rate, non-destructive and destructive testing.

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Optical Temperature Sensing Properties of er3+/yb3+ Co-doped na3gd(po4)2 Upconversion Phosphors

Saidi Kamel, Dammak Mohamed

***Abstract*—** Er3+/Yb3+ co-doped NGPO phosphors were synthesized by the solid-state method. The crystalline structure and up-conversion luminescence features have been investigated by X-ray diffraction (XRD), SEM, EDS, and up-conversion emission spectra. Green emission located at 524 nm (2 H11/2 → 4 I15/2) and 547 nm (4 S3/2 → 4 I15/2), red emission centered at 657 nm (4 F9/2 → 4 I15/2) have been observed excited by 980 nm laser. We have also investigated the thermal properties of UC emissions between 300 and 440 K, a dual-mode temperature sensor based on fluorescence intensity ratio of thermally coupled levels (TCL) (2H11/2/ 4S3/2) and nonthermally coupled levels (Non-TCL) (2H11/2/ 4F9/2) are realized. The higher sensitivity for temperature measurement could be obtained compared to the formerly reported rare-earth ions fluorescence-based optical temperature sensors. Furthermore, the heating effects produced by laser excitation was also measured, which provoked the sample temperature rising from 275.8 to 390.8 K as increasing pump power from 0.9 to 2.75 W.

***Keywords*—** upconversion, TCL, Non-TCL, sensor.

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Road Traffic Psychology: A Survey of Seat Belt Usage among Drivers in Ogbomoso, Oyo State, Nigeria

I. T. Adebayo, J. R. Aworemi, V. A. Ogundele, O. J. Babalola, J. O. Ajayi

***Abstract*—** The behavior of road users is a critical element in road safety. However, despite the proven effectiveness of the seat belt in reducing injury severity, some drivers still do not use the seat belt. The study, therefore, examined seat belt usage among drivers in Ogbomoso, Oyo State, Nigeria. Face-to-face surveys were conducted to elicit data on seat belt usage and road behaviors on 54,038 drivers plying the General-Lautech Road in Ogbomoso over a period of six months. Data collected were analyzed using both descriptive and inferential statistics. Findings revealed that seat belt usage was moderate among private car drivers in the morning (52.75 percent) and much lower in the evening (37.67 percent), while less than 30 percent of the commercial bus/taxi drivers used the seat during both periods. The paired T-test revealed a significant difference in seat belt usage by all the drivers in the morning and in the evening, as indicated with a T value of 113.977 and the level of significance $p < 0.05$. The study concluded that there is a significant difference in the usage of the seat belt by both private car and commercial bus/taxi drivers in Ogbomoso as most drivers made use of the seat belt, especially in the morning, to avoid being delayed when flagged down and fined for non-compliance with seat belt usage by the road traffic law enforcement agents. However, most of the drivers cited inadequate/lack of enforcement of compulsory use of seat belts by the relevant agencies and discomfort as the major reasons for not using the seat belt while driving.

***Keywords*—** drivers, road , seat belt, traffic psychology.

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Multi-Cluster Dynamics in Coupled Phase Oscillator

Asma Ismail, Peter Ashwin

***Abstract*—** In this paper we examine robust clustering behaviour with multiple nontrivial clus-ters for identically and globally coupled phase oscillators. These systems are such that the dynamics is completely determined by the number of oscillators N and a single scalar function g(') (the coupling function). Previous work has shown that (a) any clustering can stably appear via choice of a suitable coupling function and (b) open sets of coupling functions can generate heteroclinic network attractors between cluster states of saddle type, though there seem to be no examples where saddles with more than two nontrivial clusters are involved. In this work we clarify the relationship be- tween the coupling function and the dynamics. We focus on cases where the clusters are inequivalent in the sense of not being related by a temporal symmetry, and demonstrate that there are coupling functions that give robust heteroclinic networks between periodic states involving three or more nontrivial clusters. We consider an example for N = 6 oscillators where the clustering is into three inequivalent clusters. We also discuss some aspects of the bifurcation structure for periodic multi-cluster states and show that the transverse stability of inequivalent clusters can, to a large extent, be varied independently of the tangential stability..

***Keywords*—** Globally coupled Phase oscillators, Coupling function, Robust Clustering, Heteroclinic network.

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Lean Manufacturing: Systematic Layout Planning Application to An Assembly Line Layout of A Welding Industry

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***Abstract*—**The purpose of this paper is to present the process of elaborating the layout of an assembly line of a welding industry using the principles of lean manufacturing as the main driver. The objective of this paper is relevant since the current layout of the assembly line causes non-productive times for operators, being related to the lean waste of unnecessary movements. The methodology used for the project development was Project-based Learning (PBL), which is an active way of learning focused on real problems. The process of selecting the methodology for layout planning was developed considering three criteria to evaluate the most relevant one for this paper's goal. As a result, it was selected Systematic Layout Planning, adding three steps to it – Value Stream Mapping for the current situation and after layout changed and the definition of lean tools and layout type. This inclusion was due to consider lean manufacturing in the layout redesign of the industry. The layout change resulted in an increase in the value-adding time of operations carried out in the sector, reduction in movement times between previous and final assemblies, and in cost savings regarding the man-hour value of the employees, which can be invested in productive hours instead of movement times.

Keywords: assembly line, layout, lean manufacturing, systematic layout planning.

I. Introduction

LEAN manufacturing strengthened in after-war considering that the Japanese reality demanded methodologies which accelerate the country's economic recovery. Also known as Toyota manufacturing system, lean manufacturing can be defined as a set of combined techniques that allow the decrease or elimination of super production, waiting, transport, process, inventory, movement, and defects wastes [1].

To improve a company's layout is highly important to reduce the time from customer placing orders and receiving them – lead time. The inadequate position of equipment, machines, workstations, and other necessary resources can impact the organization performance about its productivity and compliance in delivery dates, besides in decreasing the added value in operations. By improving layout, it is possible to achieve moving economy and waste elimination [2].

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When discussing about Lean manufacturing and layout, it is common to associate to cellular layout considering its main characteristics of positioning all necessary resources for the assembly of a product part and, combining all these parts, the final product. However, accordingly to the company's context, cellular layout can not be the selected one, even if the main driver is lean manufacturing.

For this paper, the industry used as a study case is a German multinational which is in the welding segment and has a factory in the state of Rio de Janeiro, Brazil. Divided into two pavements, the machining and packaging sectors as well as the warehouse are on the first floor and the assembly line in the second, being necessary transporting products, parts, and components through an industrial elevator.

On the second floor, its assembly line is divided and identified by signs of three product lines – Meta Inert Gas/Metal Active Gas (MIG/MAG), Tungsten Inert Gas (TIG) and Robot torches and cables. There are pre-assemblies cells of components and cables which are used in assemblies cells of torches or are sold as spare parts. Despite being divided by these signs, the positioning of cells does not follow completely this separation. This fact, besides visually not being in accord to the signs, results in the need of operators move themselves between cells to arrange finished products or gather components.

These shifts are considered movement times and are included as non-productive hours in the factory's productivity indicators. These indicators are calculated considering productive hours and hours when employees remain without Production Orders (PO). Since operators invest time in movements, which are non-productive hours, the results of the indicators decrease by 10% in relation to the hours available.

In addition, it was identified by times studies that the assembly times are correct compared with the effective time invested by employees. However, the total production time is increased in 28% by movement times for torch assembly, caused by the current layout. Therefore, this paper approaches the question of redesigning layout using Lean manufacturing as the main driver.

II. Methodology Selection

The project behind this paper followed the Project-based Learning (PBL) methodology, which consists in a way of students to controls the learning process by engaging themselves in a real problem and research good practices on literature to solve it [3].

A. Literature review

The objective of this stage was understanding concepts related to lean manufacturing and layout and lean tools indicated for designing layouts. Also, identifying methodologies for layout planning and which one is the most suitable considering lean manufacturing as the main driver.

The procedures used in the literature review were based on the systematic literature review model [4] composed of five stages: search, organization, and selection, reading, annotation and critical analysis and writing.

B. Evaluation criteria

To evaluate the methodologies for layout planning and select the most relevant to be used in the welding industry, a relationship matrix was used, whose criteria were as follows:

1) Have bibliographical references been identified with specific examples of application of the methodology for the layout elaboration in industrial assembly lines?
2) What is the relevance of the methodology in relation to the number of quotations?
3) How detailed is the methodology evaluated?

In order to quantify the degree of relationship between the methodologies for layout planning with the defined criteria, it was used the relationship degree scale of "0 – none", "1 – weak", "3 – moderate" and "9 – strong" [5].

C. Analysis and methodology selection

After the literature review, 16 methodologies for layout planning were identified, in which their occurrences on Google Scholar, Web of Science and CAPES Portal were counted and compared.

The methodologies with the highest percentage of occurrence and with a moderate or strong degree of relationship in relation to criterion I were selected and evaluated in the other two criteria (see Table I).

TABLE I
EVALUATION RESULT OF LAYOUT PLANNING METHODOLOGIES

Criteria / Methodologies	Have bibliographical references been identified with specific examples of application of the methodology for the layout elaboration in industrial assembly lines?	What is the relevance of the methodology in relation to the number of quotations?	How detailed is the methodology evaluated?	Total
Systematic Layout Planning [6]	3	9	9	21
Slack & Chambers Proposal [7]	3	3	9	15
Favaretto Proposal [8]	3	1	9	13
Silva and Rentes Proposal [9]	3	3	9	15
Pache Proposal [10]	3	1	3	7
Urban Model [11]-[12]	3	9	1	13

Considering the result of the evaluation, the Systematic Layout Planning (SLP) was the one selected to orientate the re-planning of the assembly line layout.

D. Application in the welding industry

The research of this study is classified as a case study which represents the most appropriate strategy when asking questions such as "how" and "why", when the researcher has little control over events and when the focus is on contemporary phenomena inserted in some context of real life [13].

The data collection procedures [13] applied in the study and three main sources of evidence were used. Therefore, this work can be classified as an exploratory case study, where through documentary analysis, interviews and observations it is possible to determine the current scenario, propose improvements and simulate the situation after layout changed.

The data were collected in oral interviews with employees in the assembly sector, as well as the Production Planning and Control (PPC), Logistics, Production Support and Industrial Management department. Data were also collected from company documents and databases, as well as from observations made during visits to the company.

III. SYSTEMATIC LAYOUT PLANNING AND LEAN MANUFACTURING

The SLP methodology has great applicability in planning and redesigning the layout [6]. It is composed of a model of procedures and conventions for identification, evaluation and visualization of the elements and areas involved in the planning of a layout. These procedures are described as follows [14]-[15]:

1) P, Q, R, S, T & activities analysis: data collection – volume of products (P), quantity of batch (Q), route (R), support equipment (S) and setup, movement, and activity times (T).
2) Flow of materials: flow intensity of a product between equipment is defined.
3) Activity relationships: the activities are analyzed according to their importance, classifying them into A, E, I, O and U, where A represents the most important and U the least important. This stage result is the input to the next one.
4) Relationship diagram: this is a quantitative analysis that helps to place the equipment considering the frequency of the product flow.
5) Available and required space: the available and necessary space for equipment and its auxiliary resources is measured.

6) Space relationship diagram: this is an initial layout design, which tries to work out the final layout.
7) Modifying constraints: layout operators and users must be interviewed, and their needs considered.
8) Practical limitations: each need and suggestion may have a practical limitation that must also be analyzed for layout planning.
9) Evaluation: all layout alternatives must be analyzed.

The application on the assembly line of the welding industry used the nine steps of the SLP methodology, plus three steps related to the principles of lean manufacturing, following the flowchart shown in Figure 1, where the added activities are highlighted with dashed lines.

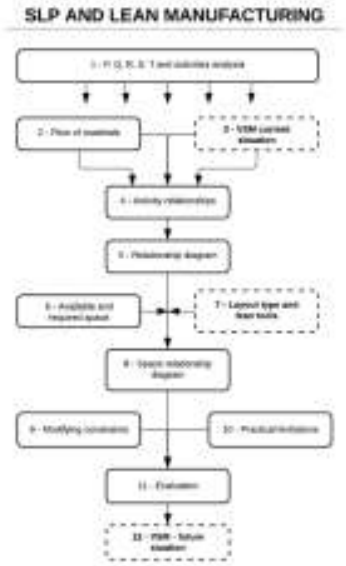

Fig. 1 SLP and lean manufacturing.

The first step added was the elaboration of the VSM for the current layout. The second step included was the definition of the layout type and tools of lean manufacturing which help in proposing the new layout for the assembly line. The third stage included was the elaboration of the VSM regarding the layout of the proposed situation.

IV. Analysis

A. P, Q, R, S, T and activities analysis

For this analysis, all the welding torches assembled in the industry were surveyed, as well as the demand of the last three years, ordering them by highest to lowest production.

After ordering the torches from highest to lowest demand, the first three standard torches were selected, that is, primary torches in the company's product mix. For these torches, volume of products per month (P), quantity of batch (Q) and setup, movement, and activity times (T) in minutes were the support equipment and route traveled were listed (see Table II).

The MIG/MAG torch does not have a defined batch, as Production Orders (PO) are issued in specific quantities to meet the order point of this company's product line. It is worth mentioning that components used in the assembly of torches are considered as pre-assembly.

TABLE II
PRIORITIZATION OF HIGHEST DEMAND TORCHES

Product	Volume of product/month (piece)	Quantity of batch (piece)	Movement time (min)	Assembly time (min)
TIG torch 3,5M 13MM	84	31	1,50	5,00
TIG torch 3,5M	61	31	1,50	5,00
MIG/MAG torch 3M	23	0	2,00	5,00

The route (R) for all the three torches is the same: PO printing and booking – pre-assembly, materials gathering for pre-assembly (kanban), pre-assembly, storage of components finished on the kanban shelves, PO printing and booking – assembly, materials gathering for assembly (kanban), assembly and testing, packaging and placing the finished torches in specific area.

The routes of both models are the same, since the assembly of the torches, in essence, is similar, differing only in components because they are applied to different welding processes. The assembly of TIG torches has less support equipment compared to the MIG/MAG torches, as there is only one pre-assembly, considering that its components are mostly purchased.

The support equipment for TIG torches are device for cutting cables, crimping device, screwdriver, continuity test device, flow meter, general tools and movement trolley. And the support equipment for MIG/MAG torches are device for cutting and striping liners, bending and fixing torch necks, cutting monocables, fixing plugs, crimping device, screwdriver, continuity test device, flow meter, general tools and movement trolley.

B. Flow of materials

Once the monthly volume and product route had been analyzed in the previous step, the grouping of products into families considered the two product lines - MIG/MAG and TIG line. The implementation of the kanban in the assembly line is in progress, in which the inputs are available in supermarkets, but not yet at workstations. In addition, the current layout has the 5S tool fully implemented.

Considering the route indicated in the previous step and detailing the flow of materials, for the assembly of MIG/MAG torches first the PPC department needs to print POs for the pre-

assembly of components. The PO is issued by the Enterprise Resource Planning (ERP) system from the need for production. The company is in the implementation phase of the Overall Labor Effectiveness (OLE) project, which consists of providing tablets to operators so that the POs, drawings, and work instructions needed for the assemblies are displayed, eliminating the need for printing.

Afterward, it is responsibility of the PPC department to deliver the POs to employees so that they collect the necessary inputs and start the pre-assembly of the liner, monocable, plug and torch neck. Once finished, the liner and monocable are stored in the supports and the plug and the neck in the kanban supermarket.

The ERP issues the need to produce torches, the PPC department prints the POs again and delivers them to employees. To assemble the torches, it is necessary to collect the liners and monocables on the supports, in addition to the other components in the supermarket. After assembly, the torches are tested in the workstation itself, taken to another bench for packaging and, finally, moved to the finished product area.

The flow of materials for the assembly of TIG torches is similar to MIG/MAG, except for the fact that there is only one pre-assembly, of power cables, which, after assembled, are stored in supports.

C. VSM – current situation

In this step added to the methodology, the VSM of the current situation was elaborated with the objective of using it as a comparison parameter for the proposed layout (see Figures 3 and 4). For the development of the VSM, the second was used as a unit of measurement and the legend represented by Figure 2 the symbols.

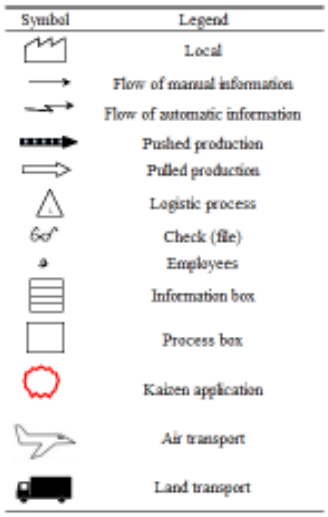

Fig. 2 VSM legend.

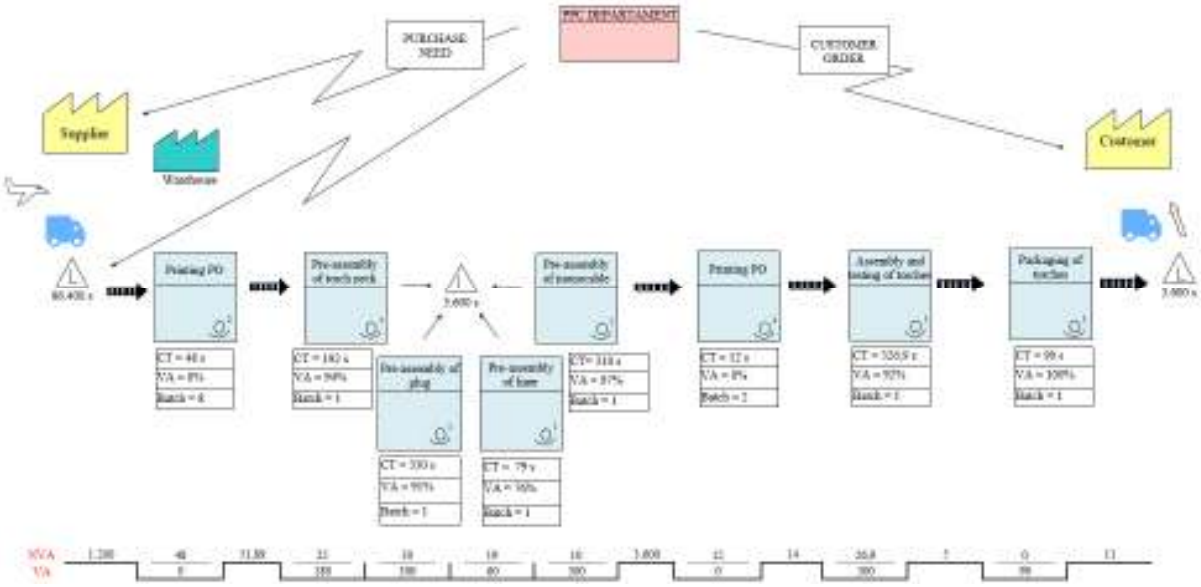

Fig. 3 Value Stream Mapping of MIG/MAG torches – current situation

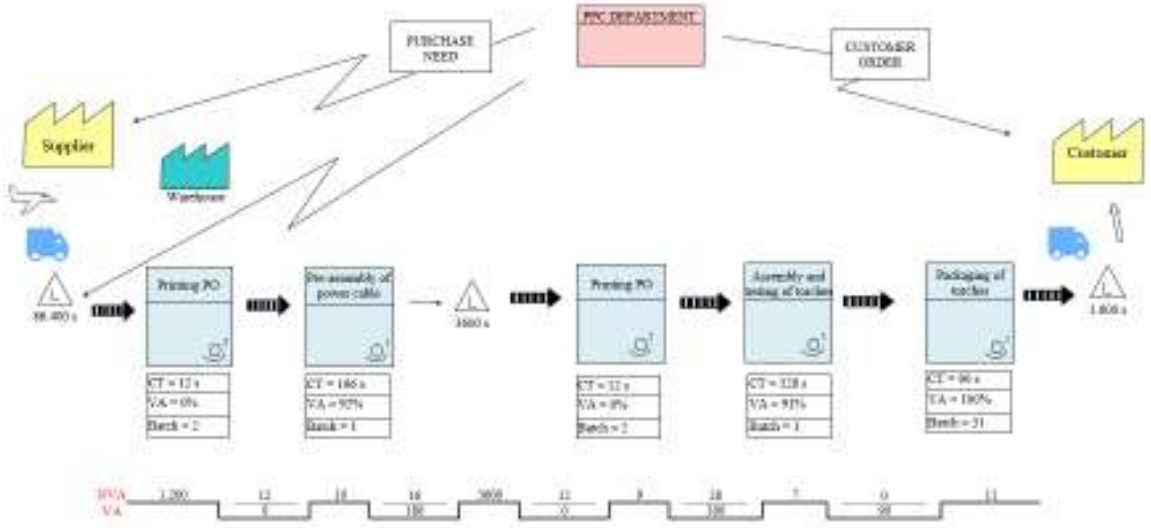

Fig. 4 Value Stream Mapping of TIG torches – current situation

Cycle time (CT), value-adding time (VA), non-value-adding time (NVA), lead time and the percentage of value-added were used as parameters of analysis [16]. Both value-adding time and non-value-adding time were resulted from time studies using chrono analysis as methodology [17]. The results of the VSM of the current situation for the MIG/MAG and TIG torch lines are shown in Table III.

TABLE III
VSM RESULTS OF CURRENT SITUATION

Parameter	MIG/MAG	TIG
Cycle time (s)	1.397,9	638,0
Value-adding time (s)	1.230,0	570,0
Non-value-adding time (s)	5.049,8	4.905,0
Lead time (s)	6.279,8	5.475,0
Value-adding (%)	24%	12%

D.Activity relationships

For the diagram of MIG/MAG torch assembly relationships, four proximity reasons were used: reducing travel distances, independent processes, no possibility of layout changing and grouping pre-assembly process. The number three reason, "no possibility of layout changing", applies only to the relationships between the "Printing PO" and the others, since there will be no change in positioning in the PPC department office. For the A classifications, priority was given to directly related activities, such as the collection of liners and monocables for torch assembly, since these components are used in torches.

For the diagram of TIG torch assembly relationships, since there is only one pre-assembly activity, the power cable, the reason "group pre-assembly process". The classification of proximity used the same criteria as for MIG/MAG torches.

E. Relationship diagram

Based on the activity relationships, the analysis was performed using the relationship diagram to position the equipment and workstations in terms of proximity classification. The main objective of this diagram is to assist in redesigning the layout, since through it there is the visual positioning according to the classification performed in the previous step.

The relationship diagram must be made listing, initially, the activities whose relation was classified in A [6]. Then, the relations with classification E must be added, including any new activity involved and redistributing those classified in A in order to arrange them respecting the relationships. In the same way, it is performed with the relations I, O and X, and those classified in U, unimportant, are not represented in the relationship diagram.

For the MIG/MAG torch relationship diagram, the torch-related activities, with the pre-assembly components already available, are those that have the highest priority in terms of proximity, being classified in A, and are related for the reason of reducing travel distances. The activities whose relationships were classified in E and I are related to the reason of grouping pre-assembly processes and/or reducing travel distances. And the activities whose relations were O received this classification because they are independent processes.

The TIG torch relationship diagram follows the same reasoning as MIG/MAG torches.

F. Available and required space

This step aims to measure the space available and necessary for the equipment, workstations and auxiliary resources, in order to make the proximity indicated through the relationship diagram. The plant drawing of the assembly line was used for this analysis and the available space was considered sufficient for the layout changes.

G.Layout type and lean tools

This step was added to the SLP methodology so that the layout planning would be carried out using the principles of lean manufacturing as the main driver.

For the definition of the layout type to be considered in the layout redesign of the assembly line, the type of manufacturing process of the welding industry was defined as a batch process,

which consists of "a wider range of volume levels and variety than other types of processes" [7]. In other words, whenever there is a need to produce a product model, more than one unit is produced, with the batch being two or three products. Thus, the assembly operations are repeated whereas that batch is being assembled.

The manufacturing process of the welding industry used as a case study fits into the batch type process since the components and torches are assembled in batches to meet the order point of their respective part numbers. This parameter is based on the demand of the item, either for consumption in assembly and / or on sale.

The types of layout related to this type of process are the process or cellular layout [7]. Since the objective of this paper was to elaborate the layout of the assembly line of a welding industry using the principles of lean manufacturing as the main driver and considering Figure 5 and Table IV, the cellular layout is the most suitable.

Fig. 5 Lean manufacturing tools related to a company size taken from [18].

TABLE IV
ANALYSIS OF LAYOUT TYPES CONSIDERING LEAN MAFACTURING TAKEN FROM [19].

Layout types / Criteria	By process	By product	Positional	Cellular
Continuous flow	Low	High	Low	High
Inventory	High	Low	High	Low
Visual management	Low	High	High	High
Quality	Low	High	High	High
Mix and volume flexibility	High	Low	High	Low
Multifunctional workforce	Low	Low	Low	High
Programming complexity	High	Low	Low	Low
Motion	High	Low	High	Low

It is worth mentioning that the current layout already has pre-assembly and assembly cells. In addition to this factor, the sector of assembly of the headquarter of the welding industry, located in Germany, is considered as benchmarking and also presents a cellular layout.

For the definition of the lean tools to be used in the layout of the assembly line, Figure 5 must be considered, which relates the type of area to be improved with lean tools and the size of the company. The welding industry is classified as medium size [20], since it has annual gross operating revenue greater than € 714.902,74 and less than or equal to € 44.681.421,00.

As a medium-sized company, the layout to be improved and according to Figure 5, below follows Table V with the considerations about the lean tools to be considered or not in the proposal of layout of the assembly line.

TABLE V
LEAN TOOLS CONSIDERED IN THE PROPOSED LAYOUT.

Lean tool	Classification	Applicable?	Reason
Cellular manufacturing	Very suitable	Yes	In accordance with the definition of the layout type described above.
First in first out (FIFO)	Very suitable	Yes	Considering the implementation of kanban in the assembly line and since this tool is already applied in the company's warehouse.
Optimization in the supply chain	Very suitable	Yes	Considering the implementation of kanban in the assembly line, optimizing the replacement of components.
Value Stream Mapping	Very suitable	Yes	Included as a step in the methodology of layout planning as a tool for analysis and comparison of results.
Workstation design	Very suitable	Yes	The current workstations consider the ergonomics, work safety and quality of life of users and it will not be changed.
One-piece-flow	Well suitable	No	The batch size of the POs is directly related to the fulfillment of the order point of the components and torches assembled in the welding industry.
Simulation	Suitable	No	The use of simulation software was not prioritized, as the company already uses VSM in its internal projects, being a tool well accepted by other subsidiaries in the welding industry.

Therefore, all lean tools indicated as very suitable will be considered and applied to the new layout of the welding industry assembly line used as a case study for this paper.

V. Results

A. Space relationship diagram – initial proposed layout

The main alteration in the proposed layout is the division of the second pavement into pre-assembly and assembly cells instead of maintaining the product line division. Visually and having as reference the access ladder to the second floor, the left side will include the pre-assemblies of components and the right side the assemblies of torches and robot cables. The monocable cell, which is component pre-assembly, will not be changed, since it is strategically located in the middle and in front of the PPC department office and is related to the assembly of MIG/MAG torches and robot cables.

In this way, the amount of transport is reduced and becomes visually linear, since production starts on the left side from the pre-assembly of components, there is storage in supermarkets and supports in the middle of the second floor so that there are the assembly torches on the right side. According to the cellular layout, there will be two macrocells, one of which is pre-assembly and assembly, and within each of them, the cells listed according to Table VI.

TABLE VI
MACROCELLS OF PRE-ASSEMBLIES AND ASSEMBLIES

Microcell of components pre-assembly	Microcell of torches and robot assemblies
Power cable cell	MIG/MAG torch cell (gas cooled)
Toch neck cell	MIG/MAG torch cell (water cooled)
Plug cell	TIG torch cell
Liner cell	Robot cable cell
Wire guide tube and cable assembly cell	Packaging bench
Brazing cell	Kanban supermarket
Stamping cell	Liner, monocable and power cable support

There will not be inclusion of new tables and workstations or any other equipment. The only inclusion will be new supports for storing liners of 3, 4 and 5 meters, in which they will be fixed to the wall next to the area of finished products. As there is a need to allocate specific lengths of liners and considering the presence of at least four operators with medium to low height, a lifting device will be contemplated for leveling the height and feasibility of collecting liners for the assembly of torches, in accordance with Brazilian ergonomics regulation [21].

Positioning shifts considered the available space. The 5S tool, already implemented in the current layout, will be considered and maintained in the layout proposal.

B. Modifying constraints

This step is considered one of the practical points of the application and consists in interviewing the layout operators and users and collecting their needs. In this way, "there is the added advantage of making them feel that they have a personal part in a decision that affects themselves and their jobs" [6].

Therefore, the employees were interviewed, and the layout proposal was presented to them. Only one change consideration was reported in relation to the torch neck cell, which was initially in front of the power cable cell.

According to the operator, in view of the electrical point and the compressed air point, the torch neck cell should be located next to the power cable cell. So, in order to consider this suggestion, the power cable cell was moved about 3.00 meters to the right and, since it was already 2.10 m away from the stairs, it becomes viable the positioning of the torch neck cell next to it.

C. Practical limitations

Since there was no inclusion of new benches, workstations or any other equipment, the practical limitations considered were the electrical point and compressed air point, so that the positioning of cells and equipment respected the perimeter of coverage of these resources.

D. Evaluation

In this way and according to the feasibility of changes within the schedule of this project, the proposed layout was implemented. The improvement suggested by the layout users was considered in order to align their needs. It was possible to calculate the benefits in time and cost savings, which are described in the next topic.

E. VSM – after layout changed

Equally to the third stage, this was added to the methodology so that the VSM of the situation after layout changed could present the results according to the new layout and was used as a comparison parameter to visualize the benefits in relation to the current situation. For the development of the VSM, the second was also used as a unit of measurement and Figure 2 as a legend for the symbols.

For both VSM of MIG/MAG and TIG torches (see Figures 6 and 7), the conclusion of the kanban and OLE projects was considered, related to the availability of pre-assembled and assembled components in the workstations themselves and visualization of PO, drawings and work instructions via tablets with software integrated with the company's ERP system. Thus, for both situations after layout changed, the non-value-adding time of activities are reduced due to the elimination of the need for operators to collect inputs in supermarkets and, also, to the new layout.

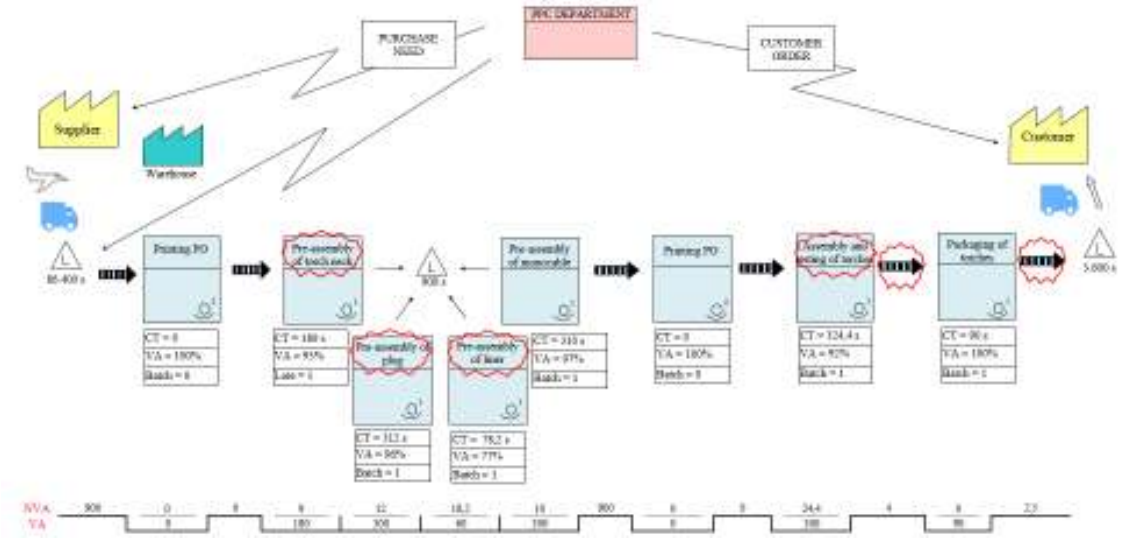

Fig. 6 Value Stream Mapping of MIG/MAG torches – situation after layout changed

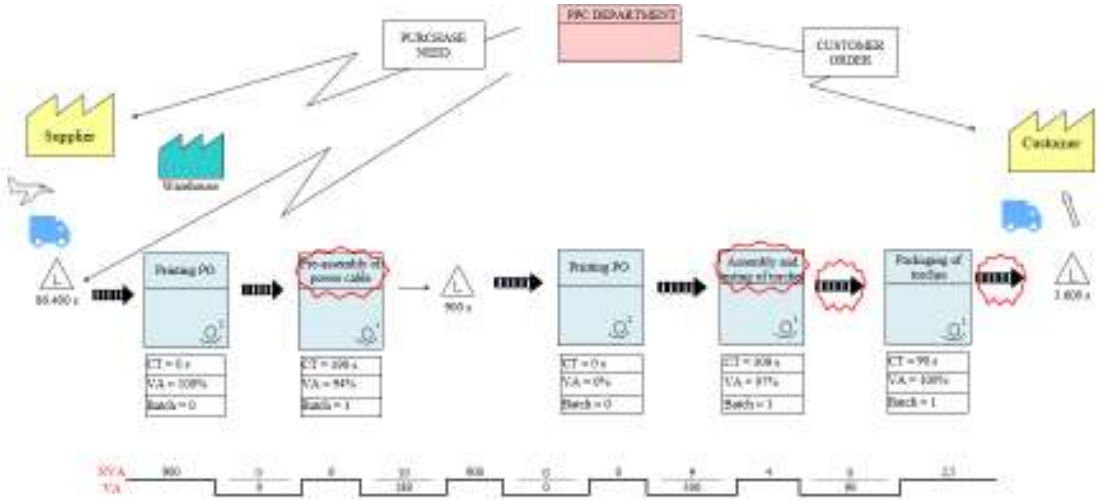

Fig. 7 Value Stream Mapping of TIG torches – situation after layout changed

For the analysis of results, the same parameters of analysis of the VSM of the current situation were used. Table VII and VIII show the results of the VSM of the situation after layout changed with the proposed layout for the MIG/MAG and TIG torch lines, respectively.

TABLE VII
VSM RESULTS OF MIG/MAG TORCHES – SITUATION AFTER LAYOUT CHANGED

Parameter	Current	After layout changed	Variation
Cycle time (s)	1.397,9	1.303,6	↓ 7%
Value-adding time (s)	1.230,0	1.230,0	0%
Non-value-adding time (s)	5.049,8	1.880,1	↓ 63%
Lead time (s)	6.279,8	3.110,1	↓ 50%
Value-adding (%)	24%	65%	↑ 41%

TABLE VIII
VSM RESULTS OF TIG TORCHES - SITUATION AFTER LAYOUT CHANGED

Parameter	Current	After layout changed	Variation
Cycle time (s)	638,0	589,0	↓ 8%
Value-adding time (s)	570,0	570,0	0%
Non-value-adding time (s)	4.905,0	1.825,5	↓ 63%
Lead time (s)	5.475,0	2.395,5	↓ 56%
Value-adding (%)	12%	31%	↑ 19%

The cycle time will be reduced as employees will not need to collect components in supermarkets since they will be available at their workstations, in addition to the fact that the layout will provide a shorter travel distance between the cells and the supermarket for disposal of finished components. The value-adding time will not change, as assembly times were not considered as the focus of this paper. The non-value-adding time will be reduced due to the implementation of the OLE project, kanban and the reduction of distances with the new layout. In turn, the lead time will also have a reduction, accommodating reductions in cycle time and non-value-adding time and, consequently, the percentage of value-adding will increase for both torch lines.

To identify the reduction in movement time due to the layout proposed, only activities and movements emphasized with the

kaizen symbol were considered. For the movements after the assembly, testing and packaging activities of MIG/MAG and TIG torches, the time reductions were considered in their entirety. Time reductions related to PO printing activities were not considered as they were caused exclusively by the OLE project. For the reduced times in the other activities emphasized with kaizen symbol, only half the time decrease was considered, since they are also related to the implementation of the kanban project.

Therefore, according to Table IX, there will be a decrease in movement time by 25 seconds for the assembly of a MIG/MAG torch unit and 18 seconds for a TIG torch unit.

TABLE IX
TOTAL BENEFIT.

Parameter	MIG/MAG	TIG
Reduction in movement (s)	25	18
Annual demand – sample (piece)	358	2.000
Cost saving/year – sample (€)	€ 551,92	€ 2.220,00
Annual demand – gas cooled torches (piece)	4.805	3.728
Cost saving/year – gas cooled torches (€)	€ 7.407,71	€ 4.138,08
Annual demand – gas and water-cooled torches (piece)	5.781	3.745
Cost saving/year – gas and water-cooled torches (€)	€ 8.912,38	€ 4.156,95
Total cost saving in movement (€)	€ 13.069,33	
Labor cost (€)	€ 932,40	
Infrastructure cost (€)	€ 70,00	
Implementation total cost (€)	€ 1.002,40	
Annual benefit (€)	€ 12,066,93	

The cost saving study was carried out in three stages and considered estimated values. First, considering only the annual demand of the selected torches through the P, Q, R, S, T and activities analysis. The second considering only gas cooled, since the selected torches are into this category. The third considered the annual demand for all torches done in the assembly line, both gas and water cooled. For the calculation of the cost saving, the demand for the reduced time in seconds was multiplied, transforming the unit of measurement into hour and, finally, multiplying by the company's man-hour value. Therefore, there is a total cost saving of € 13,039.33 due to the layout proposed by this paper.

Regarding the cost of implementing the layout, 4 hours are considered in addition to the three liner supports for 3, 4 and 5 meters, which were purchased and fixed on a wall near the MIG/MAG torch cell, totaling € 1,002.40. Consequently, the annual benefit of implementing the proposed layout is € 12,066.93.

VI. CONCLUSION

This paper aimed to redesign the layout of the assembly line of a welding industry using lean manufacturing as the main driver.

According to the method of evaluation and selection of methodologies for the layout planning, the Systematic Layout Planning was defined as the model to be used in the redesign of the layout of the welding industry according to its specificities.

VSM was selected as the tool for measuring and comparing results. Based on the VSM of the situation after layout changed, it was identified that the new layout will offer a reduction of 25 seconds for the assembly of a MIG/MAG torch unit and 18 seconds for a TIG torch unit.

It is concluded that the implementation of the layout proposed in its entirety will bring to the company in the first year a reduction of € 12,066.93 in costs invested in movement times. In the following years, this avoided cost will be € 13,039.33, since with the changed layout, there will be no implementation cost. This cost saving refers to current demand database, so it is possible to increase this annual benefit due to the growth in demand.

The implementation of the layout proposed by this paper is relevant, since if the layout remains in current conditions will continue to decrease the productivity indicators of the factory by 10% and add 28% in production times, both due to the movement times.

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Use of Radio Frequency Identification Technology for Sustainable Fashion Manufacturing in Vietnam

Majo George, Rajkishore Nayak, Irfan Ulhaq, Hiep Nguyen

***Abstract*—** The use of radio frequency identification (RFID) technology in many sectors, including fashion and textiles, can change the business dynamics and create a sustainable future. Some of the fast fashion brands have already started adopting green fashion production by using various technologies, including RFID technology. Other brands should also start focusing on sustainable aspects to secure the future, which will be beneficial for both the organization and the planet. RFID technology not only provides economical benefits in manufacturing and supply chain processes but also offers many tangible business benefits such as competitive advantage, improved customer relationship, resiliency, and finally, increased profitability. This paper has investigated the benefits achieved through the use of RFID technology to become sustainable in the fashion and textile supply chain, including manufacturing. As Vietnam is one of the emerging economies involved in the manufacturing of fashion and textiles for many global fashion brands, fashion and textile companies operating in Vietnam were selected for this study. It was found that many of the small and medium-sized enterprises (SMEs) did not understand the RFID technology and its benefits. For SMEs, the major focus is to achieve profit without extra expenses in technology such as RFID. Although the global fashion brands emphasize the implementation of RFID technology, some of the manufacturers in developing countries such as Vietnam has no intention to invest a large amount of money in implementing the new technology.

***Keywords*—** sustainability, RFID, fashion supply chain, economic benefits, emerging economies.

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DtN and NtD Surface Radiation Conditions for Two-Dimensional Acoustic Scattering: Formal Derivation and Numerical Validation

Chokri Chniti, Sharefa Eisa Ali Alhazmic, Moncef Toujani

***Abstract*—** The aim of this paper is to derive and evaluate new approximations of the Dirichlet-to-Neumann (DtN) and Neumann-to-Dirichlet (NtD) maps for two-dimensional acoustic scattering problems. Some formal approximations for the two-dimensional case are derived. These various approximations are next numerically validated and compared.

***Keywords*—** Acoustic scattering, On-surface radiation condition, Numerical method , Surface finite element.

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Secondhand Clothing and the Future of Fashion

Marike Venter de Villiers, Jessica Ramoshaba

***Abstract*—**In recent years, the fashion industry has been associated with the exploitation of both people and resources. This is largely due to the emergence of the fast fashion concept, which entails rapid and continual style changes where clothes quickly lose their appeal, become out-of-fashion, and are then disposed. This cycle often entails appalling working conditions in sweatshops with low wages, child labor and a significant amount of textile waste that ends up in landfills. Although the awareness of the negative implications of 'mindless fashion production and consumption' is growing, fast fashion remains to be a popular choice among the youth. This is especially prevalent in South Africa, a poverty stricken country where a vast number of young adults are unemployment and living in poverty. Despite being in poverty, the celebrity conscious culture and fashion products frequently portrayed on the growing intrusive social media platforms in South Africa pressurizes the consumers to purchase fashion and luxury products. Young adults are therefore more vulnerable to the temptation to purchase fast fashion products. A possible solution to the detrimental effects that the fast fashion industry has on the environment is the revival of the secondhand clothing trend. Although the popularity of secondhand clothing has gained momentum among selected consumer segments, the adoption rate of such remains slow.

The main purpose of this study was to explore consumers' perceptions of the secondhand clothing trend, and to gain insight into factors that inhibit the adoption of secondhand clothing. This study also aimed to investigate whether consumers are aware of the negative implications of the fast fashion industry and their likelihood to shift their clothing purchases to that of secondhand clothing.

By means of a quantitative study, fifty young females were asked to complete a semi-structured questionnaire. The researcher approached females between the ages of 18 and 35 in a face-to-face setting.

The results indicated that although they had an awareness of the negative consequences of fast fashion, they lacked detailed insight into the pertinent affects of fast fashion on the environment. Further, a number of factors inhibit their decision to buy from secondhand stores: firstly, the accessibility to the latest trends were not always available in secondhand stores; secondly, the convenience of shopping from a chain store outweighs the inconvenience of searching for, and finding a secondhand store; and lastly, they perceived secondhand clothing to pose a hygiene risk

The findings of this study provide fashion marketers, and secondhand clothing stores, with insight into how they can incorporate the secondhand clothing trend into their strategies and marketing campaigns in an attempt to make the fashion industry more sustainable.

Keywords-eco-friendly fashion, fast fashion, secondhand clothing, eco-friendly fashion

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Preparation of Polypyrrole (PPy) - Derived Polymer/ZrO2 Nanocomposites: Effects of Nanoparticles Interface and Conductive Polymer Stricture

Khadidja Yamani, Abdelghani Benyoucef, Raul Berenguer

***Abstract*—** In order to improve the properties of conductive polymers, they are generally mixed with other materials to form new hybrid organic-inorganic materials. New polypyrrole (PPy)-derived polymer/Zirconium (IV) oxide (ZrO2) nanocomposite materials are prepared by single-step oxidative polymerization of pyrrole (Py) and/or N-methylpyrrole (mPy) in the presence of HCl-functionalized Zirconium (IV) oxide (ZrO2) nanoparticles and Ammonium Persulfate. The physicochemical features of the PPy–ZrO2, poly(Py-co-mPy)–ZrO2 and PmPy–ZrO2 hybrids were analyzed by XPS, FTIR, XRD and UV–Vis techniques. To explore the advantages of these nanocomposites for potential applications, their thermal, conductive and electrochemical properties were investigated. The characterization reveals that a chemical bonding, based on electrostatic interactions, is established between the polymers and the ZrO2 nanoparticles. Interestingly, it is found that the growth of polymer on the surface of Cl-functionalized ZrO2 becomes more significant as the Py moiety (–NH– species) content in the polymer increases. The thermal stability and conductivity of the polymers increase by hybridization with the ZrO2 nanoparticles. This is assigned to the affective interaction of the polymers with the ZrO2 nanoparticles. Particularly, the resulting nanocomposites keep high conductivities, ranging between 0.323 and 0.929 S.cm−1. Finally, Voltammetric characterization shows that the PPy–ZrO2 and poly(Py-co-mPy)–ZrO2 nanocomposites are electroactive, thus demonstrating their capability for electrochemical applications. These results highlight the great influence of the nanoparticle interface and the nature of monomer on the nanocomposite formation and properties.

***Keywords*—** Electrochemical Properties, Nanocomposites, N-Methylpyrrole, Pyrrole, Zirconium (IV) Oxide.

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Efficient Pre-Concentration of as (III) Using Guanidine-Modified Magnetic Mesoporous Silica in the Food Sample

Majede Modheji, Hamid Emadi, Hossein Vojoudi

***Abstract*—** An efficient magnetic mesoporous structure was designed and prepared for the facile pre-concentration of As(III) ions. To prepare the sorbent, a core-shell magnetic silica nanoparticle was covered by MCM-41 like structure, and then the surface was modified by guanidine via an amine linker. The prepared adsorbent was investigated as an effective and sensitive material for the adsorption of arsenic ions from the aqueous solution applying a normal batch method. The imperative variables of the adsorption were studied to increase efficiency. The dynamic and static processes were tested that matched a pseudo-second order of kinetic model and the Langmuir isotherm model, respectively. The sorbent reusability was investigated, and it was confirmed that the designed product could be applied at best for six cycles successively without any significant efficiency loss. The synthesized product was tested to determine and pre-concentrate trace amounts of arsenic ions in rice and natural waters as a real sample. A desorption process applying 5 mL of hydrochloric acid (0.5 mol L^{-1}) as an eluent exhibited about 98% recovery of the As(III) ions adsorbed on the GA-MSMP sorbent.

***Keywords*—** arsenic, adsorption, mesoporous, surface modification, MCM-41

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Various Welding Processing Adaptability of GH4065A Ni-Base Alloy Engine Compressor

Hong Yuan, Jin-Xue Wang, Huai Yu, Guo-Dong Zhang

***Abstract*—** The experimental research on weldability of GH4065A Ni-based superalloy with high content of Al+Ti and the volume fraction of strengthening phase Y' was carried out. The results show that GH4065A alloy possesses excellent weldability adapted to good quality joints of engine compressor welded with whether EBW or IFW. The solidification cracking in WM and liquid cracking in HAZ, respectively, do not occur in the EBW joints the same as other superalloy with high content of Al+Ti, which contributes to the more lower carbon content compare to Rene88DT alloy to minimize MC-type eutectoid carbide particles. It is more easy to realize IFW weld joints with no fault quality and forged fine uniformity microstructure. The tensile strength of the joints welded by EBW at the room temperature or 750°C equal to parent metal, while the tensile strength of IFW joints at 750°C loses out because of inadequate strengthening secondary phase γ'.

***Keywords*—** weldability, high content of Al+Ti, electron beam welding, inertia friction welding.

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Guideline for the Dimensioning of an Off-Grid PV Electrolysis Unit

Ourida S,Viktor W, Romdhane.S,. Hassen D

***Abstract*—**The world energy supply is currently dominated by fossil hydrocarbons [1]. These centralized resources generate conflict, their combustion generates pollution and their scarcity (declining EROEI1) generates price increases.
The need for a low- carbon and renewable energy transition is becoming more and more important. Renewable resources are: decentralized and reduce geopolitical tension, “eco-friendly” and contributes to a cleaner environment and unlimited (on a human scale) and contributes to price stability. However, the integration of renewable energies presents significant problems: first, due to their intermittent their integration in the electrical network presents stability problems and requires storage capacities. Second, fossil hydrocarbons do not currently have a renewable substitute in the field of transport (especially air, truck and boat). In this context, the use of hydrogen as a multimodal energy vector (as a carrier and as an energy storage medium) seems ideal. Moreover, hydrogen can generate electricity with a fuel cell and generate heat by producing methane in a power to the gas plant. The clear majority of current hydrogen production (95%) comes from steam reforming of fossil fuel. The production of "green" hydrogen from renewable electricity by electrolysis of water is still insignificant and is facing technical deal. While On grid electrolysis do not have a need for sizing guidelines (the electrolysis is working in the optimal point), in the field of Off-grid PV electrolysis, until now there is no norms or guideline for the dimensioning of off grid PV electrolysis systems. In this study, 100W Pv module was connected to 36W and to 72W electrolyser (2*36W), and the Hydrogen production for both combination was calculated. A sensivity analysis for two locations with different global radiation over one year was Carried on.

***Keywords*—**Direct coupling, electrolysis, guideline, PV

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Investigation of Different Off-Grid PV Electrolysis Topologies

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***Abstract*—**The clear majority of current hydrogen production (95%) comes from steam reforming of fossil fuel. The production of "green" hydrogen from renewable electricity by electrolysis of water is still insignificant and is facing technical deal. While On grid electrolysis do not have a need for sizing guidelines (the electrolyzers are working in the optimal point), until now there is no norms or guideline for the dimensioning of off grid PV electrolysis systems. The aim of this paper is to investigate the yield of the off grid PV electrolysis systems by varying various parameters as the: power ratio PV/electrolyzers, the solar radiation and the connection topology.

Keyword: off grid, PV, electrolysis, Topology.

I. INTRODUCTION

The world energy supply is currently dominated by fossil hydrocarbons. These centralized resources generate conflict, their combustion generates pollution and their scarcity (declining EROEI1) generates price increases. The need for a low- carbon and renewable energy transition is becoming more and more important. Renewable resources are: decentralized and reduce geopolitical tension, "eco-friendly" and contributes to a cleaner environment and unlimited (on a human scale) and contributes to price stability. However, the integration of renewable energies presents significant problems: first, due to their intermittent their integration in the electrical network presents stability problems and requires storage capacities. Second, fossil hydrocarbons do not currently have a renewable substitute in the field of transport (especially air, truck and boat). In this context, the use of hydrogen as a multimodal energy vector (as a carrier and as an energy storage medium) seems ideal. Moreover, hydrogen can generate electricity with a fuel cell and generate heat by producing methane in a power to the gas plant. The clear majority of current hydrogen production (95%) comes from steam reforming of fossil fuel.

From the perspective of solar hydrogen production plants, with a power of tens or a hundred MWp, the sunniest regions are not necessarily located in areas where the electricity network is available (even if it is, not necessarily with high voltage lines capable of transporting tens or hundreds of MW). In this case, this plants will run in an off grid modus. Other applications of off-grid solar hydrogens are conceivably even predictable: replacing power generators in distant areas where electricity from the grid cannot be accessed (weather station, outpost military, humanitarian camps, mining and forestry.

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II. MÉTHODOLOGIE

Four different configurations of solar hydrogen production have been tested and the yield of H2 production for a representative day has been determined. In the first two configurations, the solar module is directly connected to the electrolyzer, while the power ratio PV / electrolyzer have been varied from 1/3 to 2/3(by adding a second electrolyzer in serial).This configurations are called "direct coupling" topology. In the third and fourth configurations, the photovoltaic module is not directly connected to the electrolyzer but through a series of electronic converters (MPPT and DC / DC converter). Here the power ratio between PV and electrolyzer has also been varied (1/3- 2/3) by adding a second electrolyzer in serial.

Each sub-element constituting the test bench have been individually tested in the lab and their characteristic curves recorded (at full load and partial load).The determination of the characteristic curves can only be done under static conditions (independently of the sunshine), this was done in the laboratory.

III. TEST FACILITY

The test facility is composed by a hydraulic part, electric part and a measurement system. The electrolyzer has 3 hydraulic ports: one inlet port which is connected to the feed water tank and two outlets ports through which the O_2 and the H_2 are generated. The H_2 outlet port is connected to a measuring tank which allows volumetric measurement of gaseous hydrogen production. During the test, gaseous hydrogen accumulates in the top of the measuring tank and push the water contained in it, to an atmospheric expansion vessel; this method allows a volumetric reading of the H_2 production without distortion led by compression effects of the gas. The hydraulic diagram is shown in the Figure 1.

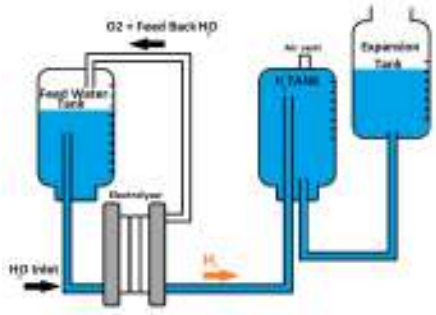


Figure 1: hydraulic connection on the test facility

The electrical system is made up of a photovoltaic panel, and an electrical regulation box containing a MPPT ad a DC/DC converter. The current and the intensities are measured at the input and the output of each electrical component. Each electrical component was first individually tested and its characteristic curve recorded.

A. *Electrolyzer*

The used electrolyzers are a PEM electrolyzer, with a nominal power of 36 W. it is made up of two cells mounted in series with a nominal flow rate is 120 ml of gaseous hydrogen per minute.

Table 1: characteristic of the PEM electrolyzer

Model	Unit	QLC-120
Cells	-	2
Stack Diameter	mm	85
H2 Flow Rate	mL / min	0 - 120
O2 Flow Rate	mL /min	0 - 60
Voltage	V (DC)	4 (9A)

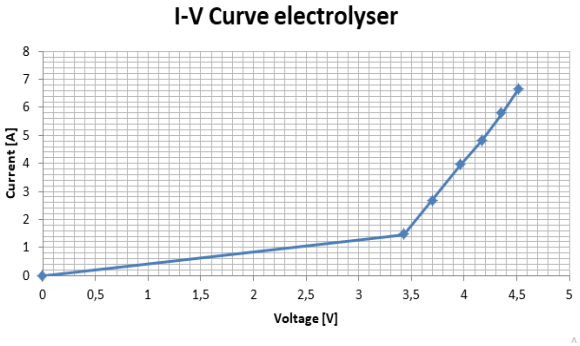


Figure 2: I-V Curve of the electrolyzer

The voltage-current curve of the electrolyzer has two parts. The first flat part from 0 to 3.4 V represents the part where the energy is needed to overcome the 2 cells (2*1.23V) and the ohmic resistance of the system (electrolyzers, wire...) here the current only increases very slowly and the gaseous hydrogen is still not generated. The second part of the curve (from 3.4V to 4.5V) represents the part where gaseous hydrogen begins to be generated in proportion to the increase in current (from 1 Amp to 7 Amps). The Hydrogen production flow rate for the different Voltage and current consumption are given in the Table 2.

Table 2 : Measured performance of the electrolyzer

Power [W]	5	10	15	20	25	30
Voltage [V]	3,43	3,7	3,96	4,17	4,36	4,52
Current [A]	1,46	2,71	3,94	4,84	5,79	6,67
H2 flow rate [ml/s]	0,36	0,66	0,98	1,16	1,46	1,82

B. *PV Module*

The used Photovoltaic module have a nominal power of 100 W at Umpp of 18.4 [V] and an Impp of 5.4 [A].The I-V curve of the module for different solar radiation is given in the figure 2

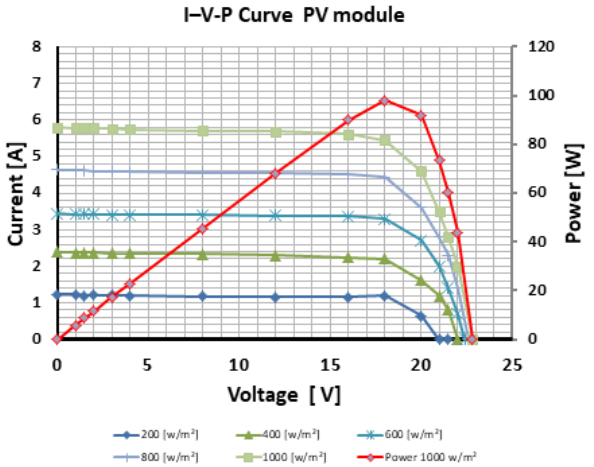


Figure 3: I-P-V Curve of the PV module

IV. DIRECT COUPLING

In this part 2 direct coupling configurations has been investigated. In the first configuration, a single electrolyzer with 36 [W] nominal powers was connected to the photovoltaic module. In the second configuration 2 electrolyzers connected in serial (total power of 72 [W] were used. A schematic figure of the connection as well as their Voltage/current characteristics curves are shown below.

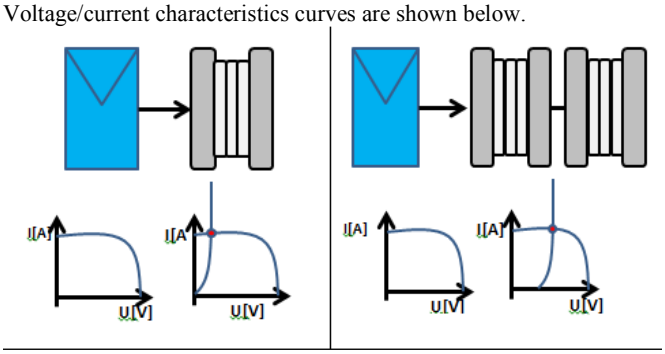


Figure 4: Schematic connection direct coupling (left one electrolyzers, right two electrolyzers in serial)

The direct coupling of one electrolyzer with the photovoltaic module reveals that the intersection of the two curves takes place far from the maximal power point (MPP) of the module, so that most of the energy is lost and not used for the generation of gaseous Hydrogen. However the direct coupling of 2 electrolyzers in series, results in the shift of the characteristic curve to the right (addition of the voltage) thus approaching more than the MPP of the solar module, decrease the loses and increase over proportionally the hydrogen generation. However, the serial addition of electrolyzers has its limitations. The connection of 3 or 4 electrolyzers in series would ensure that their nominal power would exceed that of the solar module (3*36W and 4*36W > 100 W),

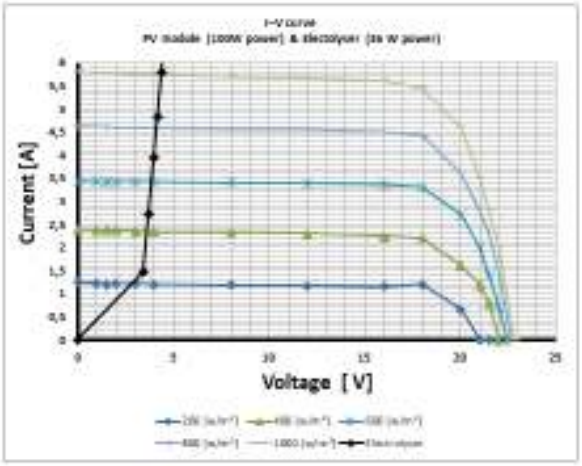


Figure 5: I-V Kurve of electrolyzers an PV module

To give some order of magnitude, with a sunshine of 1000 [w/m²] the solar module delivers 100 [W] the intersection of the electrolyzer curve with that of the solar modules curve occurs at 4.5 [V] and 5.8 [A], generating 26 [W]. The mismatching of the 2 curve explains a lost 75% of the energy. The energy loose is even greater for lower solar radiation.

The Production of gaseous hydrogen for both direct couplings configurations (one electrolyzer and two electrolyzers in serials) during the 20th of March in central Germany is shown below.

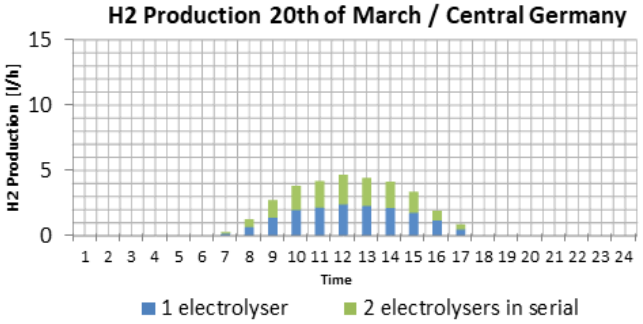


Figure 6: H_2 production direct coupling

The serial addition of electrolyzers improves the curve matching with MPP and consequently the hydrogen production, but is still insufficient to utilize the maximal solar yield of the PV module.

V. INDIRECT COUPLING

In this part an indirect coupling configurations has been investigated. A better match between the electrolyzer and the module has been achieved by using another connection topology. First an MPP tracker was connected to the module. Its role is to extract the maximum power from the module. Secondly, a DC DC converter is used to transform the U_{mpp} and I_{mpp} to a "useful" voltage and current for the electrolyzer. This transformation occurs along the imaginary line of the ISOWATT. A schematic figure of the connection as well as their Voltage/current characteristics curves are shown in the figure 6.

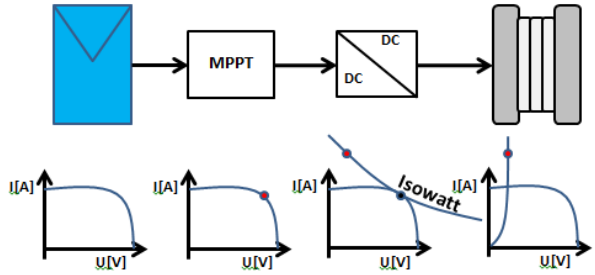


Figure 7: Schematic connection indirect coupling

The Production of gaseous hydrogen for both direct couplings configurations (one electrolyzer and two electrolyzers in serials) as well as for the ISOWATT tracking configuration using a DC DC converter is shown in the figure below. The production is reporte during the 20th of March in central Germany.

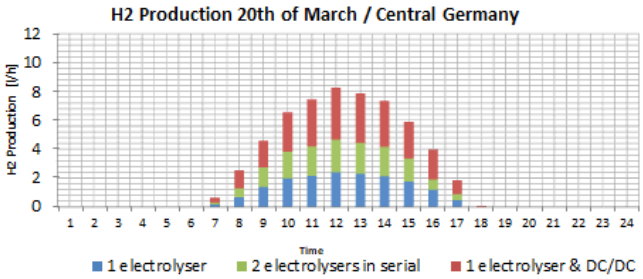


Figure 8: H_2 production indirect coupling

The use of an MPP Tracker and a DC-DC Converter with an transformation efficiency of 75%, improves the Hydrogen production by a magnitude of 4 in comparison with simple direct coupling and by a factor of 2 in comparison with direct coupling serial configuration.

Table 3: Daily H2 production for direct and indirect coupling

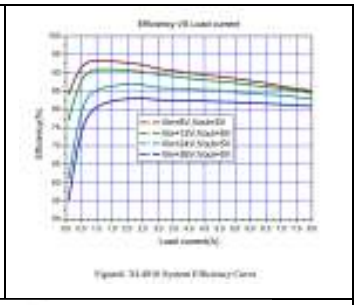
Daily production of H_2 [liter]		
1 electrolyzer	2 electrolyzers in serial	1 electrolyzer & DC/DC
16,59	31,82	57,11

VI. CONCLUSION:

Direct coupling and indirect coupling configuration of an PV off grid electrolysis system has been investigated. With the connection of MPP Tracker and an DC DC converter an hydrogen yield increase of 300% has been achieved (in comparison of direct coupling)

APPENDIX

Characteristics of the converter.



Electrical Characteristics (DC Parameters)

V_{IN} = 24V, GND=0V, V_{IN} & GND parallel connect a 470uF/50V capacitor, fosc=500mA, T_a = 25℃, the others floating unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	V_{IN}		8		36	V
Quiescent Supply Current	I_Q	V_{FB}=5V		2.1	5	mA
Oscillator Frequency	F_{OSC}		140	180	216	KHz
Output Shunt Frequency	F_{OSP}			48		KHz
Switch Current Limit	I_L	V_{FB}=0		14		A
Max. Duty Cycle	D_{MAX}	V_{FB}=8V		100		%
Output Power PMDS	R_{dson}	V_{EN}=8V, V_{IN}=24V, I_{OUT}=12A		40	50	mohm

Figure 9: Photograph of the test bench

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Impact of Silane Monolayers on the Adsorption of Streptavidin and on its Interactions with Biotin

Solène Lecot, Antonin Lavigne, Zihua Yang, Thomas Géhin, Claude Botella, Vincent Jousseaume, Yann Chevolot, Magali Phaner-Goutorbe, Christelle Yeromonahos

***Abstract*—** Protein adsorption on surfaces is used in analytical tools as an immobilization mean to trap the analyte to be detected. However, protein adsorption can lead to conformational changes in the protein structure, resulting in a loss of bioactivity. Among surfaces, self-assembled monolayers of silane molecules are widely used to functionalize SiO_2. Our objective is to study the impact of the head-group charge and alkyl chain length of silane molecules, which vary the charge and hydropathy of the surface, on the conformation of the immobilized protein and on its further interactions with a ligand.

Molecular Dynamics (MD) simulations are well-suited to investigate protein adsorption, as they give insight into protein-surface interactions and adsorption-induced conformational changes at atomic scale. Furthermore, Steered Molecular Dynamics (SMD) simulations provide additional information regarding forces and dynamics of individual ligand-receptor interactions.

Firstly, a MD simulation system (GROMACS – force field based on OPLS-AA) was developed and the structure and organization of silane monolayers including various alkyl chain lengths (3 to 18 Carbon atoms), head-group charges (neutral, positive, and negative) and surface coverages (from 1.5 to 4.2 silane molecules/nm^2) were investigated. The tilt angles obtained for the different alkyl chains were qualitatively validated by FTIR and XPS experiments. It was shown that uncharged silane molecules with long alkyl chains present the most organized structure leading to a hexagonal packing.

Then, the effect of streptavidin adsorption on different silane monolayers on its subsequent interactions with biotin was deciphered, by MD simulations. It was shown that the contact area between streptavidin and the surface is higher with uncharged silane molecules than with positively charged head groups. Furthermore, the global conformational change in streptavidin, as well as the nature of the residues with a high mobility, were shown to depend on the type of silane molecules. Also, adsorption on mixed monolayers was shown to induce conformational changes in streptavidin close to the Biotin binding pocket.

SMD simulations were performed at various pulling velocities, from 0.002×10^6 to 20×10^6 µm/s, to approach the pulling velocities obtained with atomic force microscopy experiments. By comparison with previous experimental results and SMD rupture forces obtained without adsorption on silane monolayers, it was demonstrated that silane molecules with uncharged head-group and short alkyl chain allow streptavidin immobilization while keeping biotin interactions better than silane molecules with long alkyl chains or charged head groups.

Thus, protein adsorption on silane monolayers induces conformational changes which depend on the alkyl chain length and head-group charge of the silane molecules. By coupling MD and SMD simulations, it is possible to identify which type of silane monolayer is better suited to immobilize a protein such as streptavidin while maintaining its interaction with the corresponding ligand, the biotin. The same methodology is being applied to another complex including the cell receptor ACE2 and the receptor-binding domain of SARS-CoV-2 spike protein and could be helpful for the design of new diagnosis tools.

***Keywords*—** Protein adsorption, silane monolayer, steered molecular dynamics, streptavidin-biotin complex.

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Impact of Silane Monolayers on the Selective Adsorption of Sepsis Metabolites

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***Abstract*—** Sepsis, blood bacteremic infection, is one of the first mortality cause in hospitalized patients. Survival chance decline by 7% each hour, while diagnostic required 5 days. There is an urgent need for rapid diagnosis strategies. Patterns of 6 metabolites, recently identified (such as some amino acids, fatty acids, sugar…), differentiate bacteremic Sepsis from non-bacteremic Sepsis, and the nature of the most common pathogens (E-coli, MSSA, MRSA). Metabolites are low molecular weight species, present in traces in blood, among an abundant background of larger species. Nanoporous Silicon matrix was shown able to trap metabolites from serum, while being compatible with mass spectroscopy analysis. However, for sensitive sepsis diagnosis, there is a need for selective trapping of sepsis metabolites among other metabolites, from serum.

SiO_2 surfaces functionalized by self-assembled monolayers of silane molecules were previously shown to improve the trapping of some metabolites and could be compatible with clinical and industrial requirements. In the present study, we propose to evaluate, by Molecular Dynamics (MD) simulations the impact of the chemical nature and of the alkyl chain length of silane molecules on metabolite trapping, and on the possibility to selectively harvest the sepsis metabolites among the most common blood metabolites.

Firstly, a MD simulation system was developed (GROMACS, force field based on OPLS-AA) to study the interactions between 14 metabolites (7 sepsis metabolites and 7 common blood metabolites) and 4 different silane monolayers (positively, negatively and uncharged silane head-groups, long and short alkyl chain lengths), in water at 150 mM of NaCl. This system was validated by correlating the calculated interaction energies to the metabolite detection by Fourier Transform Infrared – Attenuated Total Reflectance and matrix-assisted-laser-desorption-ionization Mass Spectrometry analysis. The interaction energies suggest that silane monolayers improve the trapping of some metabolites, in comparison with a bare SiO_2 surface. These results can be explained by the charges and the hydrophobicity of metabolites but also by their ability to deform. Moreover, by tuning the chemical nature of the silane molecules, a specific harvesting of some sepsis metabolites can be obtained. Finally, from a more fundamental point of view, our results suggest that water molecules form a highly ordered structure in the hydration layer of monolayers made of uncharged silane molecules with short alkyl chain, whereas no order in observed in the case of uncharged silane molecules with long alkyl chain. This order might be at the origin of the more favorable entropically driven adsorption of metabolites obtained with short alkyl chains than with long alkyl chains.

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***Keywords*—** Hydration layer structure, interfaces, metabolites adsorption, silane monolayer.

Characterization of Mg/Sc system for X-ray Spectroscopy in the Water Window Range

Hina Verma[1*], Karine Le Guen[1], Mohammed H. Modi[2,3], Rajnish Dhawan[4], Philippe Jonnard[1]

Abstract — Periodic multilayer mirrors have potential application as optical components in X-ray microscopy, particularly, working in the water window region. The water window range, located between the absorption edges of carbon (285 eV) and oxygen (530eV), along with the presence of nitrogen K absorption edge (395 eV), makes it a powerful method for imaging biological samples due to the natural optical contrast between water and carbon. We characterized bilayer, trilayer, quadrilayer and multilayer systems of Mg/Sc with ZrC thin layers introduced as a barrier layer and capping layer prepared by ion beam sputtering. The introduction of ZrC as a barrier layer is expected to improve the structure of the Mg/Sc system. The ZrC capping layer also prevents the stack from oxidation

The structural analysis of the Mg/Sc systems was carried out by using grazing incidence X-ray reflectivity (GIXRR) to obtain non-destructively a first description of the structural parameters, thickness, roughness, and density of the layers. Resonant soft x-ray reflectivity measurements in the vicinity of Sc L-absorption edge were performed to investigate and to quantify the atomic distribution of deposited layers. Near absorption edge, the atomic scattering factor of an element changes sharply depending on its chemical environment inside the structure.

Keywords — Buried Interfaces, Resonant Soft X-ray Reflectivity, X-ray Optics, X-ray Reflectivity.

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Effects of Chopped Glass Fibers on the Mechanical Behavior of Polymer Concrete

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***Abstract*—** With the increasing need for specialty concretes in the construction industry, polymer concrete, which emerged in the early 1900s, has evolved and persisted to this day. Polymer concretes are special concretes with high strength, water impermeability, resistance to chemical action and low surface roughness. Due to these properties, they find wide applications in many fields such as swimming pools, drainage systems, repair works. Due to this wide application, many studies have been carried out to improve the properties of polymer concrete. One of these studies is fiber additions to polymer concrete. These fiber additions are mainly glass, carbon, boron, steel, silicon carbide, basalt, aramid (organic), etc. materials.

In this study, the effects of chopped glass fibers on polymer concrete are investigated. For this purpose, fresh concrete tests and hardened concrete tests are carried out by adding chopped glass fibers in different proportions to polymer concretes. In order to closely observe the effect of the chopped fibers, all concretes are produced in the Polymer Concrete Drainage Channel Production Facility of Mert Casting Co. in Istanbul, Turkey. In order to clearly observe the effect of chopped glass fibers, the amounts of the resin, hardener, accelerator, and admixture are kept constant in the concrete mix. In the study, fresh and hardened concrete tests are carried out on the mixes to be produced.

***Keywords*—** Chopped Glass Fiber, Fresh Concrete Tests, Hardened Concrete Tests, Mechanical Tests, Polymer Concrete

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High peak G_m of $In_{0.53}Ga_{0.47}As$ FinFETs with N_2 Surface Passivation

Hua Lun Ko, Quang Ho Luc, Edward Yi Chang

***Abstract*—**In this article, In0.53Ga0.47As FinFETs utilizing nitrogen post remote-plasma (RP) treatment for surface passivation with high peak Gm and low OFF-current has been fabricated. This device exhibits a high peak gm of 2268 μS/μm and Ioff of 3.4 × 10-4 μA/μm with equivalent oxide thickness (EOT) ~ 0.8 nm. High output and good subthreshold performance can be attributed to strong electrostatic control by highly vertical fin shape and outstanding interface quality of high-κ and In0.53Ga0.47As achieved by RP passivation which effectively decreased dangling bond. N2 surface passivation is a promising candidate technique to use on logic device applications that can effectively improve oxide quality on the semiconductor.

***Keywords*—**InGaAs, FinFET, N_2 passivation, □-□

This work was financially supported by the "Center for the Semiconductor Technology Research" from The Featured Areas Research Center Program within the framework of the Higher Education Sprout Project by the Ministry of Education (MOE) in Taiwan. Also supported in part by the Ministry of Science and Technology, Taiwan, under Grant MOST 109-2634-F-009-029 - .

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Phase Transformation of the $Hf_{0.5}Zr_{0.5}O_2$ Induced by Pulse Electric Field during Thermal Annealing

Chia-Chieh Cheng, Chih-Yu Deng, Yi-Jan Li, Yuan-Chieh Tseng

***Abstract*—** High-k gate oxides have been the workhorse for the semiconductor industry in the last decades[1]. Device scaling is one of the most important factors, while the film quality, taking $Hf_{1-x}Zr_xO_2$ (HZO) as an example, is often sacrificed during thickness reduction due to phase instability. Enhancement of phase uniformity of ALD-grown HZO requires (i) powerful analytical tools that can probe the chemical state and crystal ordering of the film and (ii) new optimization processes based upon the understanding of the analysis. We adopted an electric-pulse assisted (EPA) process during thermal annealing to optimize the HZO films. The EPA provides a degree of freedom to control charged vacancy by electrically stressing the film during annealing. As reported, the migration of oxygen vacancies plays an important role in film nucleation [reference], and phase uniformity might be improved if the EPA is properly applied. We used synchrotron x-rays to conduct interface characterizations, with emphasis on exploring the (i) inter-relation between film's oxygen state and capping electrodes and (ii) phase transformation while applying the EPA. The microscopic and macroscopic properties of the HZO were correlated by linking the synchrotron and the polarization-electric (P-E) results. We present preliminary results of x-ray diffraction patterns versus EPA treatments. We obtained significant relocation of the peaks upon different EPA stressing voltages. It can be interpreted as the phase transition arising from the migration of oxygen vacancy. More characterizations, such as x-ray photoelectron spectroscopy (XPS), is needed to further understand the interface reconstruction.

***Keywords*—** thin film, $Hf_{0.5}Zr_{0.5}O_2$, oxygen vacancy, electric field,.

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Study of Buried Interfaces in Fe/Si Multilayer by Hard X-ray Emission Spectroscopy

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Abstract — To the extent of our knowledge , X-ray Emission Spectroscopy (XES) has been applied in the soft x-ray region (photon energy ≤ 2 keV) to study the buried layers and interfaces of stacks of nanometer thin films. Now we extend the methodology to study the buried interfaces in the hard x-ray region (i.e., ≥ 5 keV). The emission spectra allow us to study the interactions between elements in the buried layers from the analysis of their valence states, thereby providing sensitive information about the physical-chemical environment of the emitting element in multilayers. We exploit the chemical sensitivity of XES to study the interfaces between Fe and Si layers in the Fe/Si multilayer from the Fe $K\beta_{2,5}$ emission spectra (7108 eV). The Fe $K\beta_5$ emission line results from the electronic transition from occupied 3d to 1s levels (i.e., valence to core transition) and is hence sensitive to the chemical state of emitting Fe atoms. The comparison of emission spectra recorded for Fe/Si multilayer with Fe and $FeSi_2$ references reveal the formation of $FeSi_2$ at the Fe-Si interfaces inside the multilayer stack. The interfacial thickness was calculated to be 1.4 ± 0.2 nm, by taking into consideration the intensity of Fe atoms emitted from the interface and the Fe layer. The formation of $FeSi_2$ at the interface was further confirmed by the x-ray diffraction and X-ray photoelectron spectroscopy done on the Fe/Si multilayer. Hence, we can conclude that the XES in the hard x-ray range could be used to study multilayers and their interfaces and obtain information both qualitatively and quantitatively.

Keywords — Buried Interfaces, Hard X-ray emission spectroscopy, X-ray diffraction, X-ray photoelectron spectroscopy

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Sulfanilamide/Epoxy Resin and its Application as Tackifier in Epoxy Adhesives

Oiane Ruiz de Azua, Salvador Borrós, Núria Agullò, Jordi Arbusà

Abstract**—**Tackiness is described as the ability to spontaneously form a bond to another material under light pressures within a short application time. During the first few minutes of the adhesive´s curing, it is necessary to have enough tack to keep the substrates together while cohesion is increasing within the adhesive. This property plays a key role in the manufacturing process of pieces. Epoxy adhesives, unlike other adhesives, usually present low tackiness before curing, however, there is very few literature about the use of tackifiers in epoxy adhesives, except for the high molecular weight epoxy additives. In the present work, a tetrafunctional epoxy resin based on Bisphenol- A and Sulfanilamide has been synthesized in order to be used as a tackifier. This additive offers improved specific adhesion to two-component (2K) epoxy adhesives. The dosage of the tackifier has to be done carefully not to alter the mechanical and rheological properties of the adhesive. The synthetized product has been analyzed by FTIR and ^{1}H-NMR analysis and the effect of the addition of 1 wt % of the tackifier on rheological properties, viscoelastic behavior and mechanical properties has been studied. On one hand, the addition of the product in the epoxy resin part showed a significant increase in tackiness regarding the neat epoxy resin. On the other hand, tackiness of the whole formulation was also increased. Curing time of the adhesive, has not undergone any relevant changes with the tackifier addition. Regarding viscoelastic properties, Storage Modulus (G') and Loss Modulus (G") remain also unchanged at ambient temperature. Probably, in case higher tackifier concentration would be added, differences in viscoelastic properties would be observed. The study of mechanical properties show that Hardness and Tensile Strength also keep their values unchanged regarding neat two component adhesive. In conclusion, the addition of 1 wt % of Sulfanilamide/Epoxy enhanced the tackiness of the epoxy resin part, improves tack without modifying significantly either the rheological, the mechanical or the viscoelastic properties of the product. Thus, the sulfanilamide presented could be a good candidate to be used as an additive to the 2k epoxy formulation for the manufacturing process of pieces.

Keywords**—**Epoxy adhesive, manufacturing process of pieces sulfanilamide, tackifiers.

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The Effect of Curing Conditions on Bentonite Concrete

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Abstract

This study intends to search for an alternative material for cement because the production of cement produces a huge impact on the environment. Thus, curing condition has many effects on concrete alongside either bentonite or ordinary concrete is studied, and an experiment was carried on to examine the characteristics of concrete with the replacement of cement with bentonite. In this research, bentonite was replaced with %age of cement 5,10,15 and 20 in comparison with the control mix (CM) are taken. The features like compressive strength, tensile strength, and chloride migration test were studied under normal conditions and steam curing. The compressive strengths and tensile strength were observed for all mixes after 28 days cured in water and cured in steam, and a comparison is made between them. The ability of chloride ions to penetrate concrete was evaluated through a chloride migration test. The results showed that the compressive strength of CM (control mix) is less than B5 and B10 (5% and 10% replacement of bentonite with concrete), while the strength of CM is greater than B15 and B20 for steam curing and without steam curing. The tensile strength of CM is less than B5 and greater than others for without steam curing, for with steam curing tensile strength of CM is greater than all mixes

Key words: Control mix, Bentonite, Compressive strength, Tensile strength, Chloride migration.

1. Introduction

Bentonite is an abundant clay mineral which is not uniform in composition. The smectite mineral is commonly referred to as the rock term bentonite. This mineral is composed of calcium, magnesium, iron, lithium aluminum silicates, and several hydrated sodium. The names of the individual minerals in the group include calcium, sodium montmorillonite, montmorillonite, nontronite (Fe), hectorite (Li), and saponite (Mg). Knight in 1898 has originally proposed the name bentonite for a particular clay formation in Wyoming, USA. There are lot of bentonite sources around the world [1]. Bentonite has a large application in every field like bleaching, absorbents, adhesives and ceramics [2] & [3] can vary in color, starting from brown, viridity to blue-gray and infrequently, white [4]. The white bentonites are more valuable and desirable for applications that

need white color. the primary man to provide hydraulic cement, however, was Joseph Aspdin a bricklayer from Leeds England. He obtained a patent in 1824 and was able to produce the primarycommercial cement by calcining at high heat, a mix of English chalks with. Most of the deep research is being carried out worldwide on Portland cement concrete using pozzolans like rice husk ash, fly ash, metakioline, limestone powder etc. But little research has been done on the Portland cement using the locally available Bentonite after calcination available in Pakistan.. The rock name bentonite is often accustomed check with the smectite mineral that's composed of several hydrated sodiums, calcium, magnesium, iron, and lithium aluminum silicates The names of the particular minerals in the group include sodium montmorillonite, calcium montmorillonite, saponite (Mg), nontronite (Fe), and hectorite (Li). Curing is the action of maintaining an adequate moisture content and temperature in freshly cast concrete for a precise period of time directly following placement. The process serves two main goals: It prevents the loss of moisture from the concrete. It keeps a preferred temperature for hydration to take place at a specific period.

2. Literature Review

The research on modern concrete systems is being carried out in phases in many countries. Many authors used bentonite from Pakistan [5] & [6] used jahangira bentonite [7] & [8] utilized kheber bentonite [9] employed the research on bentonite from Brazil. [10] S. Ahmad, examines bentonite heated at 5000C. [11] R. A. Khushnood, described heated bentonite blended concrete mixes shown higher CS than raw bentonite. [12] J Mohammad, tested on bentonite-steel slag mixture with various proportions, reported that 20-60% bentonite steel slag mixtures. [13] & [14] No effect of bentonite substitution was reported by all most all authors. [15]S A Memon, 2012 reported that decrease in water absorption by increasing percentage of bentonite blending. Bentonite is an abundant clay mineral which is notuniform in composition [16]. [17] Ross andShannon provided the following definition for bentonite, “bentonite is a rock composed of essentially of a crystalline clay-like mineral formed by the devitrification and the accompanying chemical alteration of a glassy igneous material, usually a tuff or volcanic ash”. As there are now many clays that are not originated from volcanic ash or tuff [18]. Grim and Guven defined bentonite as clay which is comprised of dominantly smectite mineral regardless to its origin. The white bentonites are considered valuable and more desirable for applications that require white color. They generally outlined the reactions that occur when smectite is heated to high temperatures. Furthermore, with dioctahedral smectites, like montmorillonite, there's substantially no shrinkage and destruction of lattice structure with the loss of hydroxyl water; however, for trioctahedral smectites, like saponite, the alternative occurs with the removal of the hydroxyl water, the lattice structure is destructed, and among shrinkage of the fabric

According to many studies, concrete's compressing strength when put through heating is at least 15-50% lower than when it is put under standard conditions. When the temperature rises in this process, water in concrete expands the most, regarding other particles. Thus, water has the lead role when it comes to the compressive strength of the concrete. Ultimately, the outcome are cracks (in a micro level) and porosities in the concrete weakening the cement paste, as well as the weakest part of the concrete (the transition zone).

It is important to pic fineness, 55–60 % of C3S, C3S/C2S ratio that is above 3, SO3 percentage that is below 3.5 % and a C4AF percentage between 5 and 15% should be preferred). [19] Scientists such as Bingöl and Tohumcu have observed the results of different curing systems on the compressive strength qualities of concrete produced by silica fume (SF) as well as fly ash (FA). In this research we observed the behavior of concrete with addition of bentonite and to check the strength of concrete with variation of bentonite because we want to make concrete economical and minimize the chemical effect of concrete on environment. At the end we observed the effects of curing condition on concrete accompanied by bentonite.k the suitable cement in order to perfect the heating process (cements have a high level of

3. Experimental Procedure

Jehangira Bentonite was bought, it was dehydrated for 24-hours at a temperature of 105 degree Celsius and then grinding of bentonite is performed. The size of grinded material is such that it can pass through 325 sieves. Sample is then moisture after grinding so that it cannot flown away in air and heating was carried out. By grinding the bentonite, the fineness of bentonite increases which increase the surface area of particles which ultimately help in achieving cementations properties.

Figure 1: Grinding of bentonite

After grinding of bentonite, it is heated at temperature of 200ºC to 210ºC for 24 Hours in oven. Heating of bentonite reduces the porosity of particles and increase the surface area. With the decrease in porosity the permeability of bentonite decreases which help in gain in high strength. Aggregate is shown in fig 2 are inserted for dimensional stability of concrete.

This has crushed stone, gravel, slag, recycled concrete, and geosynthetic aggregates. This process could be manufactured, recycled or even natural. Providing bulk and compressive

strength, aggregates are about 60-80% of concrete mixture. The durability, quality, and strength of concrete is based upon the grading of its aggregates in the mixture.

Fig 2: Aggregate

Once aggregate has been acquired, it is thoroughly washed by heavy water in order to remove all dirt. Our target is to achieve 60-90 slump for that, we used super plasticizer at constant water to cement ratio of 0.4. The plasticizer is used to achieve the required workability. The amount of plasticizer varies as bentonite clay portion changed. Cement concrete mix with 1:1.5:3. Now, we replace cement with bentonite in percentage of 5%, 10%, 15%, and 20%. We prepare total five mix first control mix (CM) then with B5(5% Bentonite), B10(10% Bentonite), B15 and B20. Then, the concrete is added to a mixture. It is not practicable to hand mix concrete, especially when it comes to a large quantity. So, we used machine mixing to satisfy all the demands. After concrete mixing

A test for the concrete slump is taken when transferring the slump from one batch to another to ensure the quality during the construction. This test is a simple, low cost and an effective test for concrete that yields immediate results. As mentioned in ASTM C143, the slump has the stated process. The Vertical settlement known as the slump, could be measured by millimeters of subsidence of the specimen during the test. We cast beams, cylinder, slabs and cubes with proper tamping with tamping rod.

Fig 3: Casting of samples

Fig 4: Casting of samples

In about 24 hours, samples are demolded carefully.

Fig 5: De molding of samples:

After around 24 Hours of casting of concrete, sample is cured for 28 days. The curing period for concrete structures, the temperature of 5º C (40º F) is used for 7 days least possible or until 70% of the compressive is obtained. Also, this period of time could be shortened to 3 days only, when the temperature is temperature is above 10ºC (50º F) and early high strength concrete is used.

Fig 6: Normal curing of samples

We performed the steam curing to compare the results of normal and steam curing. Curing with water vapor at atmospheric pressure is known as steam curing. This is useful when early strength gain is wanted, as well as when heat is required in order to do the hydration process. For example, in cold weather. The temperature of the steam curing chamber is increased and/or decreased at a rate of around 0.6°C/min. End caps are placed on the cement-lined pipe as marking prior to placing the pipe in the steam chamber.

Fig 7(a): Steam curing of samples

Fig .7(b): Steam curing of samples

4. Testing Procedures

4.1 Compressive strength assessment:

Concrete cylinder's compressive strength is determined by applying force over the cylinder until failure occurs. This test was done on a compression testing machine [20].

Fig.8: Compressive strength assessment

The values obtained for compressive strength of blends with steam curing and without steam curing are shown as below:

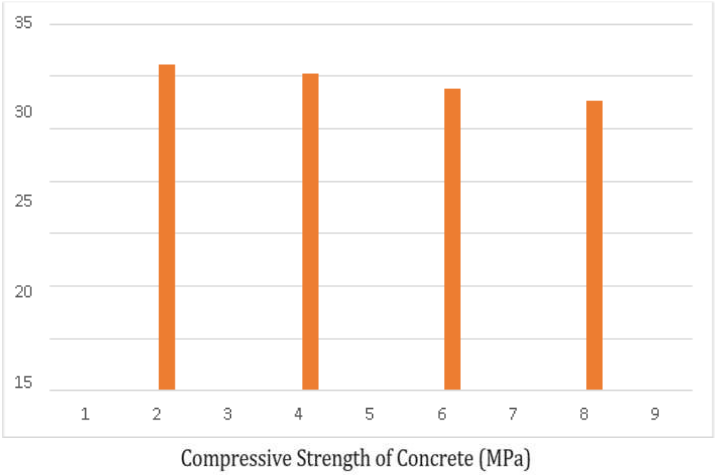

Fig9: Graphical representation with steam curing

The above graph shows that the value of compressive strength of control mix and bentonite concrete with replacement of cement with bentonite (5, 10, 15, 20) under normal curing.

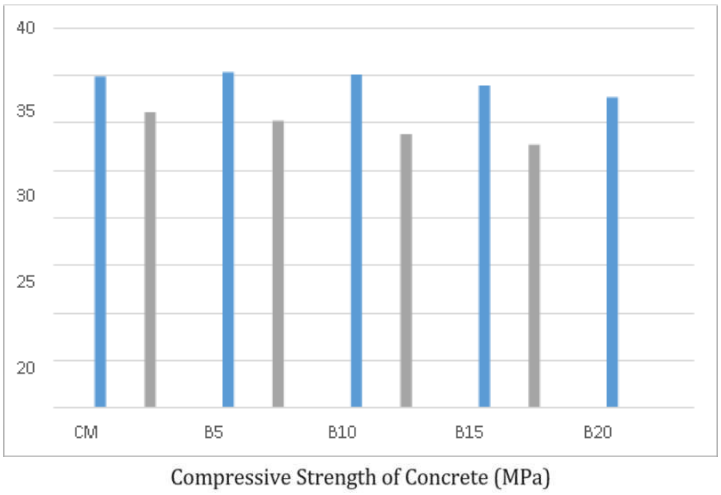

Fig10: Comparison of compressive strength under steam and normal curing

Above graph is a comparison between compressive strength of control mix versus bentonite concrete under steam and normal curing .The compressive strength for steam curing is higher than the strength for normal curing.

4.3 Tensile strength test:

Since concrete is frail when it comes to tension because of its brittle nature. Therefore, resistance to direct tension is not expected. With too much tension force (exceeding its tensile strength), concrete would develops cracks. That is the reason why the tensile strength is determined, in order to figure out the exact load the concrete needs in order for it not to crack. ASTMC496 (Standard Test Method of Cylindrical Concrete Specimen) is the process used, as well as other codes IS 5816 1999 [21].

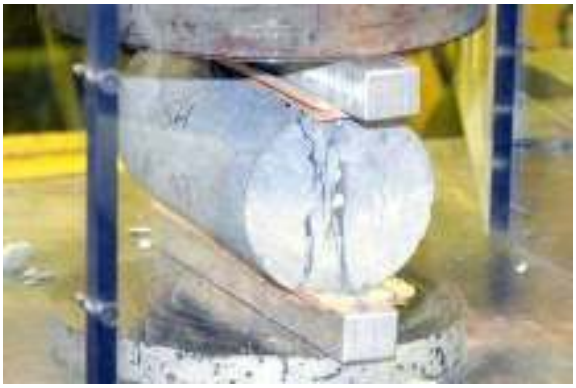

Fig 11: Tensile strength test:

The values obtained for Tensile strength of mixes with steam curing and without steam curing are shown below:

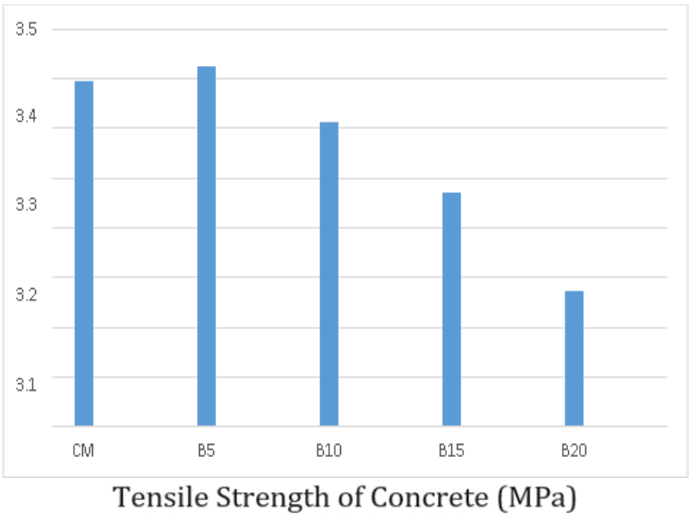

Figure 12: Tensile strength of control mix under steam curing.

Above graph shows that the value of tensile strength of control mix and bentonite concrete with replacement of cement with bentonite (5, 10, 15, 20) under steam curing.

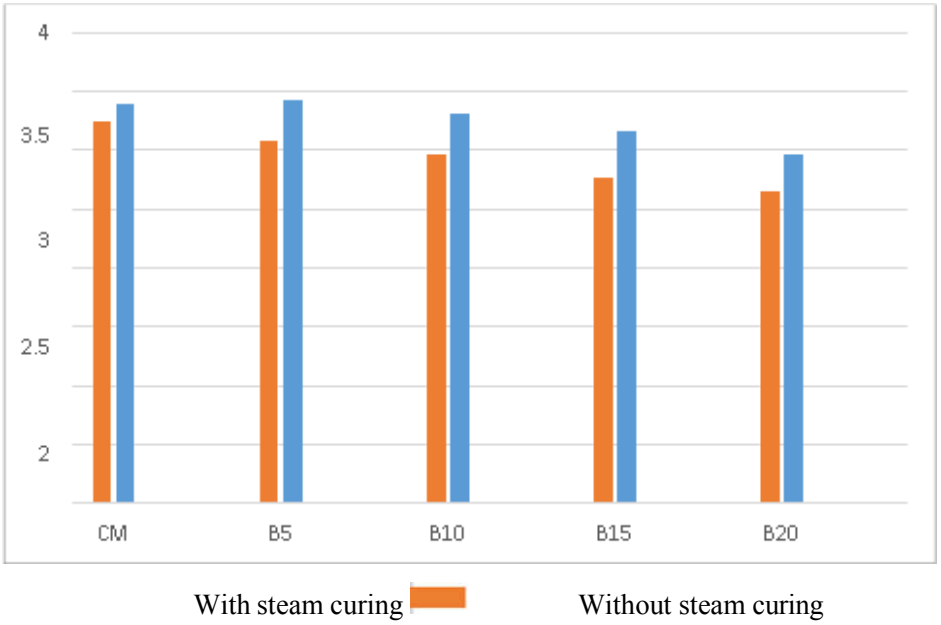

Figure 13: Comparison of tensile strength for steam curing and normal curing

This graph shows the comparison of tensile strength of control mix and bentonite concrete under steam and normal curing
.The tensile strength for steam curing is higher than the strength for normal curing.

4.4 Chloride migration test:

Deterioration mechanisms such as chloride induced corrosion of reinforced steel is essential, as it directly affects reinforced concrete constructions. Rapid Chloride Migration is a test that is commonly used as a quality assurance examination. Capillary absorption, hydrostatic pressure, and diffusion are methods by which chloride ions can penetrate concrete. Water-cooled., Vacuum container and Vacuum pump needed. The chlorine migration test is performed according to testing procedures listed in [21].

Fig 14: Chloride migration test

The result of the chloride migration test are shown below

Fig 14 Chloride migration test with steam curing

This graph shows that the value of chloride migration coefficient of control mix and bentonite concrete with replacement of cement with bentonite (5, 10, 15, 20) under steam curing. Results showed that chloride migration coefficient reduce with steam curing.

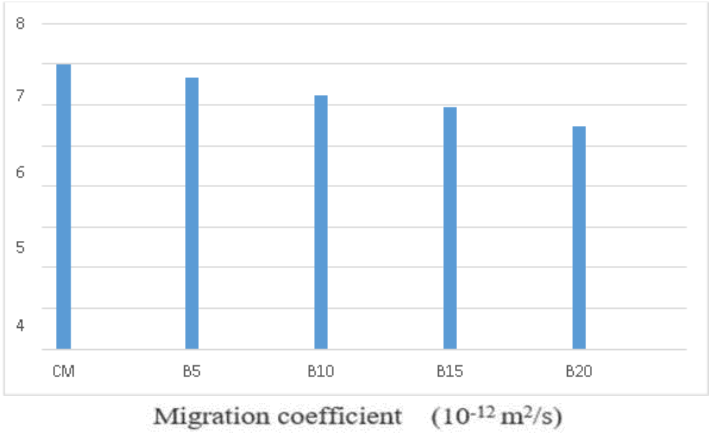

Fig 15 : Chloride migration test without steam curing

This graph shows that the value of chloride migration coefficient of control mix and bentonite concrete with replacement of cement with bentonite (5,10,15,20) under normal curing.

- **Discussion and Conclusion:**

From strength point of view observed from the result the compressive strength of control mix is less than 2-5% when cement is replaced with bentonite in proportion from 5-10%, whereas strength of control mix is greater than 2-6% when cement is replaced with bentonite in proportion from 10-15%. The tensile strength of control mix and bentonite with 5% replacement is same, whereas tensile strength of control mix is greater than 2-12% when bentoniteis replaced in proportion from 10-20%. Strength obtained from steam curing are slightly higher than the strengths obtained from normal curing. Comparatively we can say that bentonite can be replaced with cement up to 20% as it has minor effect on strength. From economic point of view: The cost of 1 ton of bentonite in US dollar is 1500, whereas the cement costs about
$1000 per ton. Using bentonite as a partial replacement of cement would save a lot of money. Which means a good development. Especially, if the concrete that has bentonite is used in hydraulic structures. Dams are a perfect example that uses millions of tons of cement.

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Structural Behavior of Composite Hollow Reinforced Concrete Column under Combined Loads

Abdul Qader Melhem

***Abstract*—**This paper is dealing with studying structural behavior of a steel-composite hollow reinforced concrete (RC) column model under combined eccentric loading. Radius of gyration according to American and Euro specifications be calculated, in order to calculate the thinnest ratio for this type of composite column model, in addition to the flexural rigidity. Formulas for interaction diagram is given for this type of model, which is a general loading conditions in which an element is exposed to an axial load with a bending at the same time. Structural capacity of this model; elastic, plastic loads, and strains will be computed and compared with experimental results. Total eccentric axial load of the column model is calculated based on the effective length KL available from several relationships provided in the paper. Furthermore, the inner tube experiences buckling failure after reaching its maximum strength will be studied.

***Keywords*—**column, composite, eccentric, inner tube, interaction, reinforcement.

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Environmental Study on Urban Disinfection Using an On-site Generation System

Víctor Martínez del Rey, Kourosh Nasr Esfahani, Amir Masoud Samani Majd

Abstract**—**In this experimental study, the behaviors of Mixed Oxidant solution components (MOS) and sodium hypochlorite (HYPO) as the most commonly applied surface disinfectant were compared through the effectiveness of chlorine disinfection as a function of the contact time and residual chlorine. In this regard, the variation of pH, free available chlorine (FAC) concentration, and electric conductivity (EC) of disinfection solutions in different concentrations were monitored over 48 h contact time. In parallel, the plant stress activated by chlorine-based disinfectants was assessed by comparing MOS and HYPO. The elements of pH and EC in the plant-soil and their environmental impacts, spread by disinfection solutions were analyzed through several concentrations of FAC including 500 mg/L, 1000 mg/L, and 5000 mg/L in irrigated water. All the experiments were carried out at the service station of Sant Cugat, Spain. The outcomes indicated lower pH and higher durability of MOS than HYPO at the same concentration of FAC which resulted in promising stability of FAC within MOS. Furthermore, the pH and EC value of plant-soil irrigated by NaOCl solution were higher than that of MOS solution at the same FAC concentration. On-site generation of MOS as a safe chlorination option might be considered an imaginary future of smart cities.

Keywords**—**Disinfection, free available chlorine, on-site generation, sodium hypochlorite.

I. Introduction

NOWADAYS with regard to safety concerns, liquid chlorine compounds such as HYPO are used instead of chlorine gas for different applications. The commonly available chlorine in HYPO (NaOCl) at concentrations between 5% and 15% is operated in liquid form. An alternate technique is the on-site generation of NaOCl, which is achieved through electrolysis by applying an electrical current to a solution of salt and water. The reported value by Singh [1] for minimum chlorine residuals varies between 1 ppm and 1.8 ppm depending on pH and contact time for bactericidal disinfection. Considering 30 min of contact time, a hypochlorous residual of 0.5–1.0 ppm is applicable. The contact time and chlorine residual concentration play key roles in the effectiveness of chlorine disinfection. As a result of the solubility of chlorine gas in water which is 7160 mg/L at 20 °C and 1 bar, hypochlorous acid is formed rapidly by hydrolyses. Increasing pH declines the power of free chlorine residuals. Hypochlorous acid concentration at 20 °C decreases from 90% to 10% at pH 7 to pH 8.6, respectively [1]. Hence, automatic monitoring of residual chlorine and automatic feedback of the injection rate is necessary to prevent over-dosage or inadequate disinfection from an environmental and economical point of view. In this regard, the practical stability of BACO solution and HYPO in terms of FAC at different contact times is concerned in the current report. Different concentration ranges including 500 ppm, 1000 ppm, and 5000 ppm of both MOS and Hypo solutions were taken into account during 48 h.

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II. Procedure and Method

The proposed work is tabulated in Table I. The BACO solution (MOS) was a transparent disinfectant liquid consisting of FAC concentration of 0.8% and pH > 9. On the other hand, HYPO containing FAC concentration of 11.5% and pH > 12 was purchased. All solutions were prepared with pre-distilled 5 µS/cm deionized water. Six beakers were set up as containers with different materials including pyrex, metal, and plastic. The DPD (N, N-diethyl-p phenylenediamine) method based on the International Organization for Standardization (ISO) Method 7393/2 for residual chlorine was adopted for FAC measurements.

TABLE I
The Proposed Study

Subject	Type	FAC (ppm)	Residual species	Timing
Disinfection	MOS	500	- FAC - pH - EC - TDS	- Initial - 1 h - 48 h
		1000		
		5000		
	HYPO	500		
		1000		
		5000		
	Control	0		

III. Result and Discussion

A. Solution Stability of MOS and HYPO

Based on the data of experiments, the efficacy of MOS was compared with that of NaOCl at equivalent free chlorine concentrations of up to 5000 mg/L. Disinfectant residuals behave differently on different surfaces. In this regard, three different materials were studied through the experiments.

As can be tracked through Figs. 1 (a)-(c), the amount of residual FAC for both solutions MOS and HYPO were decreased after 48 h as expected. However, all cases except Fig. 1 (a) (5000 ppm) indicated higher residual FAC of MOS than HYPO which resulted in promising stability of FAC within MOS. The FAC trend might be justified by its interaction effect with pH. The significant role of pH is related to the dissociation of HOCl, which in turn regulates the effectiveness of disinfection. Chlorine for pH ranges lower than 3, from 3 to 5,

and 5 to 10 remains as HOCl, CL_2 and HOCl with OCl^-, respectively. Additionally, beyond a pH of 10.0, chlorine remains in the form OCl^-. It should be noted that HOCl is the strongest disinfectant of all the different chloride species. Hydrogen and chlorine ions have no disinfection properties [2]. The experimental results in this study illustrated higher pH at the same concentration of FAC in HYPO than MOS that states the promising FAC stability of MOS. HOCl with strong disinfection properties calls attention to the reaction conditions to be so maintained through the formation of favored disinfectant species. On the other hand, OCl^- is a weak disinfectant and is discouraged. The chlorine-based disinfection at lower pH is favorable as a result of a higher amount of HOCl.

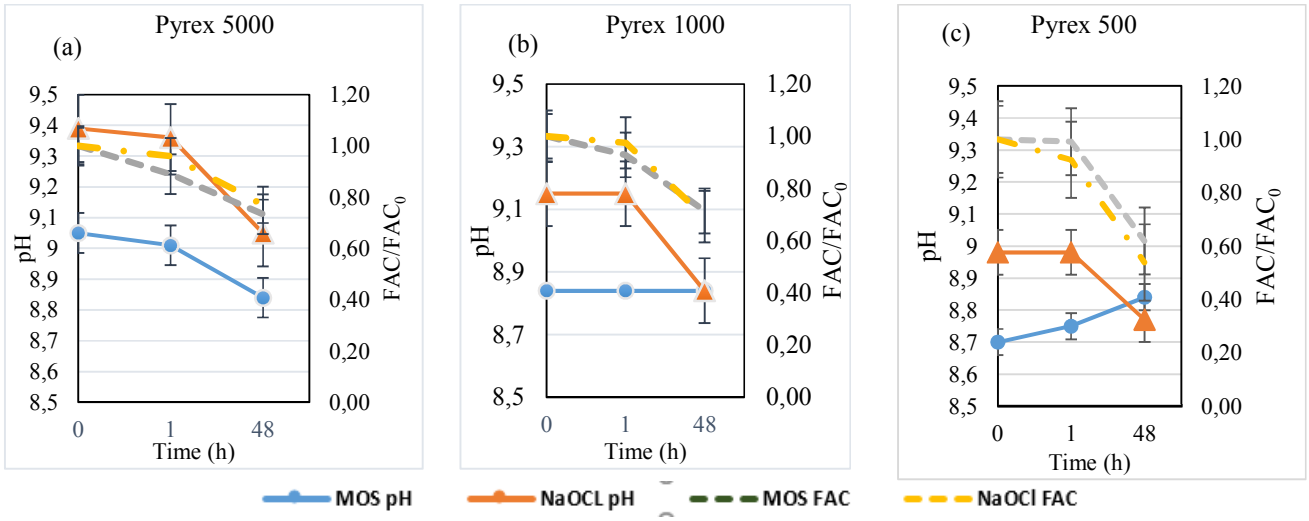

Fig. 1 Variation of pH and FAC over time for MOS & HYPO solution (a) 5000 ppm, (b) 1000 ppm, (c) 500 ppm, (solid line for pH, dotted line for FAC)

High pH values favor the formation of OCl^-, the less effective free residual form. The OCl^- initiates to dominate and the time involved for the free residual to effectively disinfect increases as pH rises from 7.0 to 10.7. This effect diminishes in the pH range 7.0–8.5 but beyond a pH greater than 8.5 significantly escalates the disinfection time [2].

When compared with chlorine as gas or as hypochlorite, the mixed-oxidant solution has been shown consistently to achieve a greater inactivation of microbial contamination at faster rates in a wider range of water (pH and temperature) conditions [3]. The disinfectant residual cannot be maintained at high levels because the strong chlorinous taste of the water would result in customer complaints to water companies. High chlorine residuals also promote the formation of trihalomethanes (THMs) which some studies [4] have shown to be carcinogenic at high levels in the mg/L range. Current regulations require that THM concentrations should not exceed 100 µmUg/l [5].

B. Effect of MOS and HYPO in Soil

In this study, plant stress activated by chlorine-based disinfectants was assessed by comparing MOS and HYPO. Chlorine deficiency appears along leaves margins and tips, leaves are smaller than usual and plant growth is also reduced [6].

The absorbed elements of Cl, pH, and EC in the plant-soil and their environmental impacts, spread by disinfection solutions were analyzed through different concentrations of FAC including 500 ppm, 1000 ppm, and 5000 ppm in irrigated water. The experimental assay consists of applying the irrigation and sprayed disinfection solutions on the soil surface of the 21 flower pots.

Fig. 2 shows the pH and EC of the soil subsamples collected on different days of experiments. The soil pH in all concentrations of FAC increased or kept constant compared to the initial value, which is due to the formation and transport of H^+ and OH^- ions. Nevertheless, in most of the sampling data, the pH value of soil content irrigated by HYPO was higher than MOS that can be due to the higher pH of NaOCl solution than MOS used for watering. Soil EC after the irrigation fluctuated compared to the initial conditions shown in Fig. 2. It is ascribed to the transport of ions from water solution into the soil. The soil EC values in the 5000 ppm samples were higher than that of 1000 ppm and 500 ppm, respectively. This tendency was in accordance with the change of FAC in the watering solution. However, the behaviors were different in most of the cases as the conductivity fluctuated.

The plants' appearance during experiments were deformed sharply until drying out with respect to the corresponding FAC concentration. In the other words, the higher concentration of FAC, the sooner drying out of the plant. Further tests are required for developing the reported study.

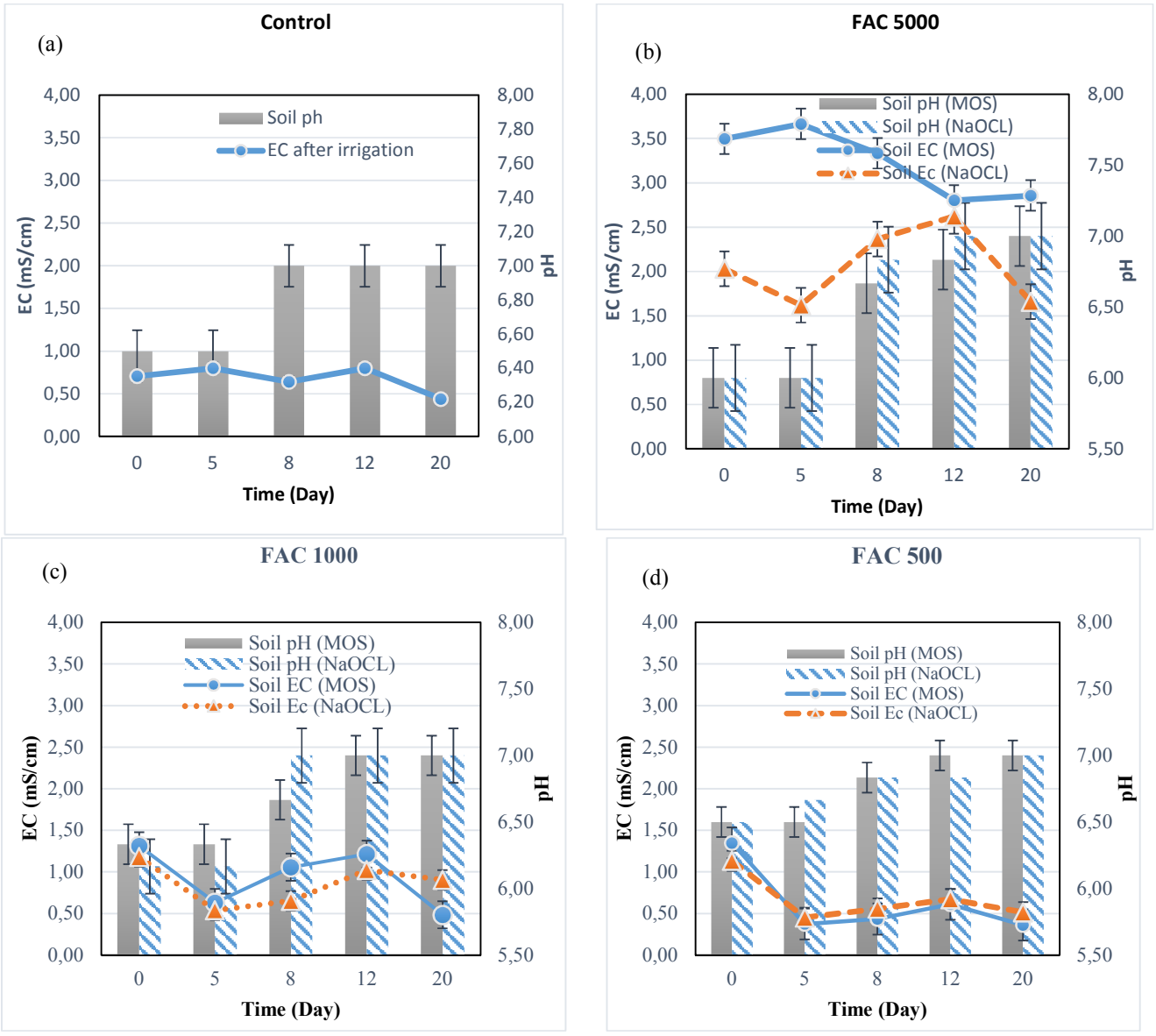

Fig. 1 Variation of pH and EC during 20 days in the soil of plants watering by (a) Control (tap water), (b) FAC = 5000 ppm, (c) FAC = 1000 ppm, and (d) FAC = 500 ppm

C. Environmental Impacts of On-Site Hypochlorite Generation (MOS) vs HYPO

Typically, the pH of oxidant solutions is in the range of 8-10. Dosing water with MOS produced oxidant solutions often does not alter the pH of the water being treated since the produced oxidant solution is used at a volume ratio of at most 1:1000 with the water to be treated under most application scenarios.

To sum up, the presented method of on-site MOS generation is the most sensible option when considering safety, economic, and environmental issues for the following reasons:

- It is a safe chlorination option. It is the safest chlorine-based water disinfection option. Indeed, the only chemical to be used and stored in bulk is salt. Also, generation takes place in an isolated system. It is a clinically clean process with no dripping, mixture of, or exposure to chemicals or fumes. The only by-product, hydrogen, is safely vented into the atmosphere or it can be diluted below 4 mol% to prevent any issues with flammability.
- The generated hypochlorite is classified as a non-hazardous chemical (0.8% concentration) as compared to commercial Hypo at 14%. It should be noted that hypochlorite above 1% is classified as a hazardous chemical.
- From safety point of view, MOS can be generated on demand and no bulk storage would be required.
- It contributes to workplace and general public safety as bulk transport, bulk storage, and bulk handling of potentially hazardous chemicals (gaseous chlorine and commercial hypo) are totally eliminated.

IV. Conclusion

The differences in MOS from those of HYPO are clear and well documented. As a result of these differences, MOS mixed-

oxidant solution can be used to address water quality issues that hypochlorite, and indeed other oxidant disinfectants as well, simply cannot. Although pH was declined over time, the pH of NaOCl solution is higher than the pH of the MOS solution at the same FAC concentration. MOS indicated regular stability of FAC and further study will be required in this process.

The experiments with the plants confirmed that chlorine ions are generally toxic to plants' growth at relatively low concentrations and may cause irreversible damage to their development. From the obtained results, it can be concluded that while plant growth was reduced in the presence of chlorine from all tested compounds, the pH and EC value of plants soil irrigated by NaOCl solution was higher than that of MOS solution at the same FAC concentration. The plants watered by higher FAC concentration were drying out faster.

ACKNOWLEDGMENT

Financial support received from the Sant Cugat city council is fully acknowledged. The authors appreciatively acknowledge all supports received by the Agency for Business Competitiveness (ACCIÓ).

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Understanding Continuance Use in Ridesharing Applications and its Consequences: Triadic-Interaction Model

Reem Alsaedi, Thomas Chesney, Robert Pasley

***Abstract*—** As an off shoot of sharing economy, ridesharing applications (RSA) such as Uber and Lyft have been introduced and have achieved rapid growth and success in the taxi business. However, there are many campaigns conducted against RSA that are organized by RSA drivers. This might lead to a puzzling observation that while peer-drivers' satisfaction is low with RSA, they still continue to use these apps. As this drivers' apparent contradictory behavior (i.e. continued use while unhappy) is inconsistent with predictions from the extant IT usage theories, this might an obvious sign of needing to evolve and refine IT usage theories to be consistent with the current evolution of the technologies. Agreeing with this argument, many IT scholars have criticized status quo in IT theories and their lack in explaining how user behavior and attitudes are developed with advancing technology. For example, RSA are experienced within the triadic-interaction; peer-peer interaction, and peer-app interaction rather than dual-interaction; user-app interaction as in the conventional technologies in previous research. Therefore, this revolution has created a need for refining IT theories to involve factors related to the peer-peer interaction and innovative context of RSA, and explain how these factors influence IT continuance use as the explanation of extant IT usage theories is limited only to factors related to user-app interaction. In addition, a widely held belief that the rise of RSA has positive implications for the individual (such as enhancing driver wellbeing), social (such as decreasing motor vehicle fatalities), and global welfare (such as boosting sustainability). While significant debate has surrounded this belief, limited empirical research has been devoted to investigating the consequences of such apps. Based on the previous brief discussion, the following two issues need to be addressed: first refining the prediction of IT continuous usage theory to include the new features of RSA; second uncovering the actual relationship between drivers' welfare and RSA continuous usage. To address these issues, extant IT usage theory was refined by adapting top-down inductive theorizing and grounding it through integrated model of customer journey and UTAUT in order to form the theoretical research model. Then, this theoretical framework was operationalized and tested by collecting data from 420 Uber drivers in Saudi Arabia. The results suggest that monetary social benefits and perceived flexibility have more impact on the drivers' continuance intention more than satisfaction. The findings also demonstrate that although the RSA continuance intention has positive impact on the driver wellbeing, the actual usage of RSA has a negative influence on the driver wellbeing. The current work contributes to research by developing and testing a specific model of RSA usage. In addition, the findings of this study could be useful for understanding the extent to which RSA use impact on drivers' wellbeing, and as a result, help decision-makers to improve the driver welfare.

***Keywords*—** continuance use intention, driver welfare, Ridesharing apps, RSA consequences.

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Use of Chemical Extractions to Estimate the Metals Availability in Bricks Made of Dredged Sediments

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***Abstract*—** SEDIBRIC (valorization de SEDIments en BRIQues et tuiles) is a French project that aims to replace a part of natural clays with dredged sediments in the preparation of fired bricks in order to propose an alternative solution for the management of harbor dredged sediments. The feasibility of such re-use is explored from a technical, economic, and environmental point of view. The present study focuses on the potential environmental impact of various chemical elements (Al, Ca, Cd, Co, Cr, Cu, Fe, Ni, Mg, Mn, Pb, Ti, and Zn) that are initially present in the dredged sediments. The total content (after acid digestion) and the environmental availability (estimated by single extractions with various extractants) of these elements are determined in the raw sediments and in the obtained fired bricks. The possible influence of some steps of the manufacturing process (sediment pre-treatment, firing) is also explored. The first results show that the pre-treatment step, which uses tap water to desalinate the raw sediment, does not influence the environmental availability of the studied elements. However, the firing process, performed at 900°C, can affect the amount of some elements detected in the bricks, as well as their environmental availability. We note that for Cr, or Ni, the HCl or EDTA availability was increased in the brick (compared to the availability in the raw sediment). For Cd, Cu, Pb, and Zn, the HCl and EDTA availability was reduced in the bricks, meaning that these elements were stabilized within the bricks.

***Keywords*—** bricks, chemical extraction, metals, sediment.

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Urban Information Modeling's applications for Energy Efficient Urban Areas: Case Study of Educational Campuses

Samar Alarif

***Abstract*—**Efficient urban energy districts follow sustainable governance approaches to face the growing urban infrastructure management challenges. Managing energy on the urban context level needs to integrate data from different domains, mainly construction, facility management, and energy suppliers. Moreover, the management process needs to support End-user engagement in buildings operation to promote the service and influence their consumptions behaviors. The integration and communication between city stakeholders enable participation models of collaboration between cities and public bodies, industry and business, research and academia, and citizens and civic society. Digital Urban Management platforms enable efficient and sustainable management for all these challenges. Urban and Building Information Modeling (UIM/BIM) have recently attained attention in the urban management platform innovation due to its applications and benefits for the Urban Energy facility management domain. This paper aims to establish a conceptual framework of UIM/BIM for Sustainable energy management in urban areas. Identify the potential benefits of UIM/BIM for Urban Energy facility management. Identify how UIM /BIM have applications in supporting FM service innovation processes and identify how to Support End-Users Integration and Coordination with different actors identify the actors' roles and benefits. The study used literature reviews and Case studies methods. The study use literature reviews to identify the applications and the conceptual framework, and validate the findings by the case study which includes actor's interviews and questionnaire. The study chooses campuses a perfect small-scale to make prototypes capable of simulating urban environments. University campuses with different sizes are acting as a district or small city, campuses are compacted enough to concentrate resources and improve efficiency; it compacts different buildings and infrastructure. The case study is TU Berlin campus El- Gouna located in El-Gouna Business Park.

***Keywords*—**Smart City, Smart Energy Campus, UIM, Urban Platforms, Sustainable Facility Management

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Co-Design with Older People: The Case of a Public Restorative Garden in Milan (Italy)

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***Abstract*—** The demographic aging and the evolution of lifestyles require new strategies to promote the well-being and active aging of elderly. Properly designed public green areas are a key factor in promoting active aging, in order to develop an urban resilience strategy that tackles both ecological and social issues.

Modern landscape design criteria point out the importance of considering the ecosystemic and "biophilic" relation between people and the environment. To maximize the impact of this design criteria, proper engagement strategies are advisable to assign an active role to elders and to inform the fine tuning of the design process according to the specific needs of the local elderly population.

This study is conducted with an interdisciplinary cooperation between researchers specializing in environmental psychology and landscape design. The goals of the Green Age research are to combine restorative gardens design criteria with co-design and apply the proposed methodology to plan and build a restorative garden; the garden itself will act as a setting where to evaluate the psychological, cognitive and social benefits that exposure to nature has on the elderly. The study area (3000 m²) is included in a community garden in the district of Milan (Italy) bordering with two nursing homes involved in the project.

The co-design process is developed through the method of the focus group which aims at placing people's experience at the centre of the design process. Three groups are held with potential users: elderly from the district (age range 65–71 years), elderly members of associations active in the district (age range 65–82 years) and residents of the two nursing homes (age range 70–84 years). Specific results were analyzed using the four properties of restorative settings according to the Attention Restoration Theory by Kaplan (compatibility, being away, extent, fascination). It suggests an evolutionary basis for emotional and physiological responses to Nature and positive attentional and physiological effects deriving from exposure to natural environments.

The garden, whose construction was completed in the spring of 2020, is the result of applying the restorative garden design criteria that focus on prosthetic, regenerative and ecological qualities and of what emerged from the focus groups.

The proposed co-design process combines social and environmental sustainability as it provides designers an insight about the user's experience in nature. Such information can be fruitfully integrated with professional competences about comfort aspects and environmental protection in order to improve the whole design project. The applied methodology allows to emphasize the experiential aspect of person–environment interaction; it is an interdisciplinary approach to collect experiential data to be translated into physical features of the environment and therefore, it helps the professional to focus on user perspectives in a more holistic way.

***Keywords*—** Biophilia, elderly, focus group, healing garden design.

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Design and Implementation of a Cross-Network Security Management System

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***Abstract*—**In recent years, the emerging network worms and attacks have distributive characteristic, which can spread globally in a very short time. Security management crossing networks to co-defense network-wide attacks and improve efficiency of security administration is urgently needed. We propose a hierarchical distributed network security management system (HD-NSMS), which can integrate security management across multiple networks. First, we describe the system in macrostructure and microstructure; then discuss three key problems when building HD-NSMS: device model, alert mechanism and emergency response mechanism; lastly, describe the implementation of HD-NSMS. The paper is valuable for implementing NSMS in that it derives from a practical network security management system (NSMS).

***Keywords*—**Network Security Management, Device Organization, Emergency Response, Cross-Network

I. INTRODUCTION

The earliest research on NSMS can be pursued back to the Europe project SAMSON [1] in 1992, which performed the security management by integrating interfaces of CMIP and SNMP. Scholars in the world discussed widely on NSMS in each subsequent year. In 1997, F. Stamatelopoulos etc. implemented an integrated network security management system on UNIX machine by adopting SNMP protocol and using architecture of Manager/Agent [2]. In 1998, Philip C. Hyland etc. proposed a three-stage theory for network security management and built a security management framework named CSSA [3]. In 1999, Soon Choul Kim etc. built a NSMS based on architecture of Client/Server [4], which collects security information from each computer, analysis them and displays results to users. Between 2000 and 2002, K. Boudaoud etc. discussed NSMS [5] from perspective of multi-agent, and built a prototype. But its main goal is to promote the ability of intrusion detection. In 2005, J. Dawkins etc. built a prototype of NSMS [6], which identifies, tracks and analyzes security events based on security information gotten from other detecting and scanning tools, and displays results to users in graph style.

Above researches focused on single network security management, most of them didn't involve cross-network security management. However, security management crossing multiple networks is becoming more and more urgent lately. Because of that most of worms emerged in recent years have distributive characteristic, which can spread to worldwide in a very short time, and maybe derive from different networks and districts, these require extensive coordination in the handling procedure of security events/alerts. Cross-network security management can meet the requirement well for that it is effective in defending network-wide attacks and managing security by the means of integrated management and cross-network cooperation when handling events, policies and vulnerabilities.

We implemented a HD-NSMS that can execute cross-network management, and mainly included five main functions: status monitor, event management, policy management, vulnerability management and security situation evaluation. On basis of the practical research and development, section 2 of the paper describes the system in macrostructure and microstructure; section 3 discusses three key problems when building HD-NSMS: device model, alert mechanism and emergency response mechanism; section 4 describes the implementation of HD-NSMS.

II. ARCHITECTURE

HD-NSMS is a complicated system, whose architecture has to be described from both macro level and micro level.

A. Macro Architecture

HD-NSMS aims to protect network of large-scale organization. This form network has three characteristics in general: hierarchical, distributed and dendriform, which is shown in Figure 1. The macro-architecture of HD-NSMS should be consistent with organization's network structure in macro level. Therefore, HD-NSMS is composed of a number of nodes. Each node is named as "security management node"(SMN) , which is responsible for centralized security management in local network and its descendent networks. Corresponding to organization's network, all of the SMNs construct a tree like structure.

As there are notable differences between managing device and SMN, SMN can be divided into two classes: Intranet SMN (ISMN) and Extranet SMN (ESMN). ISMN manages device while ESMN manages SMN.

Fig.1. Network of large-scale organization

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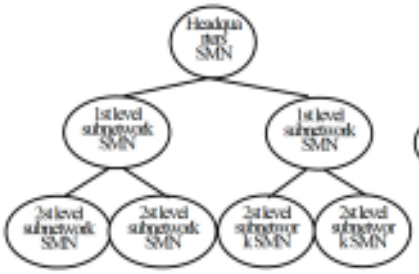

Fig.2. Macro Architecture combining ISMN and ESMN

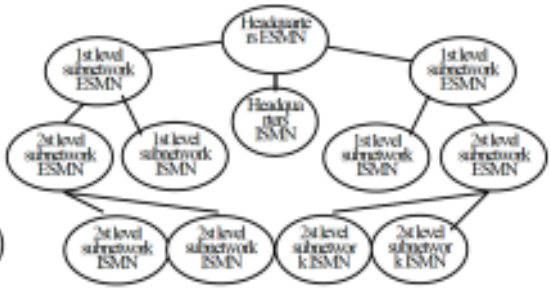

Fig.3. Macro Architecture separating ISMN and ESMN

Hence, two kinds of macro architecture can be built: Macro Architecture combining ISMN and ESMN (see Figure 2), Macro Architecture separating ISMN and ESMN (see Figure 3). Device in this paper means security related equipements, hosts or software. Devices can be divided into three classes: security devices, network devices and important hosts.

For the macro architecture separating ISMN and ESMN, ISMN is responsible for the tasks related to device, such as monitoring running status of device, receiving and handling security events from device, acquiring security policy from device and enforcing policy to device. ESMN can fulfill security management in a larger network under the support of lower ISMN and ESMN, such as analyzing security events, computing security situation, and distributing security policies and patches etc. Although this architecture divides works of ISMN and ESMN clearly, the cost of developing and maintaining such kind of management system is high. Besides that, the whole system will be complicated for that it comprises two types of SMN.

For the merged architecture, there is only one type of SMN, which manages both device and SMN. As this architecture treats SMN as a special device, the structure of the HD-NSMS looks simple, and the cost of development and maintenance is low. Therefore, we choose the architecture combining ISMN and ESMN for our HD-NSMS.

B. Micro Architecture

Diversity is an important characteristic of NSMS, which includes platform diversity, device type diversity, manufacturer diversity and information structure diversity. How to merge all of these together and at the same time guarantee high performance, reliability, security and scalability of the system is not easy. The best way to resolve such problem is to use layered abstraction. So, we divide micro architecture of HD-NSMS into five-layer depicted in Figure 4.

Fig.4. Five Layers of Micro Architecture

The ground layer is DIL (Device Interface Layer), which acquires and configures various data or files on device, hides technical details of device operations, and provides unified data interfaces for upper layers.

The second layer is CCL (Common Communication Layer), which is responsible for communication between agents and SMN, between user console and SMN, and between SMN and SMN. It includes communication in local network or across wide area network. It also involves encryption, certification, speed control, reliability, priority control and time synchronization. It provides unified communication interface to SMN, agent and user console.

The third layer is DLL (Device Logic Layer), which is responsible for maintaining device topology in SMN, hiding details such as device type or location etc, and providing more abstract device operations for upper layers.

Table 1. Five-layer structure

Layer	Function	Main operations for upper layer	Data for upper layer
UIL	Interacts with users	Graph Interface	Graph Interface
FLL	Implements device status monitoring, events management, policy management and security situation evaluation	Send device status; send device event; query event; read/write device security policy; dispatch/receive patch; scan vulnerability; evaluate security situation; handle security event.	Command parameters
DLL	Maintains device topology	Build, assemble, disassemble, expand, and shrink device topology; read, write, search, add, delete, and modify device.	Device No.
CCL	Communicates between agent and SMN, user console and SMN, SMN and SMN	Send data; Receive data	Communication data（decided by communication protocol）
DIL	Manages device directly	Read device status; read device log, receive device event; read/write device security policy; write device patch.	Device running status, device events or log, device security policy, device patches

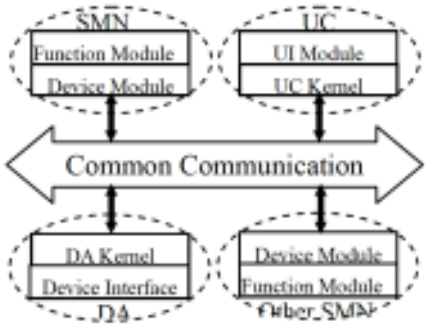

Fig.5. Micro Architecture of HD-NSMS

The fourth layer is FLL (Function Logic Layer), which helps to implement SMN functions: device status monitoring, events management, policy management, vulnerability management and security situation evaluation.

The top layer is UIL (User Interface Level), which runs on user console. It interacts with users and sends user commands and data to FLL.

Building NSMS based on the layered-abstraction can conveniently merge together devices with different types or manufactures. It is also convenient to add new functions into NSMS. Moreover, the architecture is clear and easy to maintain. The micro-architecture shown in Figure 5 is divided into four independent parts: Security Management Node (SMN), Device Agent (DA), User Console (UC) and Common Communication Server (CCS). These four parts correspond to above five-layer structure.

DA is composed of Device Interface module and DA Kernel module. Both of them belong to DIL. Device Interface module communicates directly with device through several kinds of protocols: SNMP, CMIP, syslog, manufacturer specific protocols or customized protocols. With these protocols, the module can complete operations like getting or setting device status, getting or setting device policy, etc. DA Kernel receives and explains commands from SMN, and performs required operations on device through device interface module. At the same time, it receives alerts and status information from device, transforms them into uniform formats and sends them to SMN through CCS.

Common Communication is composed of communication library and CCS, and belongs to CCL. Communication library is attached to SMN, DA and UC. It implements communication protocol stack, multi-threads parallelization and multi-level cache etc. CCS is an independently running program, mainly responsible for encryption/decryption, cross-network speed control, asynchronous storage and routing of communication.

SMN is the kernel of HD-NSMS. It consists of Device Module and Function Module. Device Module belongs to DLL. It maintains devices' logical topology, attaches device attributes when sending information, interprets device attributes when receiving information. Function module belongs to FLL. It performs SMN functions and manages parallel asynchronous information. Except device management in local network, SMN also communicates with other SMNs and treats descendent SMN as its own devices.

UC Kernel and UI Module belong to UIL. They are responsible for user interaction. UI Module is a graphical interface. UC Kernel creates and sends user commands, receives alerts and status information, and maintains device topology in user view.

III. KEY ISSUES

A. Device Model

Device is the key object of HD-NSMS. The five functions of HD-NSMS all are relative to devices. So building reasonable device model is very important. The process to build device model has three steps: addressing, abstraction and organization.

Step 1: Device Addressing

HD-NSMS is a typical large-scale distributed communication system. Network communication is required between all device agents and SMN. Therefore, uniform addressing is necessary for identifying each communication node uniquely in whole HD-NSMS.

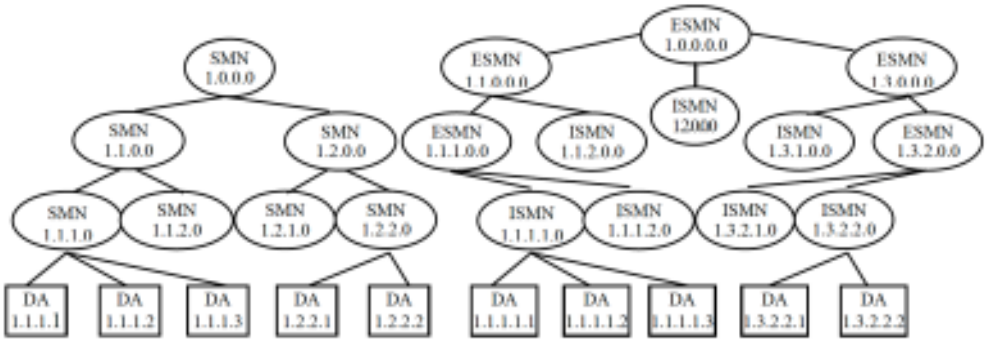

Fig.6. Addressing examples for combined architecture and separated architecture

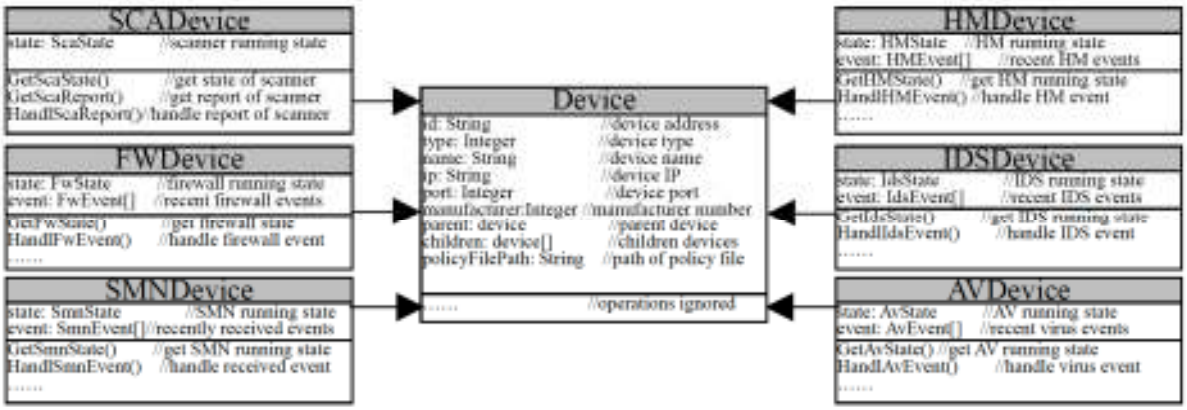

Fig.7. Static abstraction of devices

The addressing method of HD-NSMS should satisfy two requirements: uniqueness and locatability. Uniqueness means identifying a node uniquely in the macro tree structure of HD-NSMS, even if two nodes are located in the same LAN or on the same machine; Locatability means the logical location of a node in the macro structure tree of HD-NSMS can be ascertained. In other words, the level, sub-tree or number of any node can be ascertained.

For identifying a communication node, IP address is a typical example, which can identify a machine on the Internet uniquely. But, if HD-NSMS uses IP for identification, there will be some problems difficult to resolve: How to ascertain the logical position of a node in HD-NSMS' macro structure tree by using IP address? How to differentiate each node while several communication nodes share one IP address? Hence, IP address isn't appropriate for HD-NSMS addressing.

We designed a new addressing method. It assumes n and d as depth and degree of HD-NSMS' macro architecture tree, represents address of a node as following string:

$$A1.A2.A3\ldots An \quad 0 \le Ai \le d \quad 1 \le i \le n$$

The node address string is composed of several segments separated by dots. The amount of segments is equal to the depth or total levels of macro structure tree. Each segment describes number of the node under its parent node. For example, there is a node that has address as 1.2.4.0.0.0.0.0, which means the HD-NSMS has eight levels in total and this node is a 3rd level node. The number of this node in level 1 is 1, level 2 is 2, and level 3 is 4. The numbers below level 3 all are zero, which indicates level of the node is 3. This addressing method meets above two requirements well for that an address can represent a HD-NSMS node's logical position and identify it uniquely.

We illustrate HD-NSMS addressing method by using the network structure in Figure 1. Left part of figure 6 for merged macro architecture, right part for separated macro architecture.

Obviously, all nodes in HD-NSMS construct a tree. Each node in the tree represents a device and has an address. We name such tree as Addressed Device Tree. In the Addressed Device Tree, there are only two kinds of nodes: SMN node and Device node. Only SMN node can be a non-leave node.

For any node in Addressed Device Tree, the algorithm complexity of searching a node from the root is O (n), which n is depth of the node in the tree. In the case of numberless tree, the algorithm complexity should be O (n*d), which d is degree of the node. So Addressed Device Tree is efficient on performing operations of search, add and delete.

Fig.8. Dynamic abstraction of devices

Step 2: Device Abstraction

We abstract device both statically and dynamically. Static abstraction regards security device, network device, host machine and SMN as a uniform device object which has attributes of device type, operations and properties. Device object is the kernel data structure of the whole HD-NSMS, we describes it by UML in Figure 7. Firstly, we define a super class named Device, which includes basic information about device and related operations; then, define each specified device object which includes attributes of device' running status, latest events list and corresponding handling functions. Specific device object involves FWDevice, IDSDevice, AVDevice, SCADevice, HMDevice and SMNDevice.

In addition, for abstracting device dynamically, we describe a state transition diagram that contains ten statuses and twelve transfer conditions as shown in Figure 8. Ten status that pictured as nested circles include offline (S1); network disconnected (S11); device can't arrive (S12); online (S2); waiting (S21); running normally (S211); running abnormally (S212); handling alert (S22); handling policy (S23); handling vulnerability (S24). Twelve transfer conditions include

receiving network test package (T1); overtime when waiting network test package (T2); receiving device state package (T3); overtime when waiting device state package (T4); device abnormity of CPU, memory, disk, network flow or key process (T5); device normality of CPU, memory, disk, network flow or key process (T6); receiving device alert (T7); finishing handling alert (T8); receiving policy handling command (T9); finishing handling policy command (T10); receiving vulnerability handling command (T11); finishing handling vulnerability command (T12).

Step 3: Device Organization

Device organization should reflect topology of physical devices in reality, and convenient for perform any computation. Besides, device organization should be displayed in visualized way for users to understand and operate. Therefore, we propose a three mapping model for device organization: physical view, virtual view and user view.

- Physical View: a device topology that describes how the physical devices are connected in reality.
- Virtual View: a mapping of the physical view in memory. It also can be regarded as a topology of abstracted device objects. A device in virtual view is a logical abstraction of the corresponding physical device. Virtual view is the kernel of three layers and computational foundation for five functions of HD-NSMS.
- User View: a mapping of virtual view on user interface. It also shows the result of user operation. Devices in user view are different from those in virtual view. User View describes position, size, icon, alert and sounds of device objects in user interface. It not only can map virtual view, but also can modify virtual view in return.

Essentially, virtual view and user view are Addressed Device Tree composed of abstract devices. Virtual view and user view have to change dynamically for mapping updates of physical device or making user operation conveniently. Possible changes in virtual view include: building, assembling and disassembling tree, adding and deleting device, modifying and switching status. Possible changes in user view include: building, destroying, assembling, disassembling, expanding and shrinking tree; adding and deleting device; modifying and switching status. Before introducing the algorithm of dynamical changing, two concepts need to be defined:

Device Tree's Embedding Structure: a data structure for encapsulating Addressed Device Tree, used in transmitting the Addressed Device Tree between virtual view and user view, and between upper SMN and lower SMN. Device tree's embedding structure and Addressed Device Tree can convert reciprocally. It describes each device in following format:

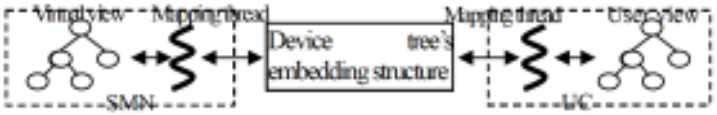

Fig.9. View mapping mechanism

[DeviceId:DeviceState:Child1:Child2:Child3……]

Then, the device tree in left of Figure 6 can be represented as:

[1.0.0.0:state:[1.1.0.0:state:[1.1.1.0:state:[1.1.1.1:state]:[1.1.1.2:state]:[1.1.1.3:state]]:[1.1.2.0:stat e]]:[1.2.0.0:state:[1.2.1.0:state]:[1.2.2.0:state:[1.2.2.1:state]:[1.2.2.2:state]]]]

View Mapping Thread: a daemon thread running on SMN and UC. Under the help of Device Tree's Embedding Structure, it may implement mapping between virtual view and user view, which is illustrated in Figure 9.

For an administrator of SMN, he/she only knows number, status and other information of direct subordinate devices. It is difficult for him/her to fill the information of indirect subordinate devices, because indirect subordinate devices maybe locate in remote place geographically. Therefore, we introduce assembling and disassembling algorithms to update automatically of subordinate device tree.

Assembling algorithm can assemble the device tree's embedding structure under the main tree and update the mapping onto user view. The assembling algorithm is given out as Figure 10. If subordinate SMN doesn't send information for a long time, it is considered offline or network failure. At this time, its subordinate sub-tree should be disassembled. The disassembling algorithm is given out as Figure 11.

Assembling algorithm:

Parameter: device tree's embedding structure

1) call algorithm of building tree to transform device tree's embedding structure to a subtree preparing for assembling;

2) search in main tree the assembling node that is the same as root node of the subtree;

3) add root node of the subtree into children device group of parent node of the assembling node;

4) set parent of the assembling node as parent of root node of the subtree;

5) delete the assembling node from its parent's children device group;

6) free the assembling node in virtual view;

7) send new device tree to user view by mapping thread;

8) find assembling node in main tree of the user view;

9) update state of the assembling node according to root node of the subtree;

10)by using an search algorithm of depth precedence, add every node of subtree circularly under the assembling node in user view;

11) update user view;

Disassembling algorithm:

Parameter: disassembling node

1) find the disassembling node in main tree of virtual view;

2) modify state of the disassembling node;

3) by using an search algorithm of depth precedence, delete every descendent nodes of the disassembling node;

4) send new device tree to user view by mapping thread;

5) find the disassembling node in main tree of user view;

6) update state of the disassembling node in user view;

7) by using an search algorithm of depth precedence, delete circularly every descendent node of the disassembling node;

8)update user view;

B. Alert Mechanism

The objective of alert mechanism is to integrate events and disclose relations among events. In recent years, a lot of researches have been done in this field [9~13], but most of them keep eyes on intrusion detection and doesn't involve relation analysis across different type of devices. Generally, they don't consider the differences of events from different type of devices and don't correlate the events based on inner relationship of events from different type of devices. Cross-device event-correlation is an inevitable problem that has to be solved for building HD-NSMS. Our alert mechanism is described in Figure 12.

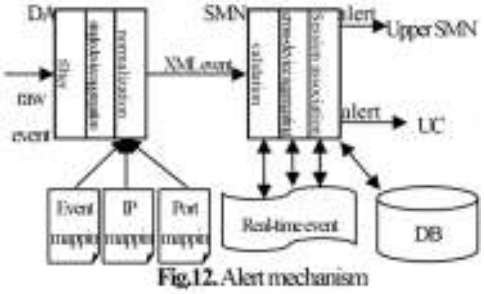

Fig.12. Alert mechanism

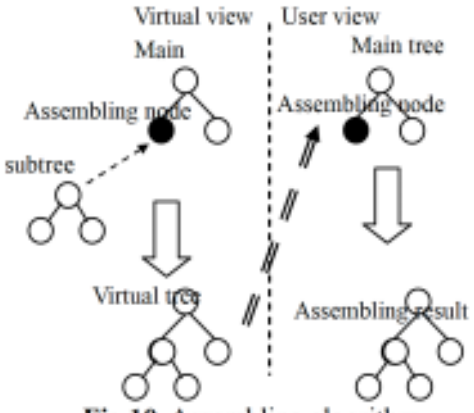

Fig.10. Assembling algorithm

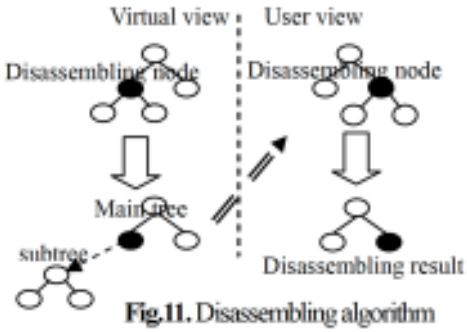

Fig.11. Disassembling algorithm

DA accomplishes single-device event handling. Filter module of DA removes useless events coming from Firewall, IDS and Host Monitor etc. Even in the case of no attacks happen useless events may be generated largely, paper [15] proves this, so filtering is necessary. Single device aggregation module merges repeated events, ports scanning events, host monitoring events and DOS events. The normalization module converts each device event into a uniform XML format satisfying the requirements of IDMEF, and prepares to cross-device aggregation.

SMN accomplishes cross-device event handling. Validation module of SMN rates normalized events that received from DA and filters the lowest events, rating event lies on value loss computed from value and vulnerabilities of information asset who is attack target of the event. Based on the event normalization, cross-device aggregating module aggregates events from multiple types of devices by uses a similarity function that has the form as in paper [16]. Session correlation module correlates events belonged to the same network session into a single session alert, and send the alert to UC.

Session alert means aggregation of all related events during one network connection. These events surely belong to one attack and have strong relation between each other. Session alert is composed of session information and event queue. Session information mainly describes the source and destination address, start and stop time of the session. Events queue means events sorted by time and is useful for administrator to analyze the attacker's intention.

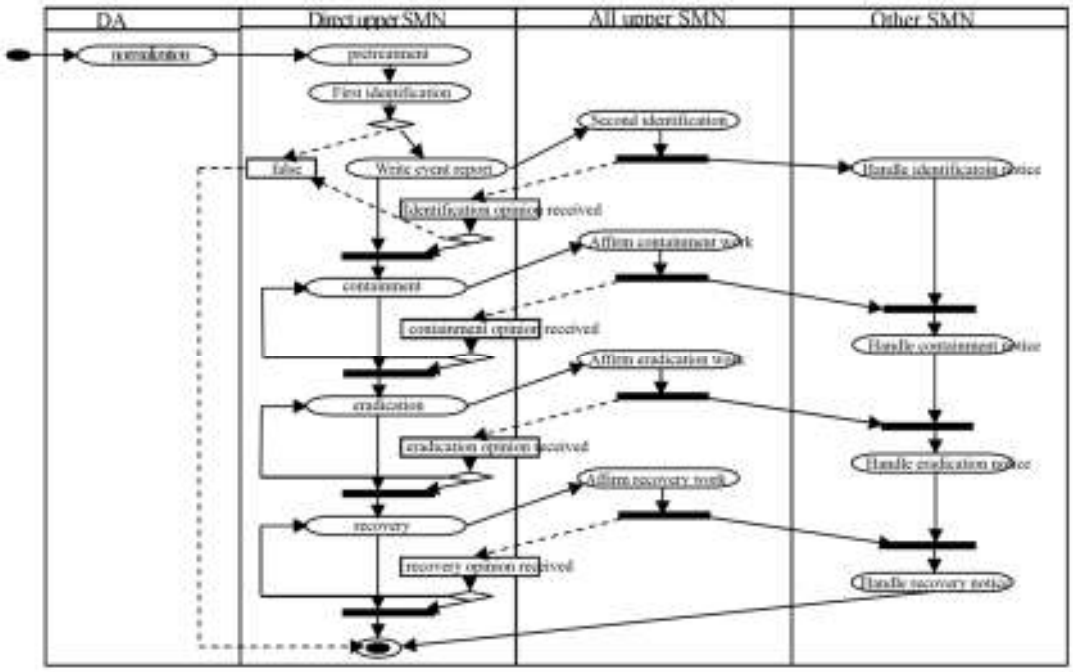

Fig.13. Cooperative emergency response in network-wide

The key to build session alert is to find the events of connection and disconnection. The events can be found from firewall logs since firewall monitors all kinds of connections and surely contains connections of attack. For connection-oriented protocols, we can easily get connection and disconnection events; for non-connection-oriented protocols, we also can get the session alert is generated from the first non-connection event and destroyed when the connection is closed. At the same time, there is a global event queue for recording beginning time of each connection. Two algorithms are shown as follows. The left is session correlation algorithm and the right is the algorithm to decide whether an event belongs to a session alert.

```
Input: event
Output: void
If(received event of building connection)
   save the event into the global event queue of building connection;
If(received event of non-connection){
  search all of session alert objects;
  If(corresponding session alert don't exist){
     search in the global event queue of building connection;
     If(corresponding event of building connection exist){
        build a new session alert object;
        initiate the alert object according to the event;
        build a new event queue;
        destroy the event of building connection;
     }else{
        regards the event as an independent session alert;
        send alert ending information to UC, database or upper SMN;
        clean the session alert and its event queue;
        return;
     }
  }
  append the event to event queue of the corresponding session alert;
  send the session alert to UC or database;
}
If(received event of disconnection){
  If(corresponding session alert exist){
     write time of connection ending into session alert;
     send alert ending information to UC, database or upper SMN;
     set a destroying flag on session alert for destroying the alert after
a while;
  }else{
     search in the global event queue of building connection;
     If(corresponding event of building connection exist)
        destroy the event of building connection;
  }
}
Return;
```

```
Input: event and session alert
Output: the event whether belongs to the session alert
If((source and target address of the event both is the same as the
session alert)or(source address of the event is the same as target
address of the session alert))
  If( event time is after connection building event of the session alert)
  If(event time is before disconnection event of the session alert)
     Return(the event belongs to the alert)
search in event queue of the session alert
If(source address of the event is the same as target address of certain
event of the session alert)
  If(event time is after building connection event of the session alert)
  If(event time is before disconnection event of the session alert)
     Return(the event belong to the alert);
Return(the event doesn't belong to the alert);
```

events in that most firewalls support stateful-inspection technology who can treat non-connection-oriented protocol as having connection [14].

Each session alert has a session alert object in SMN memory, the object has an internal event queue, and the

Session alert supported event correlation mechanism has several advantages. First, it can complete correlation in real-time as a result of that correlation operation is done in memory and searching queue is short; Second, it uses network session as unit to cluster

events instead of usual time window, because of that the events belonged to the same session have more tight relationships with each other than the events belonged to the same time window; Third, it is easy to find out in-progress attack for that the session alert not ended indicates an in-progress attack; Fourth, it is easy to link with firewall by session information.

C. *Emergency Response Mechanism*

At present, handling security emergency mostly depends on manual operation. It imminently needs an automatic or semi-automatic mechanism. We design a semi-automatic emergency handling mechanism for HD-NSMS, and the mechanism synthesizes three factors: flow, counterplan and cooperation.

Flow means that the whole emergency response progress should comply with some normative flow. We design the emergency response flow in accordance with FCC drew Computer Security Incident Response Guide [8], which divides emergency response flow into six steps: Preparation, Identification, Containment, Eradication, Recovery and Follow-up. The steps of Preparation and Follow-up are not included in HD-NSMS by reason that these two steps are minor in handling emergency.

Counterplan is a document that is written beforehand and saved in database, and it is used to guide event handling. Every event is associated with a counterplan. Counterplan consists of four sub-counterplans of identification, containment, eradication and recovery, which in accordance with the main four steps of emergency response flow. When administrator launches emergency response flow, HD-NSMS automatically sorts out corresponding counterplan and displays it to user interface.

Cooperation means that HD-NSMS provides a mechanism for entire network's SMN nodes to treat together important security event. For the local network that security incident occurred in, its SMN is the main participant for event handling. As the higher-level network administrator usually has better experience in security, he/she is regarded as the coordinator in whole handling progress. For wide range attacks or worms, HD-NSMS adopted other SMN into handling progress to implement cooperative defense. We use UML to describe the handling progress in Figure 13.

IV. IMPLEMENTATION

Based on the previously described system structure, device model, alert mechanism and emergency response mechanism, we implemented an HD-NSMS system. Figure 14 depicts the implementation using UML. It ignores tool classes, supporting function classes and thread classes. Its layers basically correspond to the modules in Figure 5 that depicts microstructure of HD-NSMS.

DAKernel Layer and DevInt Layer correspond to the "DA Kernel" and "Device Interface" modules in Figure 5. DAEvent module in DAKernel Layer is responsible for filtering, single-device aggregating and normalizing event.

CommCom Layer corresponds to the "Common Communication" module in Figure 5, and performs communications between SMNs and DAs.

DBInt Layer provides unified DB operations for other modules.

DevTopo Layer corresponds to the "Device Modules" in Figure 5. Five subsystems of IDSDevice, FWDevice, AVDevice, ScannerDevice and HMDevice manage respectively five types device of IDS, firewall, anti-virus, scanner and host-monitoring system. SMN is abstracted as device object and managed by SMNDevice module. DeviceManager is the external interface of DevTopo Layer, and implements maintenance operations on logic topology of devices.

Function layer corresponds to the "Function Modules" in Figure 5. Five subsystems of State, Event, Policy, Vulnerability and Assessment archive respectively five functions of HD-NSMS. HandleLib module handles asynchronously the input packages. SessionManager module manages session queue and

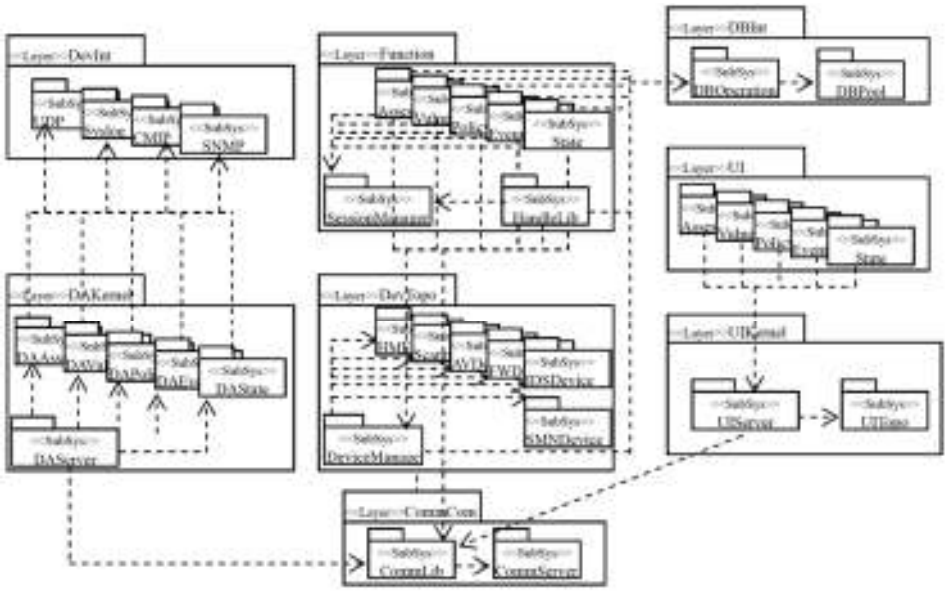

Fig.14. HD-NSMS implementation depicted by UML

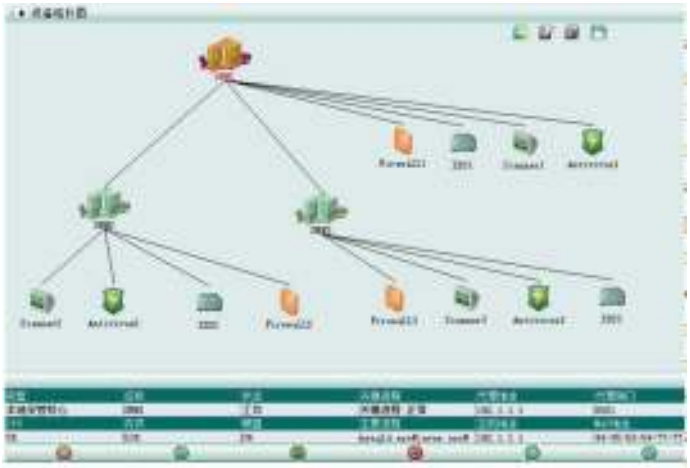

Fig.15. Devices topology in User Console

runs session monitoring thread. Event module is responsible for verifying, cross-device aggregating, correlating and handling events, and implements the emergency response mechanism.

UI Layer and UIKernel Layer correspond to the "UI Modules" and "UC Kernel" module in Figure 5. Figure 15 shows a device topology in User Console of HD-NSMS.

V. RELATED WORK

Compare to the related works [1~6][17~25], this paper innovatively builds a hierarchical distributed NSMS that can manage security in a Hierarchical distributed network. Though, there are several kinds of NSMS architectures, such as Manager/Agent [2], Client/Server [4] and Multi-Agent [5], they mainly focus on single-network security management. Recent NSMS researches on IoT networks [21][24], Cloud[25], software-defined networks[22], optical networks[19] and 5G networks [23] also can't manage policy, event or vulnerability in a cross-network environment.

VI. CONCLUSION

In this paper, we proposed an architecture for HD-NSMS, and discussed three key problems when building HD-NSMS: device model, alert mechanism and emergency response. We compared candidate architectures: macrostructure and microstructure. Macrostructure has two types which both have advantages and disadvantages. One type combines ISMN and ESMN; The other type separates ISMN and ESMN. The microstructure is divided into five layers: user interface, function logic, device logic, common communication and device interface. This layered architecture can support different device types, manufacturers and data structures. It provides a unified security management interface to administrator. Using this five layers architecture, we can build a HD-NSMS that has good performance, dependability and extensibility.

We build a device model for identifying, abstracting and organizing devices. For identifying device, we design a device addressing method that codes device address in a string, which composed of several numbers and separated by dot. For abstracting device, we use UML to describe abstracted device objects, and depict state transition diagram of abstractive device object. For organizing device, we propose a three-level mapping model that contains physical view, virtual view and user view, physical view is a topology graph of physical devices; virtual view is mapped from physical view and exists in main memory; user view is mapped from virtual view and exists in GUI. In order to build the virtual view and user view of whole network in real time, we depict assembling algorithm that add devices of lower level network into the views, and depict disassembling algorithm that clean devices of lower level network from the views.

We propose a new event-correlation method based on session alert. We cluster all alerts that related to the same network connection into a session alert, because these events surely belong to the same attack, and can help administrator to analyze attack intent. The beginning and ending time of the network connection can be identified by the firewall event of building and destroying connection. Compare to paper [9] and [11], event-correlation method of this paper considers internal relations among events that generated from different types of devices, i.e. relation among firewall event and other device's event. Compare to paper [10], the correlating method of this paper can do correlating work in real time.

As people often do cross-network emergency response manually, we build a semi-automatic mechanism for cross-network emergency response. The mechanism considers three factors of emergency handing: flow, counterplan and cooperative operation. It can be used by administrators at different locations to cooperatively handle security emergency.

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Thin Barrier Enhancement-Mode AlGaN/GaN HEMTs with Oxidation Treatment and ALD Al_2O_3 Dielectric Layer for Power Amplifier Application

C. Wang, Y. C. Chen, H. T. Hsu, C. C. Lee, T. J. Huang, and Edward Y. Chang

***Abstract*—**In this paper, a thin barrier enhancement-mode AlGaN/GaN high electron mobility transistor (HEMT) with proper recess was investigated which is suitable for low consumption power amplifier application. The combination of the thin barrier and gate recess demonstrate the advantage of increasing the gate bias, resulting in enhancement of the gate control ability and mitigating the impact such as plasma damage caused by the dry etching, respectively. Two-step oxidation treatment and high-quality atomic layer deposition (ALD) Al_2O_3 were applied to reduce the gate leakage current of the device. The developed metal oxide semiconductor high electron mobility transistor (MOSHEMT) device exhibits a maximum drain-source current (I_{DS},max) density of 610 (mA/mm) at V_g=1V and the maximum transconductance (g_m) of 484 (mS/mm). For the radio frequency (RF) characteristics, the device shows excellent performances, including the cut-off frequency(f_T) and the maximum oscillation frequency(f_{max}) = 70/107GHz, a maximum output power density of 3.22W/mm and an outstanding peak power-added efficiency (PAE) of 34.83 % at 38GHz are obtained.

***Keywords*—**thin barrier, gate recess, AlGaN HEMT, power amplifier, power-added efficiency

I. Introduction

SINCE the Si-based MOSFET had been dominating the semiconductor area in past few years, the properties of material itself brought up the limitation of application in high power and high frequency. With the increasing demands of wireless communication systems, circuitries such as power amplifier, low-noise amplifier and low power logic circuit seemed to be one of the critical parts. III-V GaN had been widely discussed in recent years due to the high bandgap, high electron mobility and high breakdown voltage properties which can be used for microwave and millimeter-wave technologies. AlGaN/GaN high electron mobility transistors (HEMTs) has high sheet carrier concentration and high peak drift electron velocity which can be attributed to the strong polarization effects between the AlGaN barrier and GaN channel layer [1-3]. Moreover, the carrier concentration of the two-dimensional electron gas (2DEG) is related to the polarity, alloy composition, strain, thickness of the barrier layer and the occupancy of the surface state at the surface.

However, the next generation mobile networks have been extensively studied in recent years, low consumption and low loss applications play an important role, since there are thousands of devices in a tiny chip. For E-mode device, only positive bias is needed, which eases the concern of biasing. Also, no drain switch is required for E-mode device to turn off the power amplifier (PA) completely. Furthermore, comparing to the D-mode device, E-mode shows a better transconductance (g_m) linearity while normally achieving a flatter curve. Considering these advantages, E-mode device seems to be a good method to reduce the circuit complexity and the cost.

In addition, many research efforts had been devoted to the development of the E-mode device technologies. By implanting the fluorine atoms into AlGaN barrier layer, the local potential has been modulated which causes the depletion of the 2DEG in the channel [4]. For the p-GaN technique, after inserting the p-type GaN layer under the gate, the p-type doping is able to deplete the channel without bias, thus transfer from the D-mode device to the E-mode [5]. As we mentioned earlier, the thickness of AlGaN barrier is a critical issue for the 2DEG in the channel. Therefore, the density of the 2DEG will decrease by scaling down the structure under the gate region. However, gate recess [6], [7] and reducing the barrier thickness seems [8], [9] to be an efficient method to achieve the E-mode performance. Although an isotropic property of plasma-based dry etching is preferred for the demand of precise control of the etching depth, the damage induced by the plasma at the recessed surface has been a big issue until now [10]-[14]. Since excessive induction to the 2DEG density may affect both DC and RF performance, we adopted the TCAD simulation of different barrier thickness and recess depth to determine which condition was suitable for us to apply for our experiment. Furthermore, two-step O_2 treatment was used to mitigate the incorporation of fluorine atoms in the surface [15] caused by CF_4 plasma dry etching [16]. Besides, in order to reduce the gate leakage current of the device, we deposited high-quality ALD Al_2O_3 after O_2 treatment. A maximum output power density of 3.22W/mm and an outstanding peak power-added efficiency (PAE) of 34.83 % at 38GHz are achieved.

This work was financially supported by the "Center for the Semiconductor Technology Research" from The Featured Areas Research Center Program within the framework of the Higher Education Sprout Project by the Ministry of Education (MOE) in Taiwan. Also supported in part by the Ministry of Science and Technology, Taiwan, under Grant MOST 109-2634-F-009-029 - .

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II. Device Fabrication

Fig. 1 shows the structure of thin barrier enhancement-mode AlGaN/GaN HEMT. In the figure, the epitaxial structure consisted of a 1.2-μm i-GaN layer, a 1-nm AlN spacer layer, and a 10-nm $Al_{0.13}Ga_{0.37}N$ barrier grown on a Sapphire substrate by MOCVD. The on-wafer Hall effect measurement of the epitaxial structure exhibited a sheet carrier density of 9.7×10^{12} cm−2, a sheet resistance of 324Ω/□, and an electron mobility of 1980 cm2/V • s, respectively. The process of the E-mode thin barrier AlGaN/GaN HEMTs could be divided into several parts. First, the wafer was dipped in the hydrochloric acid to remove the native oxide on the surface and the ohmic contact Ti/Al/Ni/Au stack was formed by using E-gun evaporation system. After the ACE and IPA lift-off solution was applied, thermal alloy was performed by using RTA (rapid thermal annealing) at 820°C for 1 minute in N_2 ambient. The nitrogen ion implantation was used to define the active region. Afterwards, a 25-nm SiNx film which was deposited by Plasma-Enhanced Chemical Vapor Deposition (PECVD) with in-situ nitrogen plasma treatment prior to the film deposition performed as the passivation layer and the hard mask of the recess region. The gate region was defined by the diluted GL-2000 e-beam photoresist, and the SiNx film at the gate region was removed by using ICP-RIE fluorine-based dry etching. Furthermore, for the gate recess process, the etch was performed by using ICP-RIE CF_4 gas with the following parameters: 40 sccm flow rate, 0.1 Pa pressure, and 200 W of RF power with 5 W of bottom bias. The voltage of the bottom electrode was approximately 20 V. After the recess depth was reached around 5-nm, the consecutive repetition of two-step oxidation treatment was applied. For the first step, the free Al- and Ga- bonds were oxidized by applying high power oxygen plasma treatment. The second step was using 36% NH_4OH to remove the oxide formed by the plasma on the surface [15, 16]. After a 4-nm Al_2O_3 gate insulator layer was deposited by the atomic layer deposition (ALD) at 250°, the photoresist GL-2000L and ZED-N50 development were used to define the T-shape gate region following by Ni/Au (50/300 nm) metal evaporation and lift-off [10]. Fig. 2 shows a SEM image of the device T-shape gate profile and the image exhibits that the gate length is 150 nm in this study. Then, the 15nm SiNx passivation layer was deposited to prevent the device from the physical damages and environmental contaminants. Finally, a Ti/Au interconnect metal stack was deposited after the removal of the SiN_x film at the contact openings.

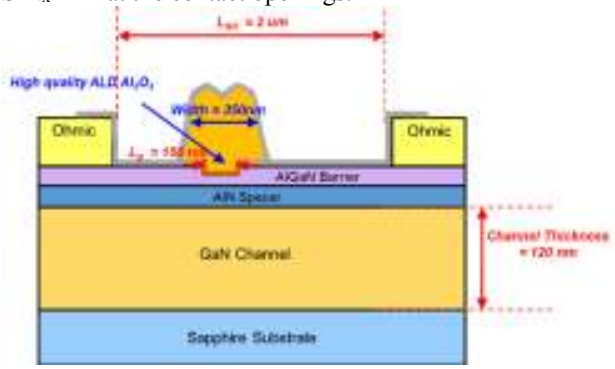

Fig. 1 Epitaxial structure of the AlGaN/GaN HEMT

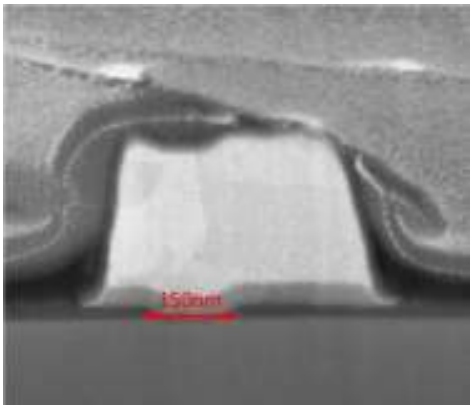

Fig. 2 SEM image of the T-shape gate for the E-mode AlGaN/GaN HEMT

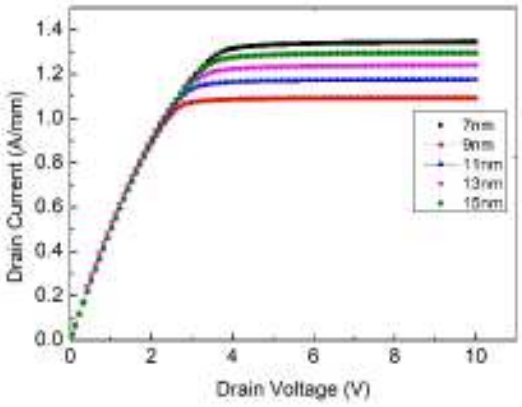

Fig. 3 The simulation of the I_{DS} versus V_{DS} curves with different barrier thickness of the E-mode AlGaN/GaN HEMT

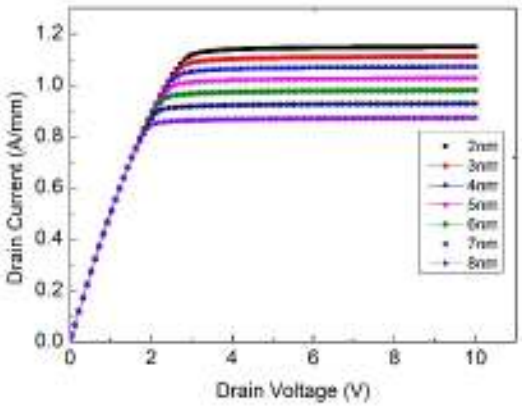

Fig. 4 The simulation of the I_{DS} versus V_{DS} curves with different recessed depth of the E-mode AlGaN/GaN HEMT

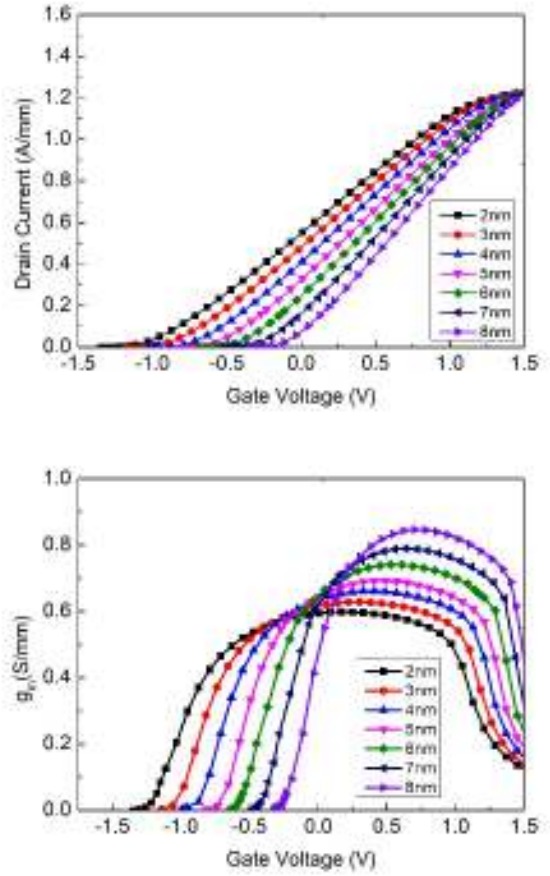

Fig. 5 The simulation of the I_{DS} and Gm versus V_{GS} curves with different recessed depth of the E-mode AlGaN/GaN HEMT

III. Results and Discussions

The simulation consisted of three Workbench projects. First, Sentaurus Structure Editor was used to create the analytic HEMT structure, which could define each epitaxial layer. For the second project, Sentaurus Device performed DC calculation based on the given physical models and material parameters. However, not only polarization strain model and drift-diffusion model but also other important physical factors such as high field saturation, SRH recombination, and trap effect in interface should be considered. Finally, the visualization tool Sentaurus Visual was applied to extract the key parameters which showed the device performance. The high current density of the AlGaN/GaN HEMTs structure could be attributed to the strong polarization effects of the AlGaN/GaN layer and their interface. The polarization effects include the piezoelectric and the spontaneous polarization. Piezoelectric polarization was strain-related, which caused by the lattice mismatch between AlGaN barrier layer and the GaN buffer layer. As the thickness increased, the effect of the Piezoelectric polarization would be more severe. However, when the AlGaN thickness was not enough, the AlGaN donor-like surface state with energy E_D would be lower than the AlGaN Fermi level. In this situation, none of the conductive electrons could transfer from the surface of the AlGaN to the AlGaN/GaN interface, and the 2DEG could not be found. On the other hand, by increasing the barrier thickness, the energy band between the Fermi level and the donor states E_D would decrease. At the critical thickness, the electrons were able to transfer from the occupied states to the conduction band at the interface to form the 2DEG when the state energy level was equal to the Fermi level. As a result, the carrier concentration was getting higher with the increase of the barrier thickness.

Fig. 3 shows that the maximum drain-source current (I_{DS}) density (V_{GS} = 1 V) varies from different barrier thickness. The current did not increase obviously when the barrier thickness is over 11nm. Hence, we chose the barrier thickness of 10nm to simulate the recessed depth corresponding to the DC characteristics. With the continuous increase of the recessed depth, there was no huge difference between each recessed conditions which is shown in Fig. 4. Fig. 5 exhibits the simulation of the I_{DS} and G_m versus V_{GS} curves with different recessed depth of the E-mode AlGaN/GaN HEMT. Although the extrinsic transconductance (gm) would increase when the recessed depth was getting higher, the leakage current was a big issue which may cause the serious effect of the RF characteristics such as the output power density and power efficiency. In order to make the threshold voltage positive, maintain the current density to a certain value and avoid the severe leakage current issue, we decided to use the recessed depth of 5nm to conduct our experiment.

The DC characteristics of the thin barrier AlGaN/GaN HEMTs is shown in Fig .6 which is the measured I_{DS} and G_m versus V_{GS} curves. The maximum drain current can reach 610mA/mm at V_{GS} = 1 V, and the peak extrinsic transconductance (gm) transconductance is 484 mS/mm when the device drain-source voltage (V_{DS}) is 3V. The V_{th} of E-mode device is determined to be 0.13 V with the recess process.

For the RF characteristics, the S-parameters of the fabricated devices were measured from 100MHz to 67 GHz using an Agilent N5245A network analyzer. Additionally, a standard Short-Open-Load-Through (SOLT) calibration method was used to calibrate the system, and the calibrated reference planes were at the tips of the corresponding probes. Fig. 7 shows the extracted cut-off frequency (f_T) of 70GHz and maximum oscillation frequency (f_{max}) of 107GHz when V_{DS} = 5V for devices with measurement results without de-embedding of the pad parasitics effect.

At last, the large signal performances of the device were carried out at 38 GHz using on-wafer active load-pull setup in continuous-wave (CW) mode. Under class AB operation, the impedance was optimized for maximize output power density. Fig. 8 shows the output power, gain and PAE with various input power for the devices. By means of the high quality of ALD Al_2O_3 film as well as the two-step oxidation treatment, an output power density of 3.22W/mm with a linear power gain (Gp) of 6.4 dB and 34.83% PAE which was delivered shows the outstanding large-signal microwave power measurements on Sapphire substrate. The drain bias was set to be 10 V and the gate bias was 0.7 V. These above-mentioned performances are comparable to the E-mode AlGaN/GaN HFET using fluorine plasma ion implantation on SiC with an output power density of 3.65W/mm and 42% PAE at 18GHz [17]. Furthermore, not only is the measurement frequency higher than normally-off AlGaN/GaN recessed MOS-HEMTs on normally-on epitaxial structures on SiC, which shows an output power density of

3.5W/mm and 39% PAE at 30GHz, but also the small-signal performances are better (f_T/f_{max} =18/35GHz) [7]. Overall, on the basis of the results of the recessed thin barrier enhancement-mode AlGaN/GaN HEMT on Sapphire, it shows the potential of low consumption and low cost power amplifier application.

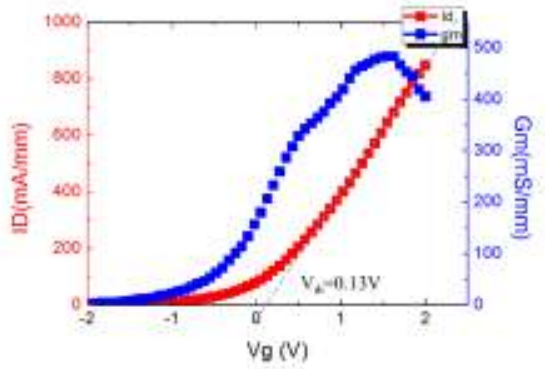

Fig. 6 I_{DS} and G_m versus V_{GS} curves of the thin barrier AlGaN/GaN HEMTs

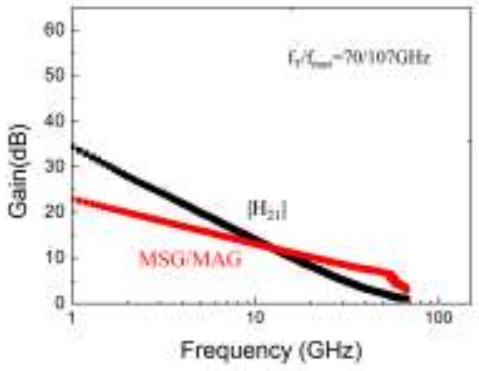

Fig. 7 The extracted cut-off frequency (f_T) and maximum oscillation frequency (f_{max}) for AlGaN/GaN HEMT devices

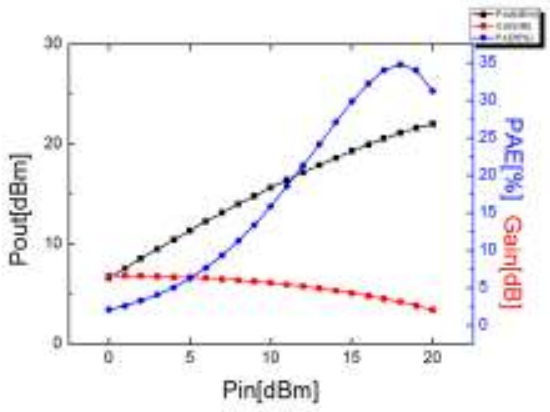

Fig.8 The measured large-signal characteristics using load-pull system for devices. A maximum output power density of 3.22W/mm and the peak power-added efficiency (PAE) of 34.83 % are obtained

IV. Conclusion

In summary, a thin barrier enhancement-mode AlGaN/GaN HEMT has been investigated exhibiting an output power density of 3.22W/mm with a linear power gain (Gp) of 6.4 dB and an outstanding peak power-added efficiency (PAE) of 34.83 % at 38GHz. Although the fabrication of the device went through the dry etching recess process, we found that applying the two-step oxidation treatment and high quality ALD Al_2O_3 could effectively reduce the gate leakage current of the device and eliminate defects issue induced by the plasma on the interface of materials. With the combination of the thin barrier and recessed treatment, it has shown a great potential for the next generation mobile networks application.

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Review of AAOM Methodology: User Stories' Weakness and Solution

Ameera Y. Alkhuzaim, Maryam S. Alghannam, Shoog N. Aldosari, Omer A. Alrwais

***Abstract*—**Agile methodology is a model of System Development Life Cycle (SDLC) that is an essential part of System Analysis & Design and Software Engineering. It used in the development of the software system focuses on the user stories, which are an informal description to specify the features of the software system. However, if the developers want to understand the big picture of the system objectives, the user stories may not be enough. Agile Agent-Oriented Modeling methodology (AAOM) was created to handle the gap of user stories, it is a visualization approach for requirements engineering that depend on the goal models to build the technique that is based on the agent-oriented modelling and connects objectives to user stories by presenting the flow of system requirements for the system stakeholders to understand the goals of the system with avoiding the problems in the development.

AAOM is focusing on visualizing the system requirements to the customer that lead to more understanding about his needs. Also, it supports the developers' team to deal with the requirements, therefore it results in eliminating the gap and achieving a successful system development with low risks. This paper has a purpose of describing AAOM methodology which fill the gap by discussing how to get the benefits when applying the AAOM in the software development.

***Keywords*—**Agile, AAOM, AAOM methodology, User story.

I. Introduction

BUILDING an information system is very important for organizations, it helps in combining several components for collecting, storing, and processing data to help in providing useful information that aid in take a proper decision.

In order to plan for develop an information system a process must be followed which it is System Analysis & Design that is a broad term for systems development consisting of stages such as analysis, design, implementation, and maintenance, but to operate an information system we must build its software toward enable it to work, software is a major part of an information system that includes hardware as well as other resources needed to operate an information system.

Software Engineering is a field of computer science includes systematic activities to build a software and it has a category which it is Requirements Engineering that document the customer requirements in a form ensuring the software/system specification of what to implement and satisfy customer needs as what he specified about his requirements.

System Analysis & Design and Software Engineering are focusing on Software or System Development Life Cycle (SDLC) which it is a model defines the phases of develop a specific software or system and there are several types of SDLC model one of them is Agile methodology, it is the most widely used iterative methodology for developing software.

The use of Agile methodology breaks requirements into smaller subsets with user story for each subset. However, user stories have a gap, and they are not sufficing for understanding the big picture of software requirements, since the customer cannot describe the requirements efficiently in the user stories.

Agile Agent-Oriented Modeling methodology (AAOM) is an agile method provides a visualize technique of the customer's user story by present it as a hierarchal model to him. It tends to the visualization of customer requirements because when modelling them, the developers' team can think and address the goals of the software system by gaining more understanding which reach to success the development and eliminate the failures.

Achieving this success is a result of following the process of presenting the requirements as a model to the customer which encourage him to give more explaining about the requirements and enable the developers team to extract the requirements easily.

In addition, agile focuses on involving the customer within the software system development stages and by using AAOM that presents his requirements will facilitate checking and discovering whether they are as what he wants which prevents raising issues later and then correcting these issues harder with high cost and delay the delivering the software/system to the customer.

The sources of data selection are several research platforms and tools that support us to gather data from significant papers such as Google scholar, IEEE Xplore (IEEE), Academia research, ResearchGate to reach our needs. Moreover, we sent emails for the inventors of the AAOM methodology, we attached some questions that will increase our knowledge in different aspects of the AAOM methodology.

Software Engineering (SE) is a fully and isolated field of engineering in computer science area, it interested in the development and maintenance of software systems [1]. The important phase of SE is a Requirements Engineering which it is the first phase that seeks to achieve a successful software[2].

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Requirements Engineering (RE) is a collection of activities that support developers to understand and document the software/system specification for the stakeholders and engineers' participant in the system development [4].

It has five activities of software requirements: requirements elicitation, requirements analysis, requirements specification, requirements validation, and requirements management [5].

The first activity is requirements elicitation that focus on the problem need to solve it, identify the stakeholders, and the goals must the software system attain, it uses techniques to carry out the requirements elicitation activity for example questionnaires, brainstorming, interview, and prototyping [3][4].

The second activity is requirements analysis that helps in understanding the requirements of an organizations structure, rules, goals and tasks of business, and data that is required. The third activity is requirements specification that descript the whole behavior of the system to be developed, it uses techniques such as scenarios, use case modeling, and natural language. The main goal of the requirements engineering is making sure if the requirements elicited can provide an accurate representation of stakeholder requirements and this is what the fourth activity do which it is the requirements validation. Finally, requirements management controls the changes in requirements through using requirements elicitation, it contains techniques for control the version and manage the configuration [1][3][4].

RE activities help to define agile form for plan, execute and reasoning, that leads to agile requirements engineering. In addition, the agile requirements engineering has a support to process some specific issues of requirements engineering but it still has caused others. Furthermore, the practices of agile requirements engineering consist narrowing down focus on requirements specification activities in a human way for example user stories [5].

Agile software development refers to a group of software development methodologies based on continues iteration of development and testing as incremental delivery throughout the software development lifecycle of the project, its most popular Agile methodologies, Scrum, Extreme Programming and Kanban [6], its practices based on the values and principles expressed in the Agile Manifesto software development, those values and principles provide guidance on how to create and respond to change and how to deal with uncertainty. [7]

One of the major issues faced by organizations is that most often customer requirements are not clear at the beginning or misunderstood by the developers' team. [8]

Agile puts its customers' satisfaction in the highest priority with the necessary of seeking to deliver the software on top of high quality in fast way that short the software development life cycle.

A survey conducted in 2018 reports that 97% of the participates organizations using agile methodologies [9], organizations move to choose agile methodology since it solves the problems that arise of not satisfying customers' requirements, it has an efficiency of developing big software, and it has an iterative development that gives more explanation of previous iterations. [9][10]

Agile plays a useful methodology in these days, 43% of organizations depend on agile methodology in the development of their software during COVID-19 pandemic because this pandemic has big uncertainty, no one know when it will finish, and uncertainty with potential for positive or negative consequences of high impact on software objectives.[11] Although, many organizations currently work remotely from their home and the agile based on face-to-face communications between its team and the customers, but many applications facilitate these communications such as Microsoft teams and Zoom.

Marinho et. al said the key elements of any software development project are the identification of potential uncertainty sources and the ability to respond to changes during the software lifecycle. [12]

Agile works well in these situations of uncertainty, it gives a flexible response while changes occur even late, its team is trained to be adapt to any scenario. In addition, it brings benefit in fast development and give working software to the customer's hands quickly.

User stories are the easiest and useful techniques used in agile software methodologies for RE. [13] A user story is a few words or sentences to describes requirements from the perspective of a system user. It has to be small enough to be applied which captures the major items of a requirement and enable to answer to questions who act as role, what is requirement and why it is important [14]. Larger user stories should be split into smaller one [13]. This restricts implementation work per user story and provides rapid insight and validation of system development's requirements. [15]

The popular format is: "As a "role", I want "goal", so that "reason".

For example: "As a User, I want to edit a report, so that I can update any changes. [14]

This paper includes eight sections, a gap will be investigated in the second section, third one is explaining the proposed methodology, after that present the tools that facilitate using the proposed methodology. In section five display a project that applied the AAOM. Finally, the next sections discuss the benefits, the results, and present the conclusion.

II. GAP DETECTION

In agile methodologies user stories are not enough for explaining the complex system requirements and they are not used in visual ways to be understand by system stakeholders.

Goal modeling techniques are designed specifically to visual representation the system requirements as goals. It has been recognized to focused on eliciting requirements based on the use of goals that need to be accomplished by the system objectives.

The concept of goal models is to present a hierarchical view of tasks that are going to solve complex requirements in order to simplify the requirements structure by visual composition.

By the integration of the both of agile development requirements and goal models it will result of a method that called Agile Agent-Oriented Modeling (AAOM) [17].

A lot of systems have been difficult to develop, and a lot of costly errors arise during their development. AAOM methodology help in the software developing by aligning and visualizing its objectives to give better software development. [16]

III. AAOM METHOD

AAOM methodology creates system goals through gathering and capturing requirements in an agile software development environment [17]. It is a visual approach that using goal model techniques identify the goals, roles, and user stories in hierarchal approach based on agent-oriented modeling (AOM) [15], in order to facilitate having a big picture of all system requirements for the stakeholders [16].

The definition of agent is any person or thing that plays a specific role or make any effect. It has been existed as a concept for thousands of years. For example, a travel agent can make holiday bookings, and a real estate agent can help you purchase, sell, or rent houses. In order to deal with the complexities in certain environments, we need to model the systems, display which features are important to the software and how they will be applied, and which features could be ignored. The model is a hypothetical representation of the entities or processes and it can help to develop a system. [18]

AOM is a method for modeling the systems that consists of people and technical components in environment (also known as sociotechnical systems). It is understandable to system stakeholders, even with non-technical stakeholders [13] [16] Goal model is a technique of AOM used in the AAOM methodology that showing functional requirements, non-functional requirements, and defining roles and their relationships between the requirements.

The reason of use visualize technique of AAOM is to ensure all stakeholders understand the system requirements by connecting the identified goals to the user stories and assign them to their roles [17]. Other methodologies in agile do not support visual techniques, they have difficulties for the system's stakeholders to understand and explain the system requirements and the project objectives. Therefore, the methodology of AAOM solves these problems.

It has an efficient way to extract the requirements from the customers with more details in a hierarchal approach with visual presentation which is reduce the amount of work needed for RE.

The steps of creating the goal-modeling that used in AAOM methodology described as follows:

Define the hierarchy of goal-modeling by presenting the main goal as a root in order to present the main objective of the system.

Elaborate the main goal into sub-goals, each sub-goal shows the functional requirement of the system acting one aspect to achieve the main goal.

Assign the main goal and its sub-goals to quality goals and roles for each one which the quality goals represent non-functional requirements of the system and the quality aspects of the functional goal, while the role represents the user function in the system.

Handle each sub-goal as the main goal and apply the previous steps.

Repeat expanding the goal model until reaching the lowest level of goals(leaves).

Assign the user stories to the last level of goal model with each role who will perform them.

Update the goal model whenever any change occurs in system requirements.

The AAOM methodology uses the following format for user story which it assigns to lowest level goals. [13] [15]

As a <role/type of user>, I want <goal>so that<reason>.

Example: As a user, I want to edit a profile so that update any changes. [13]

The Fig. 1 below presents the key elements of goal model that used in AAOM methodology.

Symbol	Meaning
	Goal
	Quality goal
	Role
	Relationship between goals
	Relationship between goals and quality goal

Fig. 1 Key elements of goal model [16]

Goal model shown in Fig. 2 as an overall view of the system and explain what needs to be done since it bases on the visual user stories that show the details of the system design and the implementable aspects of the project.

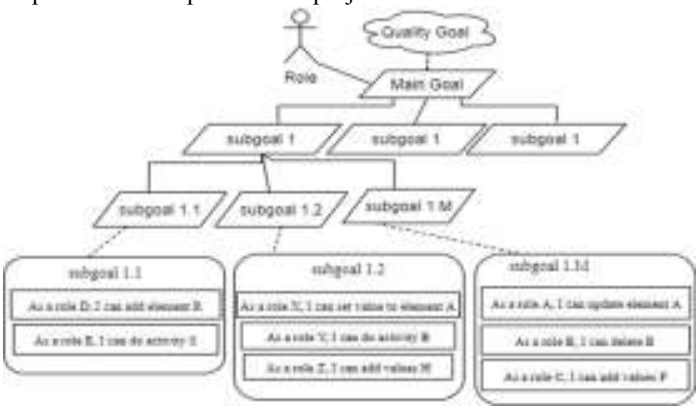

Fig. 2 Goal model with user stories attached adapted from [16]

AAOM has several phases in Fig. 3, in the initial discovery phase, it creates set of preliminary goal models for each preliminary backlog. second, in elaboration phase, the goal

model elaborated more and assign user stories for lower level of goals (leave).

After that, the goal models developed by changing, eliminating, updating in iterations. Once the main development phase of the project ends, the system maintenance phase selects the goal models that will become as the foundation for adding, modifying, or removing requirements. [15]

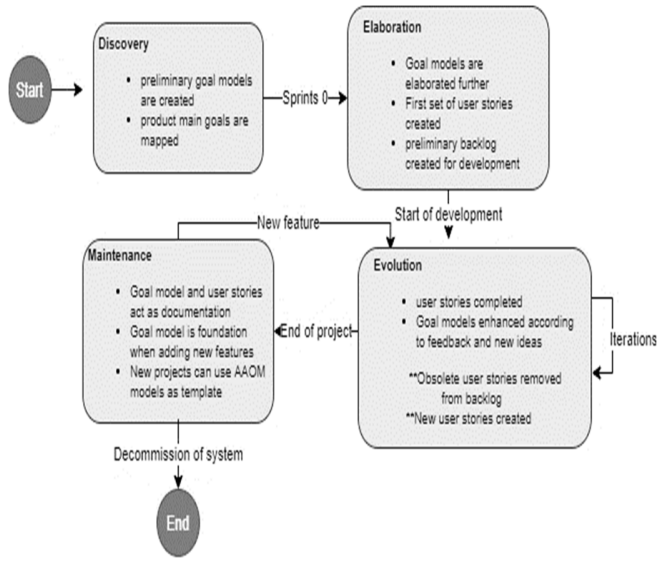

Fig. 3 Activities of AAOM in agile software engineering lifecycle[16]

IV. TOOLS

AAOM needs a visualization tool to visual its goal model, it is the most important part in AAOM. Through drawing the goal model, we will support all phases of the software development in processing and understanding the structures. Furthermore, goal model will act as assistant to explain the system features further on. The most famous and suitable tools to support users in developing the AAOM are Draw.io, Trello, and BitBucke. They are free tools in online [15] [16].

The first tool is Draw.io, it is a diagramming tool to create charts and diagrams for goal model. The second tool is Trello that classified as a cooperation tool to manage project tasks into board. It supports to visualize the project tasks and progress during software development. It has several categories such as Backlog, TODO, Doing, Done, and DoneDone to organize the project tasks. The last tool is Bit Bucke, it provides a collaborative environment for the developers' team in order to facilitate using Git operations for writing the code of the system and reviewing during the software development flow.

V. PROJECT DEVELOPED USING AAOM

Lost & Found mobile application is a project developed using AAOM its idea is to return the lost items to their owners without the need to returning to police stations, airports, cinemas, etc. The mechanism of the application is simple; it uses the phone's camera by taking an instant picture of the lost item with the ability to attach the location. The application is also useful for people who have lost something, they can announce in the application with a description of the missing item and receive notifications if the item is found by someone. [15] The project development is following AAOM method, the development iterations took place in the progress, they were visualized on a task board and meetings conducted with the customers at the end of each iteration. [17] The project it created goal model and attached to it user stories. Fig. 4 is representing that.

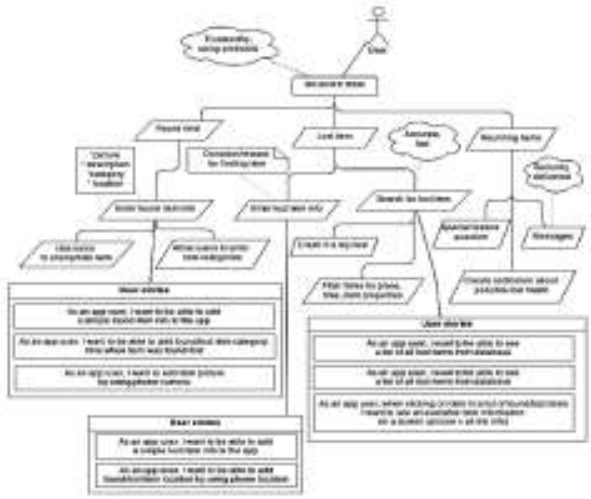

Fig. 4 Goal model of Lost & Found application [17]

VI. THE BENEFITS OF USING AAOM METHODOLOGY

The AAOM methodology provides many benefits such as a secure way of implementing the rights requirements, efficient commination with customers that support making decisions, and better method to requirements elicitation and discover new goals. Also, AAOM helps in understandings all aspects of the project including its objectives, and it provides an ideal way by offering a clear visual representation of the user stories, roles, and requirements.

In other hand, AAOM methodology uses free tools, in this way we reduce costs, however, the commercial tools are better, but they are not suitable for small and medium projects.

Furthermore, AAOM methodology increases the speed of the development cycles by taking the advantage of combing its features with the agile methodologies. It facilitates understanding the system goals through moving from the system idea to last phase, while the agile focus on developing a working software in fast way with high quality. [15]

VII. DISCUSSION

Developers may see that the user stories are overrated in software development and they are not as essential part to their work [16], they may be right of thinking the user stories have no importance in case they are exist in the software development or not, but they are very important for the analyst

to understand the customer's requirements easily and correctly, especially in the lack of technical expertise among the customers.

After obtaining the user stores and understanding them, the analysts are going to convert them to a document to be used by the developers since he has the responsibility of analyzing the requirements for the developers.

Actually, there is a lack of following AAOM methodology during the development process of applications and few papers discuss this methodology.

VIII. Conclusion

Agile methodology used to develop information system in efficient ways which the most companies are using it to as a result of its usefulness in developing the software systems such as the development speed, meet customer expectations, and big insight for the developers about the system requirements. These benefits have been facilitated by the support that come of using user stories as a base for the agile methodology. Despite the benefits of using user stories for the development process, it is inadequate to explain the requirements for the complex software system and it might to lead to a misunderstanding because may a use story be understandable as a one user story for one function while it has multiple functions in one user story.

AAOM methodology is solving this gap by provide system requirements in visual approach by using goal models with user stories to seek more explaining of system requirements by following the split process of system requirements until reach the leaf level which represented for documenting system requirements.

Therefore, future studies are going to enhance the AAOM methodology by use efficient tools that created especially for it and support it from all aspects. Moreover, future studies about the extension of AAOM methodology that is in developing currently by other authors.

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Neural Nets Based Approach for 2-Cells Power Converter Control

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***Abstract*—**Neural networks-based approach for 2-cells serial converter has been developed and implemented. The approach is based on a behavioural description of the different operating modes of the converter. Each operating mode represents a well-defined configuration, and for which is matched an operating zone satisfying given invariance conditions, depending on the capacitors' voltages and the load current of the converter. For each mode, a control vector whose components are the control signals to be applied to the converter switches has been associated. Therefore, the problem is reduced to a classification task of the different operating modes of the converter. The artificial neural nets-based approach, which constitutes a powerful tool for this kind of task, has been adopted and implemented. The application to a 2-cells chopper has allowed ensuring efficient and robust control of the load current and a high capacitors voltages balancing.

***Keywords*—**neural nets, control, multicellular converters, 2-cells chopper.

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A Methodological Approach to Digital Engineering Adoption and Implementation for Organizations

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***Abstract*—** As systems continue to become more complex and the interdependencies of processes and sub-systems continue to grow and transform, the need for a comprehensive method of tracking and linking the lifecycle of the systems in a digital form becomes ever more critical. Digital Engineering (DE) provides an approach to managing an authoritative data source that links, tracks, and updates system data as it evolves and grows throughout the system development lifecycle. DE enables the developing, tracking, and sharing system data, models, and other related artifacts in a digital environment accessible to all necessary stakeholders. The DE environment provides an integrated electronic repository that enables traceability between design, engineering, and sustainment artifacts. The DE activities' primary objective is to develop a set of integrated, coherent, and consistent system models for the program. It is envisioned to provide a collaborative information-sharing environment for various stakeholders, including operational users, acquisition personnel, engineering personnel, and logistics and sustainment personnel. Examining the processes that DE can support in the systems engineering life cycle (SELC) is a primary step in the DE adoption and implementation journey.

Through an analysis of the U.S Department of Defense's (DoD) Office of the Secretary of Defense (OSD's) Digital Engineering Strategy and their implementation, examples of DE implementation by the industry and technical organizations, this paper will provide descriptions of the current DE processes and best practices of implementing DE across an enterprise. This will help identify the capabilities, environment, and infrastructure needed to develop a potential roadmap for implementing DE practices consistent with its business strategy. A capability maturity matrix will be provided to assess the organization's DE maturity emphasizing how all the SELC elements interlink to form a cohesive ecosystem. If implemented, DE can increase efficiency and improve the systems engineering processes' quality and outcomes.

***Keywords*—** digital engineering, digital environment, digital maturity model, single source of truth (SSoT), systems engineering lifecycle (SELC)

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The AI Arena: A Framework for Distributed Multi-Agent Reinforcement Learning

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***Abstract*—** Advances in reinforcement learning (RL) have resulted in recent breakthroughs in the application of artificial intelligence (AI) across many different domains. An emerging landscape of development environments is making powerful RL techniques more accessible for a growing community of researchers. However, most existing frameworks do not directly address the problem of learning in complex operating environments, such as dense urban settings or defense-related scenarios, that incorporate distributed, heterogeneous teams of agents. To help enable AI research for this important class of applications, we introduce the AI Arena: a scalable framework with flexible abstractions for distributed multi-agent reinforcement learning. The AI Arena extends the OpenAI Gym interface to allow greater flexibility in learning control policies across multiple agents with heterogeneous learning strategies and localized views of the environment. To illustrate the utility of our framework, we present experimental results that demonstrate performance gains due to a distributed multi-agent learning approach over commonly-used RL techniques in several different learning environments.

***Keywords*—** reinforcement learning, multi-agent, deep learning, artificial intelligence.

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Alexa, Open an Event Space. About Interactive Radio Drama on Smart-Speakers

Eliza Matusiak

***Abstract*—**Radio art is changin in the face of new media. The creators want to focus new receivers' attention, make use of technological transformations. Hence they decided to resign from the linear narration of the story. There are arising new radio plays which do not require linear reception and audio games which resign from the artwork. There are new (in radio field) technological tools, like intelligent virtual asistants (eg. Alexa by Amazon), which make possible for user to bestir in the space of interactive radio drama. The observation of phonic art's transformations in new, interactive media's times, allows to draw the hypothesis, that here is forming a new phenomenon, which could be called hyperaudibility. Radio is becoming nonlinear space, hypertextual event space. Works of audio art, still based on genre's indications, are gaining ergodic features. Radio drama is not only to be interpretated by listeners. It is becoming an expanse, event space. By using nonlinear storytelling and interactive tools, user is able to moving around in radio drama like in hypertextual novels. The aim is to analyse new forms of radio art and to find the answer – what the phenomena of hiperaudibility can be? What is the event space of interactive radio drama? As my analitycal materials, I will use The Inspection Chamber, Westworld Maze, Mr Robot. Daily Five/Nine. Creators bring into existence new syncretic pieces of art, which are ditching of genre's definitions. It is mandatory to indicate features of hybrid radio arts. Nonlinear audio arts are creating a research questions about attributes of modern radio plays. To undertake attempt to answering these research questions, I will be using analitycal methods, typical to studying media. Analysis of sound's dramaturgy and used audio materials in the face of interactive construction of new type's radio drama allows to develop the features of non-linear audio storytelling and ways of interactive sollutions.

***Keywords*—**interaction, non-linearity, radio drama, smart-speaker.

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Analysing the Stability of Electrical Grid for Increased Renewable Energy Penetration by Focussing on LI-Ion Battery Storage Technology

Hemendra Singh Rathod

***Abstract*—** Frequency is, among other factors, one of the governing parameters for maintaining electrical grid stability. The quality of an electrical transmission and supply system is mainly described by the stability of the grid frequency. Over the past few decades, energy generation by intermittent sustainable sources like wind and solar has seen a significant increase globally. Consequently, controlling the associated deviations in grid frequency within safe limits has been gaining momentum so that the balance between demand and supply can be maintained. Lithium-ion battery energy storage system (Li-Ion BESS) has been a promising technology to tackle the challenges associated with grid instability. BESS is, therefore, an effective response to the ongoing debate whether it is feasible to have an electrical grid constantly functioning on a hundred percent renewable power in the near future. In recent years, large-scale manufacturing and capital investment into battery production processes have made the Li-ion battery systems cost-effective and increasingly efficient. The Li-ion systems require very low maintenance and are also independent of geographical constraints while being easily scalable. The paper highlights the use of stationary and moving BESS for balancing electrical energy, thereby maintaining grid frequency at a rapid rate. Moving BESS technology, as implemented in the selected railway network in Germany, is here considered as an exemplary concept for demonstrating the same functionality in the electrical grid system. Further, using certain applications of Li-ion batteries, such as self-consumption of wind and solar parks or their ancillary services, wind and solar energy storage during low demand, black start, island operation, residential home storage, etc. offers a solution to effectively integrate the renewables and support Europe's future smart grid. EMT software tool DIgSILENT PowerFactory has been utilised to model an electrical transmission system with 100% renewable energy penetration. The stability of such a transmission system has been evaluated together with BESS within a defined frequency band. The transmission system operators (TSO) have the superordinate responsibility for system stability and must also coordinate with the other European transmission system operators. Frequency control is implemented by TSO by maintaining a balance between electricity generation and consumption. Li-ion battery systems are here seen as flexible, controllable loads and flexible, controllable generation for balancing energy pools. Thus using Li-ion battery storage solution, frequency-dependent load shedding, i.e., automatic gradual disconnection of loads from the grid, and frequency-dependent electricity generation, i.e., automatic gradual connection of BESS to the grid, is used as a perfect security measure to maintain grid stability in any case scenario. The paper emphasizes the use of stationary and moving Li-ion battery storage for meeting the demands of maintaining grid frequency and stability for near future operations.

***Keywords*—** frequency control, grid stability, li-ion battery storage, smart grid.

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Value Chain Analysis of the Seabass Industry in Doumen

Tiantian Ma

***Abstract*—**The district of Doumen, Zhuhai has a sophisticated seabass value chain. However, unlike typical Global Value Chain (GVC) industries, the seabass value chain in Doumen is highly domestic both in terms of production and consumption. Still, since the highly-industrialized and capital-intensive industry involves many off-farm segments in both upstream and downstream, this paper will be utilizing the method of value chain analysis. To be specific, the paper will concentrate on two research goals: 1) the value chain mapping of the seabass industry such as identifying actors in the hatchery, fish feed, fishponds, processing, logistics, and distribution. 2) the SWOT analysis of the seabass industry in Doumen, including incompetence of the waste disposal, the strategy of marketing, and the supportive role of the government, etc. In general, the seabass industry in Doumen is a sophisticated but not yet comprehensive value chain. It has achieved a lot in industrializing aqua-food products and fostering development, but there are still improvements that could be carried out, such as upholding environmental sustainability and promoting the brand better.

***Keywords*—**Agricultural Value Chain, Fish Farming, Regional Development, SWOT Analysis, Value Chain Mapping.

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Oxidation of Ammonia in Concentrated Aqueous Solutions over Graphite-Supported Two Different of Morphology α and β -Manganese Dioxide Electrodes (MnO_2/G)

Marzieh Joda, Narges Fallah, Neda Afsham

***Abstract*—** Graphite-supported two different of morphology α and β -MnO2 electrodes (MnO_2/G) were prepared by electrochemical deposition at appropriate potentials with regard to Mn(II)/MnO2 redox couple under alkaline and acidic conditions, respectively, for studying the direct electro-oxidation of concentrated ammonia in aqueous solutions. Results of surface characterization, including scanning electron microscopy (SEM), X-ray diffractometer (XRD), and X-ray photoelectron spectroscopy (XPS), indicated the presence of α polymorphs which is stable phase of MnO_2/G. Cyclic voltammetry (CV) of the electrolyte containing NH_3 indicated mediation of electron transfer by MnO_2. At the onset potential of ca. +1.0 to +1.1 V (vs. Ag/AgCl), a pathway of NH_3 oxidation to nitrogen byproducts, namely, N_2, NO_2^-, and NO_3^- was proposed. The removal efficiency and selective conversion of ammonia (0.1 M Na_2SO_4, pH 11, 25°C) on MnO_2/G was determined based on controlled potential experiments.

***Keywords*—** manganese dioxide, morphology, ammonia oxidation, nitrogen selectivity.

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In-Situ Brownfield Remediation Using Micro-Emulsions of Plant Oils in Water to Extract Mineral Hydrocarbons

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***Abstract*—**Spills and industrial activities have led to the formation of contaminated soil, where mineral hydrocarbons from a few mg/kg to the g/kg range are present, in huge numbers of inflicted sites. The persistent fraction of the mineral hydrocarbons has a low degradation rate, which leads to the accumulation of polycyclic aromatic hydrocarbons (PHA) and cycloalkanes. State-of-the-art is to excavate the contaminated soil and to thermally treat it. This process is costly and has a high environmental impact, due to the energy consumption. In this work, a novel process is proposed to capture the mineral hydrocarbons from the ground in an in-situ remediation process: Micro-emulsions of 5-10% canola oil in water are infiltrated in the ground and allowed to travel through the soil until they reach the groundwater level. From there, one can pump the material to the ground, and the mixture can be separated into water and oil. It was found that the plant oil is able to absorb more than 80% of the mineral hydrocarbons in the ground, and that less than 20% of the plant oil bearing micro-emulsion stays in the ground. The process is applicable to soil with a minimum permeability or infiltration rate of approx. 10cm/h, because the micro-emulsions are stable for up to 50h. The mineral and plant oil mixture can be separated from the aqueous phase using $MgSO_4$ and an oil separator. In this project, we made good experience with oil-binding non-wovens. As they can be pressed out for regeneration of up to 20 times, the water can be purified from plant oil and mineral oil to a residual content below 1 mg/l in a cost-effective way. The mixture of plant oil/mineral oil can be disposed of, and the water can be reused to make a novel micro-emulsion. The process is also feasible for the saturated zone with hydrocarbon contamination, by pressing the micro-emulsion into the ground at a level below the ground water horizon and letting the canola oil droplets rise and coalesce. After laboratory experiments, field trials were carried out in an abandoned industrial site in Lower Austria, where from 1899-1938, a petroleum refinery was operated and left behind 50,000m² of highly contaminated area.

***Keywords*—**in-situ, brownfield, mineral hydrocarbons, polycyclic aromatic hydrocarbons, PAH, plant oil, canola oil, micro-emulsions.

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Mining Waste Recovery Study Boukhedra-Mine

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***Abstract*—** The mining discharges can harm the environment and in particular human health, which requires urgent solutions. To solve this environmental problem, an integrated management by the valorization of the mining wastes is necessary to reduce the volume of the stocks on the one hand and on the other hand to minimize their environmental impacts.

The studies carried out in the Boukhadra iron mining wastes made it possible to deduce that the Boukhadra waste rocks are constituted of limestone, hematite, gray and yellow marl, with an average content of 20% in Fe2O3. Mineralogical and chemical-granular analyses have made it possible to conclude that the iron-rich class (27.67% Fe2O3) is situated between -0.5 + 0.25 mm.

On the basis of the physical properties of these mining wastes, magnetic susceptibility was taken into account for the enrichment of weak magnetic iron minerals by dry high intensity magnetic separation (DHIMS). Therefore, the valorization and the integrate management of the mining wastes are a major concern for the sustainable development of Algerian mining industry.

***Keywords*—**Iron mine,vMagnetic separation, Management, Miningv wastes, Optical sorting, Sustainable development, Valorization.

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Non-Candida Albicans Candida: Virulence Factors and Species Identification in India

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***Abstract*—** Background and Purpose: The predominant cause of candidiasis was Candida albicans which has shifted towards non-Candida albicans Candida (NCAC) (Candida species other than the C. albicans). NCAC, earlier considered non-pathogenic or minimally virulent, are now considered a primary cause of morbidity and mortality in immunocompromised. With the NCAC spp. gaining weightage in the clinical cases, this study was conducted to determine the prevalence of NCAC spp. in different clinical specimens and to assess a few of their virulence factors. Material and Methods: Routine samples for bacterial culture and sensitivity, showing colony characteristics like Candida on Blood Agar and microscopic features resembling Candida spp. were processed further. Candida isolates were tested for chlamydospore formation, biochemical tests including sugar fermentation and sugar assimilation tests, and growth at 42oC, colony colour on HiCrome™ Candida Differential Agar, HiCandida Identification Kit and VITEK-2 Compact. Virulence factors like adherence to buccal epithelial cells (ABEC), biofilm formation, hemolytic activity, and production of coagulase enzyme were also tested. Results: Mean age of the patients was 38.46 with a male-female ratio of 1.36:1. 137 Candida isolates were recovered. 45.3% isolates were isolated from urine, 19.7% from vaginal swabs and 13.9% from oropharyngeal swabs. 55 (40.1%) isolates of C. albicans and 82 (59.9%) of NCAC spp. were identified, with C. tropicalis (23.4%) in NCAC. C. albicans (3; 50%) was the commonest species in cases of candidemia. Haemolysin production (85.5%) and ABEC (78.2%) were the major virulence factors in C. albicans. C. tropicalis (59.4%) and C. dubliniensis (50%) showed maximum ABEC. Biofilm forming capacity was higher in C. tropicalis (78.1%) than C. albicans (67%). Conclusion: This study suggests varied prevalence and virulence based on geographical locations, even within a subcontinent. It clearly demarcates the emergence of NCAC and their predominance in different body fluids. Identification of Candida to species level should become a routine in all the laboratories.

***Keywords*—** ABEC, NCAC, non-Candida albicans Candida, Vitek-2TM compact.

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Stubble Burning and its Impact on Ambient Air Quality in Delhi NCR

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***Abstract*—** Stubble burning is now considered to be one of the major activities affecting the air quality because it is one of the major sources of aerosol as well as gaseous pollution. There are two main reasons for biomass burning, first one is that there is a very short window of time between the harvesting and the wheat sowing of the wheat. The second, removing the paddy residue that has remained on the field, is a time-consuming job. The time period from harvesting to sowing being very low and the labor is either very expensive or unavailable; this leads to the only easiest option that the farmer has, i.e., burning the residue right on the field after harvest so that the farmers can quickly prepare the land for the next sowing. This method is very cheap and takes less time that's why farmers use this method. For this specific reason with the onset of winter, stubble fires become rampant in north India. Stubble-burning emissions contain toxic chemicals which cause respiratory problems as well as diseases. The paper aims to examine the environmental impacts associated with stubble burning over the NCT of Delhi. The paper performs both qualitative and quantitative analyses on the statistical data pertaining to crop burning. The monthly variation for particulate matter (PM10 and PM2.5) and trace gases (NOx, CO, and SO2) during the stubble burning period (September-November) has also been studied and analyzed for 5 years (2015-19). During each stubble burning season, there was a noticeable increase in pollutant levels.

***Keywords*—** stubble, pollutants, emission, air pollution, NCT of Delhi.

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International Conference on Forensic Sciences and Investigation May 24-25, 2021 in Montreal, Canada

Davood Keshavarzi

***Abstract*—** insect successional wave is a primary method to estimate the time elapsed since death. Several studies have shown that antemortem consumption of opioids affects maggot growth rates. However, there are no published data that investigate the effect of antemortem opioids uses on successional patterns. Therefore, the purpose of this research was to investigate the effect of methadone on the successional patterns of insects on rabbit carcasses. During this successional study, 15 and 12 insect taxa were recorded on carcasses for 15 d sampling intervals during spring and winter 2018, respectively. Chrysomya albiceps and Calliphora vicina were the most frequent fly species. These two species preferred to lay eggs on the control carcasses earlier than the treated carcasses. Lucilia cuprina was observed exclusively on the remains of untreated carcasses, while Saprinus chalcites was recorded only from the remains of treated rabbits. Permutation analyses based on the Mantel test for the similarity values of taxa between treated and untreated carcasses in the spring and winter were 0.64 (P = 0.009) and 0.69 (P = 0.003), respectively. Permutation analyses for the two most dominant fly species between the treated and untreated carcasses in the spring and winter were 0.51 (P = 0.05) and 0.49 (P = 0.09), respectively. The results revealed that the overall pattern of insect succession was similar between the treated and untreated rabbit carcasses. However, the patterns of succession of Chrysomya albiceps and Calliphora vicina were slightly different between both treated and untreated carcasses and this could have an influence on the PMI estimation.

***Keywords*—** forensic, insect, methadone, pmi

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Next Generation of European Nanomaterial Regulation – The Way Forward

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***Abstract*—**Materials obtain unique properties when at the nanoscale and multiple application possibilities. This has caused a rapid development in the field of nanotechnology and an increase in the production and societal use of nanomaterials since the 2000s. Due to the inevitable release of nanomaterials from the increasing production and uses, concerns have been raised about the potential risks that nanomaterials might pose to human health and the environment and whether existing regulations is adequate. Numerous health and environmental regulations exist in Europe, with the aim to secure safe use and production of chemicals and consumer products. Implementation of nano-specific provisions in these regulations has increased substantially in the recent years. There is, however, a need to evaluate the sufficiency and suitability of these regulations to properly incorporate nanomaterials. The aim of this study is to analyze and compare key features of European regulations relevant to nanomaterials, identify strengths and weaknesses, and provide recommendations for future efforts to overcome identified regulatory challenges related to nanomaterials. Eurlex was used to identify relevant legislation and each Directive, Regulation, etc. identified as relevant was subjected to an in-depth analysis with regard to definitions used, information, risk management procedures and monitoring requirements as well as stakeholder views. It was found, that many regulations have been revised to explicitly cover nanomaterials. Despite these efforts, limitations evidently still exist. Cross-cutting limitations include the lack of a common nanomaterial definition among the regulations and unclear terminology used. Specific challenges exist for the individual regulations and include challenges related to the grouping of nanomaterials in the European Chemical legislation, identification of treated articles and conduction of ecotoxicological testing in the Biocidal Product Regulation and challenges of pre-market safety assessment of cosmetics in the Regulation on Cosmetic Products.

***Keywords*—** Common definition, European legislations, Grouping, Nanomaterials, Test methods

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