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Potential Influences of Graphic Design, And Critical Thinking on Publishing Scientific Products and Performance of Academic Services

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Abstract: Graphic design is a creative process that includes art and technology to convey thoughts, particularly if it is accompanied with creative skills based on strong academic knowledge. It can be used to reflect ideas, trends, and tendencies and this helps touching their reality. This research is mainly aiming at studying how critical presentation of scientific findings, data and applications with graphic and creative designs using an expressive visual language would help enhancing data dissemination and simplifying difficult scientific data and phenomenon making them more convenient for a wide range of audiences and better understood by various levels of background and professionalism.

Keywords: Creativity, Creative thinking, Design thinking, design methodology, scientific representation, visual aids.

1 Introduction

Design has touched all aspects of life and is gaining the attention of researchers as much as the rest of the sciences. The creative thinking is one of the important styles of thinking, which are used by designers to express their ideas, and transmit information of an advertising message to the audiences. Design is one of the most attractive types of art to an audience regardless of language or culture as it can be understood and interactive. With the current and continuous development of societies, scientific research and applications as well as the revolution of computer graphics and design software, graphic design has become widely used in various purposes, including scientific and academic representations as one of the most important methodologies for demonstration and showing off [1].

At the global level, design and computer graphics software has become now the widely used method for representation that gradually changed from being just accepted to being favored by people. Several software is available nowadays on the market that are aiming at various technical operations; such as producing image design (i.e., print advertisement) and are very beneficial to the design industry. Graphic design, particularly with the advanced software can be used to simplify the design operation, to enrich the required themes and/or the design forms. This enables a better quality of the presented work. Therefore, application of graphic software in design provides related practitioners with a broader design space, a richer visual language and more expressive design that all come up with a much powerful performance.

Sometimes the design replaces writing an article, presenting a seminar, or discussing a proposal. The design can be used to shorten words, and sometimes the goal is to combine images with writing to convey the idea and emphasis. The design has become a vital and important part due to the multiplicity of its images and forms and the different design programs to show specialized areas and to define the public and the beneficiary, which is intended for students and researchers in various fields. Design is a communication process that has the main goal of influencing the recipient because it is a message that the artist or designer addresses to the audience in a plastic artistic language that relies on lines, colors, and images as a basis for expressing reality or event.

This paper combines the relationship between computing graphics, graphic design and quality of performance of scientific outcomes. It also discusses the approach and methodologies of application of computer graphics in the design of science advertising. The paper will display some examples from academic entities to show how applicable the approach and determine the level of effectiveness in the scientific field.

1.1 Research problem

The research problem is embodied in the presence of reputable commercial or educational and research bodies that exerts huge products with different forms; such as new scientific theories, models, applications and/or services. Those products need to shed the light into them to: 1)

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highlight their scientific importance; 2) grab more readers/audiences/users; 3) widen their field of application and beneficiaries and 4) help disseminate the producing entity and develop their academic ranking among other similar ones. The academic reputation and/or ranking level would be greatly impacted and relied on the approach they use to showing off and advertising their multidiscipline products to the insiders (within the same institution) and outsiders (other institutions inside and/or outside the country).

1.2 Research scope & objectives:

There is a "Science beyond the art of graphic advertising and computer graphics. Graphic demonstration and/or advertising design is not a type of image processing but a combination of technology, art, Entertainment, and Publishing tool that uses various visual symbols, such as graphics, images, text and other elements, to comprehensively improve the visual appearance and performance of the product advertising design. It might involve any or more of posters, videos, short Movies, or art games, web, books and/or magazines [2,3].

The paper is conducting a scientific and analytical applied study explaining the impact of design on scientific work, outcomes, projects and activities in reality as it is applied on four models of different academic entities. It seeks to provide a clear picture of the artistic, philosophical and artistic concepts of the four case studies (the academic institutions) by noting their varying topics, outcomes and multidiscipline projects and present them in a motivate and creative way that help putting them forward and widen their reader community through a simple presentation that are easy-to-understood.

This research itself is a new addition to the science knowledge and scientific products as it fills the gap between scientific research and the different users in various academic institutions worldwide through the application of graphics and computer designs. The field of designing and all its tools [4,5] can greatly enable to draw attention to the many problems and/or obstacles that hinder the recite of academic and educational services, products and applications to the market, appliers, research audiences, and any other interested parties. IT simply creates for them a good channel of mass communication and communication with others [6,8].

Therefore, this research is mainly aiming at ; 1) demonstrating the importance of design, graphics and computer software as a documented outreaching channel based on science and art to announce, present and disseminate the various products/services of research and educational institutions; 2) revealing the role of graphic design in better highlighting the efforts and impacts of these institutions and; 3) Test the impact of good presentations, creative advertisements using graphic design in widening the audience/reader market of science and scientific products using four different case studies.

2 Methodologies

- *Research approach* :The typical process of graphic designing in scientific fields

Designers often do not know where they would start, however using the joining tool contains many stages that recover the designer and once these stages are fulfilled, the idea is obtained. To correctly use the joining tool, the following steps should apply

- 1- Define the product and service promises or messages.
- 2- Make a list of items of message. Think about things that can be adapted to the message.
- 3- Examine the message items and define items that can be easily associated with the message. Try to choose those that can provide the most rapid and intuitive connection inside them, and that is in an environment that can reach your target audience.
- 4- Choose the item that exhibits the message item most effectively; create an advertisement that combines the message and item [9].

The authors followed the typical descriptive analytical method to measure the effectiveness to reveal the academic activities and outcomes of the educational and scientific institutions with the innovative analytical approach composed of a series of ordered process; as presented in Fig (1). Talking about graphics and designs are not exactly on art or on science, it is a mix of both as it takes elements from both. The use of graphic advertising design for any specific practice, including scientific data, is always starts from the base-line-information about the practice need to be presented graphically, e.g., the binding design required for book publication, the core date of a scientific piece of information with sample representation or the raw sample of the design required, etc. The raw information combined with preferable in design requirements are crucial for a designer to understand and utilize the relevant knowledge, digest and formulate the idea beyond the final graphics of the product, and, certainly will improve the design level gradually [10].

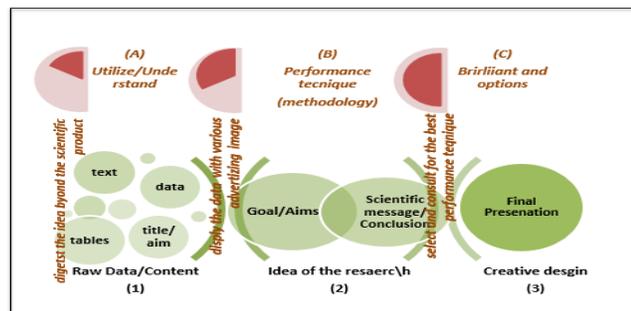


Fig. 1: The approach of graphic designing process applied for scientific fields

A previous similar analysis [11] – with a different mandate – was conducted an interview that designed to find out what

kind of situations designers describe as non-routine and in which they felt ‘inefficient or ineffective’ or ‘out of routine’. It studies sixteen (16) design practitioners in six (6) design companies in the USA and the Netherlands [12] and the data were collected through open-ended, semi-structured interviews. The interviewees’ answers included the procedures they follow (i.e., use a known design methods or others) and whether they developed it personally or with external guide. The interviewees sample was heterogeneous in terms of experience level, expertise and work domain. The experience-level ranged from 1 to 30 years of work experience. The expertise domains ranged from new business development to developing manufacturing strategies and project management. The work domain ranged from product design to user research and mechanical engineering. The data were analyzed according to the ‘Framework’ method. This research will use the audiences/readers/beneficiaries of the academic (research/education) products /services who attended to the product venue (wall labels, screens or videos, posters) or any of their showcases (conferences, seminars, workshops, etc.).

• *Research study area (case studies):*

To measure the factor of geographical and cultural variability as well as background and levels of the recipients, the approach applied in 4 different academic institutes with different specialty and mandates (Research and education) including both public and private sectors and distributed in 2 countries (Egypt and Saudi Arabia); as in the following table (Table 1)

Table 1: The different cases used in the research analyses and used as the area of the study

Saudi Arabia (A)		Egypt (B)	
1	2	1	2
Dar al Uloom University (DAU)	Majmaah University (MU)	National Authority for Remote Sensing and Space Sciences (NARSS)	Suez University (SU)

a. *Location 1*

Dar al Uloom University (DAU), is a private university located in Riyadh, Saudi Arabia (since 2008/2009). It offers a range of programs for Saudi and international students, with academic training and accreditation by the Saudi Ministry of Higher Education. DAU programs have been designed in collaboration with King Fahd University. College of Architectural Engineering and Digital Design . The university believes in values such as organizational development, educational excellence, advancing scientific researches and creative works, culture of community and supportive environment, expanding engagement and outreach with academic, industry, community and values for societal and sustainable development.

b. *Location 2*

Majmaah University (MU), is located in Al Majma'ah, Saudi Arabia (since 2009). The university main campus is located in the south part of Majmaah City. Teaching and research are delivered in 13 academic schools. The university is established to serve a wide area including Majmmah, Zulfi, Remah, Ghat and Hawtat Sudair. The university has around 20 buildings for the administration, colleges, deanships, medical services and units. The university believes in values such as Institutional work, Professionalization, Transparency, Integrity, Excellence, Creativity, Sustainability

c. *Location 3*

National Authority for Remote Sensing and Space Sciences (NARSS) (since 1971, then 1994) is the pioneering Egyptian institution in the field of satellite remote sensing and space sciences. It is an organization under the State Ministry of Scientific Research to promote the use of state-of-the-art space technology for the development of the country and introducing high tech capabilities to regional planning and other applications.

d. *Location 4*

Suez University is an Egyptian public university established in 2012 as an independent university after being a Suez Canal University branch at Suez. Suez University include 13 faculties with a pile of various academic multidiscipline programs and several research sectors.

• *Experimental design:*

It is the process of envisioning and planning the creation of objects, interactive systems, buildings, etc. It’s user-centered, i.e., users are at the heart of the design thinking approach. It is about creating solutions for people, physical items or more abstract systems to address a need or a problem that can greatly vary from one field to another. The design units established in this work were chosen to include the four institutions as the research case studies based on the targeted goal of each case. It permeates many aspects of our lives and branches out into many different subgenres, from product design, sound, virtual reality, interaction, video games, software interfaces, the home and offices interior etc. Schools adapted to the market's evolution accordingly by creating graduate and postgraduate programs in Design.

- *For location 1 (DAU)*, the Designs made for the Department of Graphic Design, which is aiming at putting their students forward on the professional market, helping them to better communicate with the outer community and introducing them and their capabilities to the labor market. This involve teach them value of the arts of digital design and communication in the field of digital movement diagram in the Kingdom of Saudi Arabia (KSA).
- *For location 2 (MU)*, the design was mainly made for the collage of Education to highlight the new programs

considering being in line with the needs of the labor market and coincident with the developmental plans. It was also concerning the establishment of partnership with the public and private sectors to improve the education level by supporting teaching/learning processes with workshops and training

- For Location 3 (NARSS), the designs made to highlight the institute as the most distinguished scientific centers in the field of developing and applying remote sensing and space science technologies at both local and regional levels. Its main mandate is to explore and manage land resources to support decision-makers and researchers in various development sectors and follow-up, transfer and present the latest earth observation technologies. It also seeks every single peaceful applications of space sciences, building self-capacities, and cooperating with various state institutions to serve the national and regional developmental plans.
- For Location 4 (SU), the design made mainly to announce and advertise the university within the local and national/international academic communities during an international conference conducted and coordinated by the university as one of the biggest scientific events.



Fig. 2: The local and national/international academic Location.

- Target group :include scientific, economic, environmental, cultural, educational and other audiences, readers and/or beneficiaries.
- Design sources and types: include printed, digital for the Internet and displayed on walls or/and screens. The designs varied to include posters, logos, 3D designs, and screen static images and videos.
- Display method: the designs were placed on the institutions' wall, on the roll-up for conferences and events of the institution, and on the institution web pages.
- Nature of the content: included characters, topics, research, projects, products and services that are specific to the nature of each of the academic institution of the four case studies.

- Study duration: from 2014 to 2021

3 Discussions

The overall results reflect the crucial role of using graphics and computer designing in grabbing the attention to the scientific academic products and increased the number of audiences/readers who viewed the designed presentation. It also promotes them to stay for longer time to read and investigate the product/service/application. We can generalize this result for all the four study cases keeping in mind their various attitude (private or public) and mandate (education or research) and their different goals out of the advertisements (marketing, dissemination, publicity or offering service). The results of this current analyses out of all cases used demonstrated a number of important findings;

- 1) The used design is mainly focused on themes without the characters and was normal valid and used lots of colors, each according to the nature of the entity goals, activities and needs using methodology of critical thinking that mainly based on a set of mental processes to address the topics/the activities in the first place;
- 2) The variety of cases used for this study from academic and educational institutions make the designers face a variety of situations of demands and targeting group which widen the area of thinking and maximize the imagination that can be categorized according to the needs of the organization paid great attention to design and graphics as they published nearly 100/year various designs between logo, poster, banner, catalog, magazine, printed designs, and digital designs, static and dynamic formats;
- 3) The use of simple and innovative designs and involving the producers as well as the stakeholders throughout the process of designing (thinking) helps to fill the gap that is often causes communication problems arisen from the cognitive distance between the mental models of stakeholders. This enhanced and increased the greetings from the academic community (audiences/readers/beneficiaries, etc....) who are sharing the same interest of the product advertised widen the dissemination and the opportunity for the product/service through attendees and stakeholders with multi-disciplined backgrounds and goals.
- 4) It is documented that creativity, designing and design thinking are human-centered and it should be understood in a systemic approach, where not only the designer and the interdisciplinary team of professionals are important for success, but also the cultural

domain, the working environment, and the form we (experts and society) use to judge new products, and services; and

- 5) The quality and success of the final product or service advertised is mainly dependent of the exciting approach the designer used, particularly it was originally based on creativity by creative-thinking, creative idea and use of creative materials.

- *Effectiveness of Scientific representation:*

scientific representation is the important and useful relationship that holds between scientific sources (for example, models, theories, and data models) and their targets (for example, real-world systems, and theoretical objects) [13] The role of graphic design is to show this integrated scientific system in an image that attracts the viewer to an emphasize the meaning and show the scientific goals in a simpler and easier way for the researcher, the academic and the target audience.

visual aids: Visual aids are tools that help to make an issue or subject clearer or easier to understand and to know, for example: -models, actual objects, charts, pictures, maps, videos, 3d design and design on screen, etc. All of these to make design effective and the best dissemination of knowledge [14].

Creativity: Definitions of creativity according to [15], creativity is the initiative of a person with the ability to break away from the normal sequence of thinking to opposition thinking. The process of creative thinking is related to the intellectual skills, sensory and psychological of the human being, resulting in different products from ordinary products and traditional products that result from the normal or traditional thinking process, despite the different views of the scientists - psychologists in particular in defining the concept unifying the meaning of creativity, describing it as a product of creative thinking [15,17]. That means the creativity is: a process that results a new work that satisfies a group or accept it as useful and forms the bases of the innovative process which expresses the ability to create relationships between things in an unprecedented way. According to [18], creativity is the ability to bring many unique solutions to a single problem within a short time, which can be learned and trained to become a permanent individual skill that create amazing effect [19]. It is worth mentioning and remembering that creative ideas must be aesthetics, simple and new and the quantity of an idea gets ahead of its quality.

Design thinking: It is well known that design thinking itself, is a human-centered idea [20] and the approach of “design thinking” offers lower clear procedures and does not give clear instructions on what and how to do. One of the most detailed definitions on design thinking was provided by [21], who referred to a-six aspects definition that characterize design thinking namely; collaborative, abductive, experimental, personal, integrative and interpretive, ignoring

results from ‘design thinking’ research. The current ‘new’ design thinking movement has been mainly a practice-based enumeration of aspects of the design process at low resolution, that stresses the relevance of activities, such as collaboration, exploring and integrating options, and low-fidelity prototyping and interpretation. This movement is an overarching holistic and interdisciplinary approach for innovative problem solving (for example, [20, 22,24].

Design methodology: This is mostly made by providing a competitive edge due to innovativeness, for a product, system or service. Practitioners and academics claim that the education is too narrow and does not provide the skills needed in contemporary business, such as creativity. Brown [22] describes design thinking as an approach to innovation that is powerful, effective, and broadly accessible, that can be integrated into all aspects of business and society, and that individuals and teams can use to generate breakthrough ideas that are implemented and therefore have an impact. The instructions are not deducted empirically or theoretically, as mentioned by Norman [25] in his column “Design Thinking: A Useful Myth?”, calls the approach a myth that “is nonsense, but like all myths, it has a certain ring of plausibility although lacking any evidence.” It is very difficult to prove the superiority of using methods. It is also very difficult to analyze the impact of introducing new methods. Another issue related to the performance of methods is the criticism that methods do not account for different forms of designing [26].

Creative thinking: Creative thinking is the result of the interaction of mental and psychological process [27] and it is human ability to find new unique and innovative ideas that is appropriate and socially acceptable as well as could be used as a solution in an advertising form for a specific problem or definite goal. Methodologies for creative thinking are greatly based on a set of mental processes such as analysis, criticism, imagine, abstraction, comparing and logic... etc. Each of those methodologies do not require the combination of all these mental processes, but each methodology should be generally based on one specific mental process (called as dominant mental), distinguishing the overall domain of the product, with some other processes, but at smaller rate [28]. Jagadeesh emphasized in his discussion [29] on creative thinking, critical thinking, and logic in research that completing any research project requires meticulous planning, experimental execution, compilation and publication of findings in the form of a research paper.

The use of creative thinking in advertising “science” or academic products/service is just an effective tool, not to change or modify the original idea beyond the research or education product but to make it appear with an innovative format that be interested by wider community. Therefore, it is a kind of thinking by which the thinker or the designer is accessing the raw information and understand the original ideas with which, a new innovative and unprecedented product is generated relying on wide imagination and

emphasizing the value of originality and renovation [30]. This type of thinking is sometimes called divergent thinking, and sometimes it is called creative thinking as it depends on creativity/innovation during the search for new ideas or for a new updated applications for the previous knowledge [16] via enormous imagine capacities and visualization to understand the meaning of original product (i.e., knowledge/information/application/service), its main concepts as well as the meta-information.

- *Potentiality of implementations*

A) Case Study 1: Faculty of Architecture and Digital Design at Dar Al Uloom University.

In the Faculty of Architecture and Digital Design at Dar Al Uloom University (Appendix 1), designs have been done in different forms such as posters, logos, panners, multimedia designs and 3d animations, in order to create multimedia content for websites, television, films and advertising presentations. These variable forms of designs were done to help students realize the importance and the impact of graphic designs.

The role of graphic design is obvious in representing the university and its activities, enhancing the good image of the university for the new students, Strengthening the relationship with alumni by sending posts to their personal emails and publishing them on the university's official website like recruitment workshops, trainings and discussions. Visits to the Kingdom's printing presses and MBC station to broadcast demo about the university, its programs and activities.

B) Case Study 2: College of Education, Majmaah University

In the College of Education, Majmaah University Design (Appendix 2) has been done in a variety of areas of Graphic. Designs have been made for the College of Education and for Majmaah University, which appeared through a commercial activity of logos and infographic posters to Simplify complex information and make it easy to understand, transfer of information and data of numbers, letters and images into attractive graphics [31] and build a positive image of the university for the community. These results are determined and improved through increased awareness of the university, its activities, programs and workshops and any event held at the university will be announced in both print and digital form. Attention to printed designs that are psychologically visible to the customer and the speed of response is very clear. Graphics show a big difference in vision for the academic community and public.

C) Case Study 3: The National Authority for Remote Sensing and Space Sciences (NARSS)

In the National Authority for Remote Sensing and Space Sciences, various designs have been made (Appendix 3) in all fields and according to the activities held by the authority, such as specialized laboratories, professional diplomas, geographic information systems, as well as designs for the

members of the authority and its departments, in addition to the designs of all events, workshops, training and visits from multiple places and conferences. The Authority learned more through the designs. The Authority's activities and events appeared on the community, and cooperation was established with international and local bodies and organizations, and many regional and international research and projects were implemented, and graphics were added in several ways, including infographics, printing, videos, brochures, design, and organizing a conference in which a full advertising campaign with many designs for the conference would be made. Use a variety of graphic software, including design software, montage software, drawing software, and 3D software. A great change occurred in the authority as a result of the work of various designs in the various areas of the authority, which had a great impact on the spread, contracts and knowledge at the regional and international levels. The posters were redesigned instead of the old posters in an acceptable manner and attracts attention to be placed in conferences and in the facade of the building at the National Authority for Remote Sensing and Space Sciences.

D) Case study 4- Suez University (SU): The blue Economy Conference

For Suez University that has been selected as an education institute case study; both critical thinking and creative graphics were used (Appendix 4) to better represent the university services and its various products and outcomes. This was shown during the big international even; the blue economy conference through the various designs made either before the event commence (e.g., logo, brochure, website, invitations, ...etc.) or within the event (booth display, videoing materials, maps, power point's design, ..etc.) and after the event (proceeding book, website update and photos gallery, etc..) The conference left a strong referral about the university and the organizing faculty; faculty of fish resources (FFR) and highlight the university services and programs in a very productive manner as well as it gave good insights on the researchers outcomes from their scientific studies. These results were determined through the number of conference attendees, their feedback afterwards, the excessive media spoken about the event and also the number of students enrolled to the university/faculty the next academic year. The university in general and FFR in specific became much well-known at the local and regional levels since it receives many requests for cooperation from many African countries. This confirms the potentiality and effectiveness of using the graphic programs, including design programs, montage programs, drawing software, and 3D programs for better exposure and dissemination of academic institutions and products.

Recommendation

The research emphasized the importance of designs and graphics (either printed or digital) and their great value for

the appearance academic entities and their impacts on the dissemination and availability of the products and services these entities are generating. Based on the results of this survey analyses; it is recommended to use the modern technologies in designing for scientific presentations and to consider it as one of the main components of the advertising process in all academic institutions and expand this process to involve diversity of designs that are appropriate to the institutions' goals, needs and their target groups to guarantee the success to attracts wider community with getting their full attention and care. This will concrete the shed light on the unique activities and the success stories of these entities maximizing their roles in achieving the global SDGs and the National 2030 vision through the core integration of sciences.

Appendix (1): Case Study 1; Faculty of Architecture and Digital Design at Dar Al Uloom University.

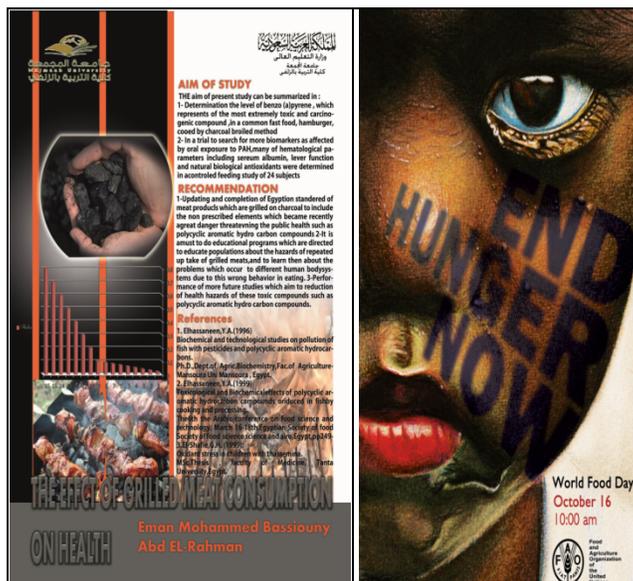


The multimedia advertising about Al Rabie juice and education for all. This was to present in an event for the College.



Advertising, Typography and visits with my students to MBC, and Hala Press.

Appendix 2: Case Study 2; College of Education, Majmaah University



Posters, Art Design and workshops design.



Logos and Exhibitions design.

Appendix 3: Case Study 3; The National Authority for Remote Sensing and Space Sciences (NARSS)



Posters, Flyers design.



Posters, catalogues, booklet, logos and montage Videos.



Fig. 9: Posters for the National Authority for Remote Sensing and Space Sciences before and after

Appendix 4: Case study 4- Suez University (SU); The blue Economy Conference

Conference Themes
The Conference of 'The Economy to Achieve the African Agenda 2063'

Suez University
First International Conference
Blue Economy to Achieve the African Agenda 2063 and Sustainable Development

Suez, 10 - 13 September, 2019

Under the Patronage of
H.E. Prof. Mostafa Madbouly
The Prime Minister

H.E. Prof. Khaled Abdel Ghaffar
Minister of Higher Education & Scientific Research

M. G. Abdel Maged Sakr
Governor of Suez Governorate

Prof. El-Sayed El-Sharkawy
President of Suez University

Prof. Shymaa Shalaby
Conference Chairman

Prof. Elham Mahmoud Ali
Conference Coordinator

Conference brochure initial and final design.

Blue economy

Blue Economy

UONIR
University of Nour International Research

NAF COAST

Conference logo initial and final design

Other logos (for the university international office – for a coastal and marine project

SDPI - Potential Fishing Zone - PFZ

Product: Potential Fishing Zone - PFZ

Product Description:
Without project funded from EC and AUC through GMS and Africa Program, it is aimed to map the potential fishing zones along the Mediterranean Sea coast for some fish species.

This service is estimator for fish species (Sardinella tawilis) from MCSIS satellite data based on the algorithm of SDPI and GIS and suitable environmental conditions for this species, which is validated against some real data.

This PFZ map is the average potential fishing zones for the Sardinella tawilis species on 0th June 2020.

Data Source: WCSIS
Resolution: -80M
Date of Data: 0th June 2020

Project Coordinator:
National Authority for Research and Scientific Studies, Egypt

Project Partners:
Suez Canal Authority, Suez Canal Economic Zone, Suez Canal Authority, Suez Canal Economic Zone, Suez Canal Authority, Suez Canal Economic Zone

For more information please contact us at:
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University booth design

Poster for results presentations

Conference advertisements

Conference Schedule

Conference invitations to VIPs

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Conflict of interest:

The authors declare that there is no conflict regarding the publication of this paper.

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