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Investigating the Challenges Climate Communicators Face Connecting to the Public: A Qualitative Study

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Abstract

Given that carbon dioxide is mostly to blame for the earth's and air's fast temperature rise, climate change in Egypt has resulted in ecological homogeneity, damaged coral reefs, vector-borne disease transmission, food instability, reduced water supplies, coastal areas swamped, human habitat and settlement destroyed, and temperature variations. Egypt is currently developing a national plan for climate change adaptation as well as its first national climate change strategy to address potential erosion and degradation of Alexandria, the northern shore, and portions of the Delta. Investigate other cultivars that can withstand salt and heat. In the end, to lessen carbon emissions and air pollution, particularly from the production of cement, which fuels climate change, this paper serves as an initial investigation of the challenges or obstacles communicators face while conveying their message to the public. This paper utilized the qualitative method and conducted in-depth interviews with 16 communicators in the climate change field as the method of data collection. Findings indicate that climate change information sharing on social media requires attribution to trustworthy institutions and public awareness.

Keywords: Climate communication, Artificial intelligence, low emission transportation.

Introduction

Climate action – goal # 13 is one of the sustainable development goals assigned by the United Nations. The furious increase of greenhouse gases has been causing climate change and its effects have been salient worldwide especially in developing and less developed countries with low literacy rate. Regarding research, the iconography of climate change imagery is being neglected.

Egypt has developed five clear strategic goals in alignment with the national sustainable development strategy, Egypt vision 2030. Climate is one of the five strategic goals. Heatwaves hit Egypt on August 2021, the Egyptian Supreme Council for Climate Change and UNFCC (United Nations Framework Convention on Climate Change) are cooperating together to handle issues caused by climate change in which Egypt already has developed power generation projects from renewable sources of energy like solar parks and wind farms. Moreover, the transition toward more electric and low emission transportation powered by natural gas.

Importance of Research

• It offers managers and policy makers with the finest available comprehending of the vulnerability of Egypt's energy use to climate change.

• It helps be acquainted with the predictions of local environmental stressors in Egypt.

Literature Review

The Use of Digital Media in Climate Change

It is being emphasized that in order for the public to make acquainted ecological and environmental decisions, it is essential that people should have an entry to proper and clear absorbed data on such themes like climate change or development. Up till now, scientific digital platforms targeting the audience are precise but full of jargons and excessively complicated. Hence such information is less circulated and based on communication uncertainty (Lam et al., 2019; Hunter, 2016).

Concerning digital media and environmental communication, it is found that though traditional media are contested by the distinctive of different new entries into the digital scene, findings reveal that the media and journalists remain very apparent. Further, survey results imply that a lot of science communicators might fight to gain grip or friction in the jammed digital landscape, and in specific, that comparatively minor scientists and research foundations and universities are reaching a high rank in the public digital media scene of science communication (Weitkamp et al., 2021).

The Social Media Life of Climate Change: Platforms, Publics, and Future Imaginaries, is a study that used a meta-approach to comprehensively review the literature about climate change communication on social media, particularly on Twitter. The method used is based on a large

range of search protocols to question the Scopus and Google Scholar databases, and importantly applying perception from the social media literature. There are 3 key findings, firstly, the previous studies are considerably bias toward Twitter, and 26 out of 35 articles (the sample) extract their data only from Twitter. This is because Twitter provide access to its data through their APIs (application programming interfaces). Secondly, recognizing three distinctive research methods to study such communication, that's considering Twitter as a site for climate change publics. Secondly, a forum of climate change issues and at last as a means to investigate climate change professional communication. Thirdly, the study came out with essential experimental conclusions from the literature and they are framing climate change as a 'settled science' and leaning towards 'echo chambers' (Niederer et al., 2018).

The Use of Artificial Intelligence in analyzing Climate Visuals

A study titled "Climate Change: The Networks of #climate change Hashtag

Engagement and "climate emergency" Image Circulation, a Cross Platform Digital Networks, is an investigative case study founded on analysis of climate change and related hashtag engagement on Twitter and Instagram highlights variances in usage and content across platforms. Additionally, the visuality of climate emergency by repurposing Google image overtime. The methodology used is query design and visual protocol, built on artificial intelligence-based software, Instagram loader to extract data using Python and data are analyzed through Excel and Table2Net and visualized via Gephi and Raw Graphs software. The key finding is that Instagram clusters seem well-defined by the topic matter and the use of the hashtag is more associated to arts and design. These topics are climate action, global warming, sustainability and environment. Regarding #climate change on Instagram, there are more co-occurrences of tags but used less often. Perhaps this refers to the culture of hashtag use on Instagram that permits more than 30 tags in a post. The top 10 hashtags in global occurrences on Instagram from 10 to 1 are environment, Australia, climate, vegan, sustainability, Trump, Fridays for future, art, zero waste and ecofriendly. Hashtags might be low in number compared to Twitter but are more diversified than Twitter's tags which focus on climate related issues. However, may be exactly because of that, variety tags are less occurrences. (Geenen et al., 2020).

Generative adversarial networks (GANs) used in domain adaptation tasks have the capability to produce images that are both realistic and personalized, converting an input image while preserving its identifiable features. Exploring the latent of using images from a simulated 3D environment to expand a domain adaptation job done by the MUNIT architecture and the usage of Google Street View API targeting to use the resulting images to increase awareness of the likely future effects of climate change. It turns out that the model trained on simulated and real data performs worse than when trained on real data only (Cosne et al., 2020).

Machine learning can be an influential tool in dropping greenhouse gas emissions and serving society adapt to a changing climate. From smart grids to disaster management and recognize great impact matters where present gaps can be filled by machine learning, in alliance with other fields. This includes appealing research questions in addition to capable business prospects. It is a call for the machine learning communal to unite with the international effort against climate change (Rolnick et al., 2019; Cosne et al., 2020)

Theoretical Framework

Complexity Theory

Complexity theory in new media, one of the digital media theories is used in this research; it is implemented to new media emphasizing if digital media can be diminished to a certain number of tight characteristics that is not possible. This theory is influenced via social determinism and not technological determinism in which social interactions and constructs alone determine individual behavior, this is as result of a media or high-tech development (Littlejohn & Foss, 2009).

In this research, high social interactions and constructs about climate visuals have boosted dramatically across social media networks as digital media is involved in our daily lives excessively. Due to the existence of social media and the present situation of climate change imagery, the image is posted with communal or time-based aspects, lack of geographic site and it is abstract lead to the emergence of climate artists and photographers in new media journalism, dissemination of participatory methods, and appearance of creators and influencers on social media such as Instagram. In other words, individual behavioral change occurred when dealing with climate related matters because of social media.

Research Problem

Recent studies ensure that the current state of the portrayal of climate change imagery in public perception is that the image is psychologically distant and does not feature human, so it does not lead to an actual public engagement. To date, there is not a clear system or path of how to use the climate change imagery efficiently in order to guarantee public engagement. The severity of the issue is that according to Knoema, Egypt CO_2 emissions was 259.3 million tons in 2021 and Egypt CO_2 emissions per capita was 2.48 metric tons in 2021 – growing at an average annual rate of 2.61%.

The research problem is the usage of climate change imagery by communicators such as NGOs, artists, photographers, and environmental journalists on Instagram as it operates more with visuals in order to reach public engagement. Considering this dilemma, the paper is interested in exploring the challenges confronted with communicators when delivering their desired message.

The Objectives

1- Understand the successful mechanism for the usage of climate change imagery to achieve public engagement.

2- Identify new encounters for scholars to consider for future research.

Research Questions

1- How is it possible to verify information disorder like misinformation about climate change in the light of such infodemic on social media?

2- What are the most widely types of climate change visuals used and the most climate imagery seen on social media in Egypt?

3- What are the hinderances that prevent the presence of trained and qualified environmental journalists?

4- What are the obstacles and challenges communicators confronting during the coverage of climate events?

5- What are the external factors that affect climate change communication?

6- Does the application of the seven principles of climate change visuals for "Climate Outreach" ensures an effective public engagement?

7- Why the number of environmental pages or journals in Egypt is very small?

Methodology

Method: In-depth Interviews

In-depth interviews as a qualitative approach will be conducted with 16 communicators and they are environmental journalist, climate scientist, photojournalist, NGO, climate artist and activist, photographer and many others in Egypt. This is to acknowledge the matters and provocations they meet while connecting with audience (the public) or when conveying their message and especially through social media (Instagram).

Sample

The type of sampling is non-random – purposive sampling. The following names are the 16 communicators:

1- Ashraf Amin, Senior Science Editor and Head of the Science Journalism and Technology Department in Al-Ahram Newspaper

2- Dr. Samir Tantawi, Senior Climate Change Counselor/UNDP Project Manager

3- Alaa Eldeen, Social media Director and Visual Communicator at Greenish Organization

4- Amr Sobhy, climate change advisor at Deutsche Gesellschaft Fur Internationale Zusammenarbeit (GIZ)

5- Mohamed El Magrabi, Founder of the Science Museum.

6- Dr. Ahmed El-Adawy, JSPS Postdoc Fellow at Tokyo Institute of Technology, Nakamura Lab.

7- Watter El Bahry, Conservation Photographer, Senior Ornithologist and Bird Guide.

8- Marwan Ramsy, Business and Programme Development Specialist at Greenish Organization.

9- Mohamed El-Basheir, Business coordinator at Fab Lab Egypt

10- Rana Seif, Climate Change Specialist at UNFCCC, Cairo, Egypt

11- Mustafa Metwally, Project and Research Assistant at the Center for Applied Research on the Environment and Sustainability (CARES) in American University in Cairo

12- Dr. Hussein Abaza, Senior Consultant to the Ministry of Environment for Sustainable Development and Former Expert on green economy and climate at the UNEP.

13- Sarah Rifaat, Climate Artist

14- Dalia Abd El Salam, Editor in Chief of Scientific American (Arabic Edition)

15- Dr. Eman Abd El Azim, Member of the National Council for Climate Change and National Committee for Environmental Matters, and Owner of the "Climate" - Environmental Mediator Initiative on Facebook.

16- Hossam Emam, Climate Change and Sustainability Advocate or Activist

Findings of Climate Stakeholders in-depth Interviews

Ashraf Amin, senior science editor and head of the science journalism and technology department in Al-Ahram Newspaper claimed that currently we are confronting extreme weather events in different parts of the world. In United States, there are groups who are advocating climate skepticism and pro-climate deniers, they are referred to as "cult" and they use soft terms like usual climate or natural weather cycle to trivial climate change issues. Such cult gains monetary support from business stakeholders so that those beneficiaries protect investors' interests while that enterprises should adopt the approach of blue and green technology solutions instead of promoting industries which harm the environment or cause pollution. He has also indicated that when writing a hyper local climate story, the journalist needs to show alternatives like what is the transition plan?

About Solutions Journalism (SOJ/SJ) have always been there but not practiced. It is been on spot recently since the emergence of climate change issue. Its importance lies in proposing solutions for the problems caused by climate change. It is beneficial when the solutions are new and numerous. This type of journalism roams, interact and engage with local community for example, graffiti is used to illustrate solutions on the walls as well as discussing causes and effects with audiences.

Dr. Samir Tantawi, senior climate change counselor/UNDP project manager confirmed that it is crucial that the suggested solutions should be relevant to the public in order to make sure that the audience will adopt the resolutions. There are no final and comprehensive solutions to climate change. Therefore, solutions journalism must focus on countries' commitment to treaties and what penalties are imposed in case of non-compliance. Solutions must be put forward in which there is climate justice, and they must be based on a scientific basis and have strong justifications and evidence for natural systems to be destroyed.

It is true that solutions journalism's audience is small or almost non-existent. HEPCA – Hurghada Environmental Protection and conservation Association is one of the NGOs which applied SOJ when they pushed the journalists to take a public stand during Mubarak era to prevent the sale of the protected Giftun Island in order to establish a resort, and this is for protection of coral reefs. It contributes to disseminating or transmitting the solution to the general public and the decision of officials on a large scale. It also contributes to raising awareness, but in reality, it is just a means of displaying solutions, and the whole matter is up to those concerned with the decision. It is a link of communication between academics, businessmen and decision makers. It can be used to put pressure on decision and policy makers within the country, especially countries that increase carbon emissions, in addition to supporting the economy in developing countries and highlighting different solutions from various fields to spread positivity about the environment.

Alaa Eldeen, social media director and visual communicator at Greenish Organization assured that pseudoscience got disseminated easier and faster through digital media and visual communication, for instance saying that the water plastic bottle is 75% recyclable but in fact 25% of its material can be recycled and only 4% upcycle. Visually, art can be used for a good cause. A campaign called "Art of Change" initiated by Greenish Foundation in partnership with Schneider Electric Foundation cooperating together to encourage young people to be involved in making 'Mask book' exhibited in COP 27, it consists of distinctive face masks - upcycle from used materials like flawed tire - each mask has a title and a message such as coral reef mask illustrating how coral reefs are harmed by climate change.

Eldeen referred to "Storytelling for Climate" is an event organized and executed by Beirut DC in Lebanon, Green Screen in Jordan, and Artists Association and climate activists in Egypt coordinated by Greenish presenting films about environment meanwhile inspiring filmmakers to go more for sustainable production process. Casabrava a film that is produced with minimum waste for example less food waste, limited use of utensils by the crew, and use of stainless-steel ones instead in addition to carpooling and ride public transport rather than private limos. In spite of all this, the film was produced in high quality.

Science communicator is clever at his work than science journalist because not all science journalist has the skill of communicating science to the public. Further, science journalist cannot deal well with scientists when collecting data or scientific information. The bottom-line is that the journalist meets the scientist then convey the information to the science community and later the science communicator deliver the message to the general audience **unlike** Amr Sobhy, Climate Change Advisor who said that simplifying science is the role of the scientist and not the journalist nor communicator. Examples of science communicators are Ahmed El Ghandour (El-Daheeh), (Science Street) – initiative for scientific content creation on Facebook by Abduallah Anan, Mohamed El-Shorbagy (information in a Capsule), Espitalia for Eman Emam and at last Science Museum by Mohamed El-Maghrabi that's based on workshops and science camps for youth and also involve the making of online videos and reels on social media. Science Museum already have worked with Scicomm X and Arab Science Week to spread the importance of science communication confirmed by **Mohamed El Magrabi**, founder of the Science Museum.

Pollution reduces and weakens the ability of natural systems to protect themselves, and climate change increases deterioration. Concerning the oil slicks from ships in Dahab, Sharm El-Sheikh, the issues of the Red Sea district lie in that there supposed to be a surveillance system to track the source of these slicks which can be dangerous to marine life. Paying fines by whoever is causing the casualty is more significant than awareness and public participation to stop and limit the damage. Human activity like snorkeling near the shores and diving at the sea, they are the ones causing the damage to the coral reefs in terms of the number of times of immersion in the sea and friction. There are unsustainable limits. In recent researches, it is been positively stated that

it is discovered that coral reefs are adapting in order to deal with climate change. The filling of beaches in front of hotels at the Red Sea has been stopped because the filling materials are of very poor quality and kills coral reefs. Protecting beaches from slashing and preserving the balance of nature and tourism is vital stated by **Dr. Ahmed El-Adawy**, JSPS postdoc fellow at tokyo institute of technology, Nakamura Lab.

Dr. El- Adawy added that regarding the gap between scientists and the media, the first problem is that the journalist is not aware of the subject he/she is writing about. The second matter is that not focusing on what is important or relevant to be delivered to the audience, and the way the data is presented (data visualization) should be interesting to the viewers and free from exaggeration so decision makers can interact with it as well. The scientist must be accurate when it comes to data and figures/numbers and media has to dig, verify, and ask for the correct piece of information. Simplifying scientific information is crucial. Scholars are the focal point; science matters seem to be a poor material for the media, not all the time and so neglected by the public. Concentrating on science achievements is important and useful to bring about change in society.

As for biodiversity, there is no outright or complete extinction of birds, there have been bird's species that are endangered and threatened with extinction like the Egyptian vulture, it is in danger of extinction. This is because of losing its habitat, and hunting. It lives in Halayeb and Shalateen province, Egypt. Actually, as a result of climate change European falcons migrate on October/ November from Eastern Europe to Africa and spread all over the continent said **Watter El Bahry**, conservation photographer, senior ornithologist and bird guide.

Greenish Projects are the product of youth s' ideas or prototypes that goes into incubators and get funds from investors. Youth obtain trainings and TOT through workshops, internships developing their skills and abilities about subjects related to environment and climate such as waste management, biodiversity, public health and clean energy which include practical work as well. The projects mainly are green solutions around cleaning up and taking sustainable actions towards issues that are useful for society and are awarded at Greenish festival. This contributes to raising the competencies of the current local community via participation and engagement and helps in policy development and negotiations with stakeholders claimed by **Marwan Ramsy**, business and programme development specialist at Greenish Organization.

Mohamed El-Basheir, business coordinator at Fab Lab Egypt said that Fab Lab subsidizes in simplifying science or communicating science easily via digital fabrication thus fabricated prototypes using 3D printing, laser and vinyl cutting, CNC milling, and PCB production. Digital fabrication is very effective in physics, chemistry, math, and biology. It enhances illustrations yet design new type of visual. It generates a physical model; the physical model is the new visual. It highly serves stem education. Basically, the process is about making the design of the model using 2D/3D software and the design gets a code then the code is inserted into a technological machine that produces a physical output or product. Later, such models or similar outputs/products like

upcycling, recycling plastics, smart trashing system, and aqua-bionics are demonstrated at Maker Faire Cairo organized by Fab Lab. It involves start-ups and hobbyists. It is a community gathering to do environmental related activities.

Rana Seif,climate change specialist at UNFCCC, Cairo, Egypt implies that meanwhile the public confront or get affected by the influence of climate change in their daily life, they become frustrated but do not suffer from climate fatigue unless the media adopted this path during covering climate news. **Sarah Rifaat**, climate artist **agrees** and added that telling new stories is the most important to avoid climate fatigue and there are vital aspects about this in terms of public policy and climate risk management. According to **Mustafa Metwally**, project and research assistant at the Center for Applied Research on the Environment and Sustainability (CARES) in American University in Cairo, there are three different categories of youth in which a one category has 'eco-anxiety', another category experience fatigue and the third one is the young people who do not care about climate change issues. 'Eco-anxiety' comes from showing and stressing on climate impacts and these impacts do not have to be in Egypt, it can be anywhere in the world. However, climate fatigue is a result of excessive news about climate change. Regarding this category, such youth are good readers, familiar, and keen followers of the western news coverage for climate related issues since there is no that much of media reporting climate matters in Egypt.

Concerning climate data visuals, climate impact image about climate changes in Egypt is little in number and this to avoid the spread of panic in society. When demonstrating climate matters, the current adaptation or mitigation projects are not linked with the issue of climate change. This is a focal point. Infographics are comprehended by elites or highly educated persons. Sometimes, the infographic is not clear although it is supposed to be easy to read. The specialist who is working on the data visual must know about climate. Videographic, audio files, video clips, cartoons, and reels are more appropriate to use when targeting illiterate audience or people with special abilities. Short visual messages with actual incidents are much effective other than that the effect would be limited and not resulting in an outcome. It is recommended that more climate solution image is needed to be used to show solutions, tackle different audience, and tailor the message to explain the consequence a certain societal segment gets influenced by, this ensures relevance. Put the role of the public in the message whether it is socially, economically, environmentally, and health wise since the full life cycle is destroyed or life support system is disrupted stated by Dr. Hussein Abaza, senior consultant to the Ministry of Environment for Sustainable Development and Former Expert on green economy and climate at the UNEP.

Interpretations to Research Questions

The in-depth interviews with 16 communicators provide answers to the research questions.

RQ1: How is it possible to verify information disorder like misinformation about climate change in the light of such infodemic on social media?

It is important to share information related to climate change on social media when it is stated by more than one entity. Public need to make sure that the shared piece of information is released or posted by well-known organizations like UNFCCC, credible entities like the Ministry of the Environment or National Council for Climate Change, and scientists or scholars, and experienced climate experts.

Before sharing climate related data on social media, be keen that referencing is attributed to a trustworthy institution to fight or resist infodemic and disseminate the correct scientific information. Whoever is in charge of operating social media network has to work on activating special algorithm which make certain that the data is verified.

Apart from sharing information, it is advisable that the public should try to use art, tools and human capacity to shed the light on climate change issue. For example, In Egypt, '350 Earth' celebrated EARTH Day by taking part in a massive art piece that is photographed from a satellite on Friday, 26 November 2010 at Wadi Natroun. **Sarah Rifaat,** climate artist claimed that hundreds of Egyptian youths trekked out the desert outside Cairo to form an enormous traditional Egyptian scarab (60*90 m) holding a "sun" composed of people to symbolize how solar energy can power Egypt's future. The project was done by a great number of volunteers coming from 12 countries worldwide. It took 2 days for preparation by 6 persons. It took 3 hours to implement this climate art.

"Online public spheres" or bubbles are created on social media in which it is a closed group and people tend to discuss mal-information and rumors concerning climate change. However, the existence of public policies is significant which support freedom of expression and speech. Moreover, increasing awareness regarding climate change through campaigns can do good against rumors. The educated general audience should always be able to go after and search for the reliable source to obtain the exact scientific data such as universities, research centers, scientific platforms, and with time they will be capable of verifying the data.

Climate change is a normal process. Human activity is making it extreme causing disorder in nature's defense system. Media literacy is vital wherein audience must be well educated and aware of information disorder, and be able to recognize misinformation, and differentiate between it and mal-information. Other factors like digital literacy and pressure groups (climate skeptic) affect the way audience approach climate data. Firstly, social media networks are updated more than websites. The public is aware of the official pages like UN Climate or IPCCC. The pages that post false information about climate change are obvious but only for digital literates. The concerned scientific bodies are responsible for publishing the true information. It goes without saying false information does not continue.

On the other hand, it is the foundation's job to do fact checking before publishing or posting information online about climate change. Further, data verification is an important part of a good content creator's job especially on social media networks.

Regarding climate change, old people believe in conspiracy theory, it is the human nature thus elderly people need special handling when discussing climate change with them just like when dealing with children. As for youth they are the future, they have to be familiar with climate change and raise awareness among each other. Awareness resists sharing false information.

The familiar scientific sources must be known to the public. It is the role of the concerned bodies like the Ministry of the Environment to make statements of climate change issue to respond to misinformation.

It is significant to focus on Egyptian youth by showing examples of what they can do in real-ity hence promoting human stories on social media. For example, a project called "Sea Diaries", a partnership among Greenish - Egyptian NGO, Alexandria and Saida in Lebanon. This project is an invitation for people to come and tell what changes or consequences they face because of climate change. It is targeting late teens and late twenties individuals. A teenager and his father are telling a story of a place they used to go to, sit and do fishing on the seashore in Saida but now this place disappears and does not exist anymore because of climate change said **Alaa Eldeen**, social media director and visual communicator at Greenish Organization.

According to **Dr. Hussein Abaza,** senior consultant to the Ministry of Environment for Sustainable Development and former expert on green economy and climate at the UNEP to conclude, most of the time, audience's behavior is wrong in which he/she is in a hurry in sharing data. It is the public's role to follow a reliable media source or science-based outlet. However, the biggest part is on the media, it is the responsibility of media outlets more than the audience to enhance the quality of information or knowledge of climate change.

RQ2: What are the most widely types of climate change visuals used and the most climate imagery seen on social media in Egypt?

Climate Visuals (mostly used)	Climate Imagery (mostly seen) with a rank
1- Photos – including 3D, 360, computer generated images (animation)	1- Climate impact image
2- Videos – short clip and video-graphic	2- Climate image features human interest
3- Infographics	3- Climate solutions image - mitigation but mostly adaptation
4- Reels and cartoons	4- Psychological distant image

Concerning climate visuals, communicators mention other illustrations that are used like GIFs, reports, maps, timeline, archive footage, mini doc, charts, graphs, audio messages, graphics, virtual and augmented reality.

RQ3: What are the hinderances that prevent the presence of trained and qualified environmental journalists?

The present situation of environmental journalism in Egypt is not at its best. A hinder like the press institutions are not supported financially or technically enough by the government especially that youth are looking for more information and knowledge about climate change or the environment. However, some journalists participate in green jobs. In science journalism, all efforts of journalists are individualistic. There is no sustainable press institution model and most journalists go after what is trending and what sells.

Other hinders are that a lot of journalists don't have passion for investigative reporting. Nowadays, journalists' skills are not up to standard. There are no specialized journalists in Egypt so basically journalists can write in any field. Photojournalists are the most who suffer from a low salary. Press institutions lack interest in the environment because of the return back on investment since audiences who are attracted to science are little. Concern for the environment is only found in theses and research.

Furthermore, the Central Department of Information in the Ministry of Environment is responsible for the capacity building in media. At the end, it is related to science in which it is an interest so it is not easy to push someone to shift to be a science enthusiast despite of trainings that's why the number of environmental journalists is small in Egypt. It is also hard to address specific segments like children or youth when tackling climate related issues.

Dalia Abd El Salam, editor in chief of Scientific American (Arabic Edition) assured that back to 1999, there was a complete support from Environmental Affairs Agency to public newspapers like Ahram Hebdo dedicating a page or half a page for news and awareness about environment. There was a cooperation between international bodies such as Danish Auxiliary Agency and the Egyptian Ministries to offer TOT trainings and workshops for the environmental journalists. Regarding the delays of the presence of qualified journalists, journalists have language barriers and they lack research skills, absence of finance for foundations, and the environment is not a priority unlike now journalists seek online trainings or workshops and western opportunities scholarships.

Few journalists try to write about climate change issues but from a different side through the most important and exciting projects for example in 2016, the Rashid show in the Nile International Day. It is a play demonstrating river level rise and possible challenges we could face as one of Nile River countries, and the effect of the sea on the river, and pollution of the Nile. Sometimes, such site-specific performances are done in Breaking Walls Festival, a collaboration between international and local artists coming together in Cairo. Climate art includes theatre and not only a brush, graphic or graffiti.

On the contrary, lately, journalists started to show curiosity in environmental issues or cli-

mate change this is because it is related to economy. The economic factor is significant because the economic and environmental losses lead to crisis. Most climate finance is directed to energy sector. It is a matter of societal culture and the general system in Egypt began in backing climate related issues. Originally science journalism is a specialized journalism which use science communication to reach its audiences. In the near future, the mechanism of science journalism in Egypt will change due to artificial intelligence and digital journalism indicated by **Dr. Eman Abd El Azim,** member of the National Council for Climate Change and National Committee for Environmental Matters, and owner of the "Climate" - Environmental Mediator Initiative on Facebook.

RQ4: What are the obstacles and challenges communicators confronting during the coverage of climate events?

The obstacles are lack of funding and time since it takes a lot of time to develop a good story, use of unreliable technology, lack of organizations supporting the environment, and making visuals is costly. As for journalists, one of the obstacles is the absence of experience for covering forums or conferences, deficiency of training in content creation, no or less sponsorship to cover a story, and fewer public policies that backup science.

The bottom-up approach includes no science education, no societal awareness, and generally journalism does not go for science advocacy. It is essential to study your target audience in order to reach them, specify the message, and choose the most suitable tool to deliver it. When it comes to art, the importance of the movies needs to be spotted while handling a dilemma like climate change, for example, the movie "Don't look up". Theatre is vital for interaction. Society, politics, history and heritage all must be linked. The communicator has to be creative.

Other disincentive is the difficulty of accessing information or even its lack of availability or no access to updated data such as statistics or reports, inadequate publication of scientific research, the presence of climate deniers or skeptics, officials and decision makers do not speak to press, and there is no editor in chief who provide or dedicate space for science and environment.

Watter El Bahry, conservation photographer, senior ornithologist and bird guide assured examples of challenges faced by photojournalists, which can be field difficulties like off road, riding jets or water bike. Making a good photo or a visual cost a lot whence the use of equipment like cameras, and lenses. Studying and communicating with the local community to complete your story. Snowball technique in making new stories is the biggest challenge in addition to security clearances.

People who are living at the coastal cities are more in contact with the climate changes and much aware than others living in urban or rural. It is hard to discuss or communicate an issue like climate change in media. Sometimes, media can cause depression to the public and already public suffers from lesser awareness and hence later on this could lead to climate fatigue. Media should focus more on the positive side of climate change, giving hope to the public.

Another interesting communicator who is **Mohamed El Magrabi**, founder of the Science Museum added that the audience's interest and receptiveness to the content is the first barrier the communicator meets, also the medium, or tools and style needed to convey the message, for example the science show he does is about experiments, funny explosions and use of colors. Technically as a science maker, you might need materials, which are not available or expensive. In addition, when young audience who study science away from climate and environment specialization are exposed to incredible science information sometimes, they may suffer from climate fear.

For digital fabrication, that's not popular yet in Egypt, a security clearance is a must, to be able to use 3D printing, such clearance takes 3 months to be issued. At second, the little number of science communicators who are responsible to communicate science skillfully.

Additionally, poor communication among stakeholders is a hardship. The dynamic response locally and globally is significant especially during Corona virus or the Russian Ukrainian war. Rules and regulations of freedom of expression and speech can be a barrier for journalists when writing about climate change. Entities have to be committed in submitting regular reports related to climate because it is quite few recently.

Disputes confronted by communicators are increasing awareness, putting science communication in education, integration of youth, women and people with special abilities in the developmental process, and guaranteeing continuous participation of all segments of society in decision making. Furthermore, bring someone outsource to document, video shoot, or taking photos can be a challenge when covering a climate story. This person has to be good and honest. In social media, it is vital to announce about a certain event a couple of days earlier before going live in order to make sure that the material is seen. It is crucial to be aware of the algorithm of a social network. Concerning cluster posting, it makes no reach since the automation of social media forbidden it from happening however sometimes mass post is not an option. Being keen to post the material on time is very significant, not to lose the public's engagement.

RQ5: What are the external factors that affect climate change communication?

The external factors can be not having access to local data, have incomplete information , or data only appears in ministerial statements, less free exchange of data, less freedom of scientific research in the Nile Basin countries, gap between scientists and media people, not handling problems, and discussing it in depth with the public to reach solutions, and no vent for expression .The absence of a clear plan or strategy with a specific methodology on how to deal with scientific information in the media by the government and the concerned bodies.

Disinformation has a great impact on climate change communication in which the aim is to blur the fact that climate change exists. The private sector is always interested in profits so the government must work on priorities at the national level however the public sector is still based

on centralization and no feasible cooperation among entities and authorities. Less developed and developing countries obtain no compensation or low reimbursement to fix the damages of climate change in addition to allowing carbon trade.

Science journalists do not do their job correctly when writing climate news story in terms of communicating science and popularizing scientific terms. When it comes to geopolitics, the issue becomes a taboo like the Ethiopian Egyptian water problem. Furthermore, digital fabrication is a new technology to be adopted in the Egyptian market and hence Ministry of Education and Higher Education coordinate with FabLab company to implement this tech when science teachings in schools and universities.

Different stakeholders in distinctive sectors are involved in the process of affecting climate change communication through harmful practices that eventually lead to more carbon emissions. Less resources and unclear rules and regulations regarding establishing civil associations is an important factor which has an impact on climate change communication.

Other factors may comprise expensive solutions to solve problems caused by climate change, changing behavior and habits is difficult, and it is overwhelming to alter culture, a culture that is based on individualistic approach and not communal. Public commodity is less vital in Egypt said **Marwan Ramsy**, business and program development specialist at Greenish Organization.

The effect of the external factors can be positive for example presence of educated journalists, and science communicators, scientists need to communicate more with media people. Art is a tool that touches and moves audience's feelings thus story campaigning is important to be used while communicating science to the public. As a sort of restoration, decision makers support research and knowledge translation in order to get an effective outcome. The formation of public policies backing climate change communication is significant such policies urge climate action, help in achieving sustainable development goals and so contribute to less climate change. For instance, reduce emissions, save energy and water, create smart cities, and distribution of population in new cities, use of public transportation, and activating the role of civil society.

Likewise, the state direction and political determination play a part in the development of public policy, climate change awareness carried out by civil society taking into account different audiences, ease of communication, environmental education for children, and the extent of interest of press institutions in climate change issue. All these are aspects which have an influence on climate change communication.

RQ6: Does the application of the seven principles of climate change visuals for "Climate Outreach" ensures an effective public engagement?

According to Climate Outreach the 7 principles of climate visuals that guarantees a real public engagement and active climate change communication are showing "real people" not staged photo-ops, telling new stories, presenting climate causes at scale, climate impacts are emotionally powerful, demonstrating local but serious climate impacts, be careful with protest imagery, and understand your audience.

Some communicators added that social marketing can be one of the principles.

Seven principles of climate change visuals for "Climate Outreach"

Mentions	Principles
5	Showing "real people" not staged photo-ops
2	Telling new stories
3	Presenting climate causes at scale
5	Climate impacts are emotionally powerful
8	Demonstrating local but serious climate impacts
0	Be careful with protest imagery
8	.Understand your audience
4	All

Amr Sobhy, climate change advisor at Deutsche Gesellschaft Fur Internationale Zusammenarbeit (GIZ) implied that when discussing a local story for climate impact, the global relation needs to be spotted. It is much important to illustrate the global impact with the local because the community's issue is eventually connected to the world. While showing climate impact image using emotions, this may cause climate fear for some viewers. Concerning GIZ, currently it is tangled in an adaptation project called Nile Delta water management in association with the Egyptian government.

RQ7: Why the number of environmental pages or journals in Egypt is very small?

Science journalism is not sustained by the press environment in Egypt despite its important and rich topics, also there is no financial support. The more stakeholders (journalists, editors, and editors-in-chief) involved in the process, the better for regular science content production. **Hossam Emam**, climate change and sustainability advocate or activist stated that another reason is no education in which there is a lack of science journalism specialization in Mass Communication Faculties, or no science communication diploma provided by Ministry of Higher Education. Further, NGOs or civic organizations in Egypt are few in number as a result of low funding for local community.

Climate artists who use graffiti, and other types of arts like caricature to express the matter of climate change are increasing in number after the media frenzy about COP 27 and climate change. From other side, the government must work on how to communicate science for the public and assuring that the science information or data is correctly reaching to the audience, trying to fill or narrow that gap between scientists and media.

Besides, there is an expectation of establishing and opening new science or environmental pages or magazines especially after the recent climate related events, however this is just a speculation and not certain. On the contrary, scientific writings by journalists were boosted in number only during COP 27 as if it is a trend and then it dropped significantly locally which is not an idealistic scene. Covering everything related to the environment is still an individual effort by science journalists.

Central Department of Information in the Ministry of Environment is responsible for capacity building in which offering training to science journalists, and writers who are interested in science, and science communicators. Other point of view emphasizes on the importance of the duties of climate ambassadors to convey the message to the public. There is also an Environmental Mediator Initiative on Facebook, that has a stronger effect than word of mouth because it uses videos, climate visuals, audio clips since it is easy to disseminate among online users.

Conclusion

To sum up, sharing climate change information on social media requires attribution to trustworthy institutions like UNFCCC, the Ministry of the Environment, and scientists or experts. Public should also use art, tools, and human capacity to raise awareness. In Egypt, '350 Earth' celebrated Earth Day with a massive art piece, showcasing solar energy power. Online public spheres can create closed groups, allowing for mal-information and rumors. Public policies support freedom of expression and speech, and campaigns can help combat rumors. Media literacy is crucial for understanding climate change, and digital literacy and pressure groups can affect audience approach. Social media networks are updated more than websites, and the public is aware of official pages like UN Climate or IPCCC. Scientific bodies are responsible for publishing true information, and foundations must verify data before publishing information. Elderly people need special handling when discussing climate change, while youth should be familiar with climate change and raise awareness. Concerned bodies like the Ministry of the Environment should make statements to respond to misinformation.

Environmental journalism in Egypt faces challenges such as lack of government support, lack of interest in investigative reporting, and a lack of specialized journalists. The Central Department of Information in the Ministry of Environment is responsible for capacity building in media, but it is difficult to push individuals to become science enthusiasts. The number of environmental journalists in Egypt is small, and it is difficult to address specific segments like children or youth when tackling climate-related issues.

In 1999, the Environmental Affairs Agency provided support to public newspapers, but there is a lack of qualified journalists, language barriers, research skills, and funding for foundations. Journalists are now seeking online trainings and western opportunities scholarships. However, some journalists are focusing on climate change issues through projects like the Rashid show in the Nile International Day and the Breaking Walls Festival.

In the future, the mechanism of science journalism in Egypt will change due to artificial intelligence and digital journalism, as suggested by Dr. Eman Abd El Azim, Member of the National Council for Climate Change and National Committee for Environmental Matters.

At the end, the challenges faced by science communicators in addressing climate change include lack of funding, time, unreliable technology, and lack of organizations supporting the environment. Journalists also face challenges such as lack of experience, lack of training, and fewer public policies backing science. The bottom-up approach lacks science education and societal awareness, and often does not advocate for science. To effectively communicate climate change, communicators must study their target audience, specify their message, and choose the most suitable tools. Access to information, inadequate publication of scientific research, and the presence of climate deniers or skeptics also pose challenges. Photojournalists face challenges such as field difficulties, high costs, and communication with local communities. Media should focus on the positive side of climate change and provide hope to the public. Additionally, poor communication among stakeholders and the dynamic response during the Corona virus or the Russian Ukrainian war can also hinder communication.

External factors affecting climate change communication include limited access to local data, incomplete information, and lack of free exchange of data. Disinformation and a lack of clear strategies by governments and concerned bodies also contribute to the issue. The private sector's focus on profits and centralized government structures hinders cooperation. Science journalists often fail to accurately communicate climate news, and geopolitics can make the issue taboo. The Ministry of Education and Higher Education in Egypt is collaborating with FabLab to implement digital fabrication technology in science teachings. Other factors include lack of resources, unclear rules, expensive solutions, difficulty in changing behavior, and a culture based on individualism. However, positive factors include educated journalists, science communicators, and the use of art to communicate science. Public policies supporting climate change communication, such as reducing emissions, saving energy and water, creating smart cities, and promoting civil society, can also contribute to effective climate change communication.

The limitation of this paper is that it is conducted only in Cairo, Egypt. The sample is non-random – purposive which means that results can not be generalized. Another detain in this paper is the lack of Arabic academic studies about climate visuals or climate change imagery and its relation with public engagement.

As a conclusion, science journalism in Egypt faces challenges due to lack of financial support, lack of education, and limited funding for local communities. Climate artists, who use graffiti and caricature to express climate change, are increasing. The government needs to work on communication and ensuring science information is correctly reaching the audience. There is speculation of opening new science or environmental pages or magazines, but this is not certain. The Central Department of Information in the Ministry of Environment is responsible for capacity building, offering training to science journalists and writers. Climate ambassadors play a crucial role in conveying messages to the public.

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