

Exploring the Scientific Model for Constructing a Platform for the International Communication of Pingjiang Opera

Jing-jing Wu¹, Weibo Dang²

Abstract

Considerable changes have occurred in many areas of science and technology as a result of the current information technologies' quick development and use. Specifically, new theories in mathematics have surfaced; they may be used to construct and refine current mathematical models of different processes and objects. Regulatory and permitting decision-makers are worried about the ambiguity surrounding the possible environmental consequences arising from the introduction of these innovative devices in coastal and riverine ecosystems as research and testing of maritime energy devices progress. The Triton Initiative conducts studies and makes suggestions for environmental monitoring techniques and technology to give industry stakeholders with the information required to approve maritime energy system testing. The efficient distribution of research findings is crucial in enhancing data accessibility for stakeholders who might use the information to make informed policy choices. Nevertheless, there are few frameworks available for carrying out scientific communications related to marine energy projects. Using the Triton Initiative's pilot scientific communication program as a case study, we discuss methods, resources, and strategies for creating a science communication framework for marine energy projects or other related fields of research in this article. This article uses the historic Pingjiang Road in Suzhou, China, as a case study to investigate how, in the era of globalization and digital media, urban spaces that have been revitalized for historic and cultural consumption may demonstrate the publicness or potential capacity for publicity.

Keywords: *Rapid Development, Pingjiang, Urban Space, Triton Initiative's, Monitoring Technologies, Mathematical Models, Industry Stakeholders, Public Space, Publicity.*

Introduction

Data is the primary commodity in the era of information technology, and in firms that are driven by data, having more data usually results in more value generation. The International Data Corporation (IDC) reports that in 2010, the quantity of digital data created exceeded one zettabyte. Moreover, since 2012, 2.5 Exabyte's of additional data have been created every day. By 2020, according to Cisco, there will be almost 50 billion linked devices worldwide. The Internet of Things (IoT) is made up of these interconnected gadgets, which might produce enormous amounts of data. The present mobile network designs will struggle to handle the pace and magnitude of data with this enormous volume of data [1]. The majority of data that is needed for storage, analysis, and decision-making in modern cloud-based application deployments is delivered to cloud data centres.

Advanced technologies give rise to intricate technical, economic, educational, and societal issues that need supplementary expertise. As a result, the educational system requires scientific and pedagogical personnel with the training and competency levels necessary to fulfil modern standards. Graduate students must learn about facts, occurrences, [1, 2], and processes as well as the origin, evolution, and patterns of scientific findings [2]. They must be familiar with current scientific theories, research methodologies, and many subfields within the relevant field of study. A significant component of contemporary scientific inquiry is mathematical modelling.

Scientists had to come up with mathematical models, figure out the fundamental patterns of the phenomena they were studying, and design efficient numerical algorithms to handle complex problems [2, 3]. The interconnected process of developing mathematical representations, numerical algorithms, developing and creating complex programs for solving these issues along with their analysis, storage, and output of the results of calculations served as a basis for fresh perspectives in scientific research. In turn, implementing

¹ International College, Krirk University, Bangkok, Thailand, Email: 452740223@qq.com, (Corresponding Author)

² International College, Krirk University, Bangkok, Thailand

of these techniques on computers has led to the creation of fresh programming languages, computer operating systems, and software support systems, [4], as well as new approaches in programming and information technology. The theory of novel information operators is one such avenue in mathematical modelling [4, 5].

Technological Advancements Drive Shifts in Scientific Communication

Science has traditionally advanced most quickly when its members can effectively disseminate their findings to other scientists and laypeople who are eager to apply these findings to new practices and technologies. The communication network relied on laborious manual copying of scientific books for centuries, which made it very sluggish. In the few institutions that existed at the time, most communication was oral and mostly local [5, 6]. A significant advancement in communication was made possible by the printing press, which made it possible to reproduce monographs at a reasonable cost and develop more structured channels of communication like academic journals that are published on a regular basis [6, 7]. Simultaneously, scientists organized learned organizations, the primary goal of which was to promote the dissemination of information.

The 20th century saw a sharp rise in the number of scientists as research was acknowledged as a key factor in economic progress. Because of the greater opportunities for travel, conferences emerged as a significant means of communication in addition to journals and monographs. Information technology had a significant influence on the scientific publication process in the second half of the 20th century [8, 9]. It first made it possible to create bibliographic data databases, which made it much easier to find relevant articles. Second, word processing made both drafting manuscripts and managing them throughout the printing process more efficient.

A computing paradigm closer to connected devices is necessary to handle the challenges of high-bandwidth, geographically scattered, [10], ultra-low latency, and privacy-sensitive applications. Both business and academics have advocated fog computing as a solution to the aforementioned problems and to satisfy the need for a computing paradigm that is closer to networked devices. By providing computation, storage, [11], networking, and data processing on network nodes near IoT devices, fog computing fills the gap between the cloud and IoT devices. When a result, when data goes from IoT devices to the cloud, computing, storage, networking, decision-making, and data management take place along the way.

The technique of assigning each pixel in a medical picture to one of the predetermined categories is known as semantic segmentation. For instance, a patient's CT case is used as input in the semantic segmentation of liver tumour job to determine which category—such as background, liver, or lesion—each pixel in the CT picture should fall into [11, 12]. The objective is to comprehend every pixel in the picture semantically in order to identify Regions of Interests (ROIs) in the picture, [13], such the liver, pancreas, and tumour, which may assist medical professionals in analysing just crucial portions of the image that are challenging to diagnose.

With the exception of conventional information push channels like websites and WeChat platforms, there hasn't been much innovation in opera culture transmission techniques in the past. Links to specialized opera-related material may also help the audience comprehend opera performances. The transmission of opera culture is restricted by its uniqueness and limitations, which also make it more difficult for the general public to consume mass entertainment. Disseminating opera culture should be close to life, adapt to the times, and reflect the aesthetic preferences of the general audience with regard to plot and performing style [14]. It is vital to concentrate on the state of opera growth from a cognitive and mental standpoint, as well as the means of opera transmission. Using public media art as a foundation requires producing interactive pieces that invite public participation and emotional exchange.

A Digital Twin-Based Algorithm For 3D Transformation

Opera Culture Dissemination

The early 20th century saw a very positive trend in the cross-cultural adoption of Chinese opera. Among them are several distinguished Chinese intellectuals and opera artists who are both patriotic and skilled in Chinese opera. It's also because, although causing the Chinese people unending misery, the ongoing battles throughout this time also opened up China [15]. This makes it possible for visitors from the West to visit China and makes it easier for Chinese citizens to go elsewhere. At last, Chinese opera has found a platform on the Western stage to showcase its distinct appeal. Chinese opera is often referred to as opera. Three distinct art genres make up Chinese opera: burlesque, rap, and folk song and dance. It is a full stage art form with a lengthy history that evolved from simple singing and dance. Text communication was the primary means of cross-cultural Chinese opera communication at this time.

Possibility of Integrating Chinese Opera Cultural Platform with Digital Twin

A new wave of industrial transformation and technical revolution has evolved in recent years with the growth of information technology. It encourages intelligent manufacturing to grow into a necessary trend in the industrial sector's growth. The digital twin has garnered significant attention in the field of intelligent manufacturing as the most effective means of achieving the integration and interplay of information and physical space [15, 16]. Digital twin technology is still only being researched theoretically, however. The investigation and practice phases of the digital twin application study are also ongoing. A digital twin is a simulation technique that fully utilizes operational history, sensor updates, physical models, and other data to incorporate Multiphysics, multiscale, multiprobability, and interdisciplinary simulation. It completes the mapping in the virtual environment, mirroring the whole physical equipment life cycle.

Developing a Digital Twin-Based Opera Culture Platform

Three areas may be identified by the practical layout of the digital service platform: instructional support, experiential learning, and management and promotion [17, 18]. The opera cultural educational administration sub-platform, the opera culture teaching support sub-platform, and the learning experience sub-platform are therefore the three modules that make up the platform. It systematically optimizes the administration and development of opera culture and supports the growth of associated opera cultural works via the building of three modules. In order to further the advancement of traditional culture dissemination education, it enhances students' exposure to and interest in traditional arts.

Principles of System Design

- *Consistency Principle:* In general, the principle of consistency states that in order to facilitate the promotion and upkeep of the platform, different user terminals and modules should be exceptionally uniform when it comes to of design concepts, model architecture, data standards, etc. during the platform design and development process.
- *Targeted Principle:* Better outcomes can only be attained by encouraging users to impromptu into the scenario. Thus, while the technical requirements and "situation" are consistent, the various demands of various users should also be taken into account throughout the design process. Diversification and pertinence should be prioritized in the operating interface and user management in order to cater to the various users' attention and habits.
- *Interactivity Principle:* One of the cornerstones of digital platform design is good interaction. The interactive function should be emphasized in order to fully use the situational benefits and depend on the Internet and mobile platforms for design and development. The key features of this platform's design and development, which is based on the situational education theory, are its interaction and experience functions.

System Architecture Design

The web terminal management backdrop and the mobile terminal application (APP) should serve as the foundation for the construction of the opera culture digital platform. Students will study and comprehend opera culture more fully thanks to the mobile application, which may assist the subject matter expert in carrying out their teaching duties more successfully [18]. The organizer may upload the ready-made opera cultural materials via the platform system's website, and people can study using their phones by following a few easy steps, as seen in Figure 1.

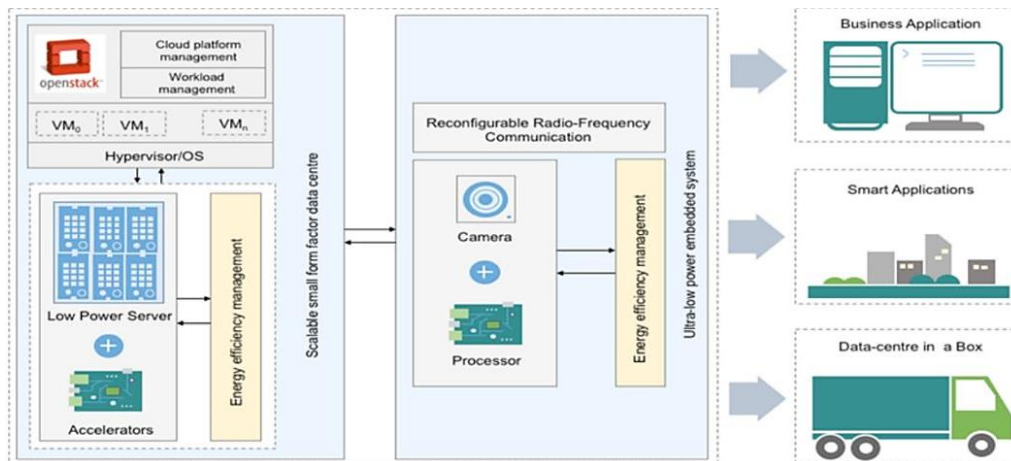


Fig. 1 Design of System Architecture.

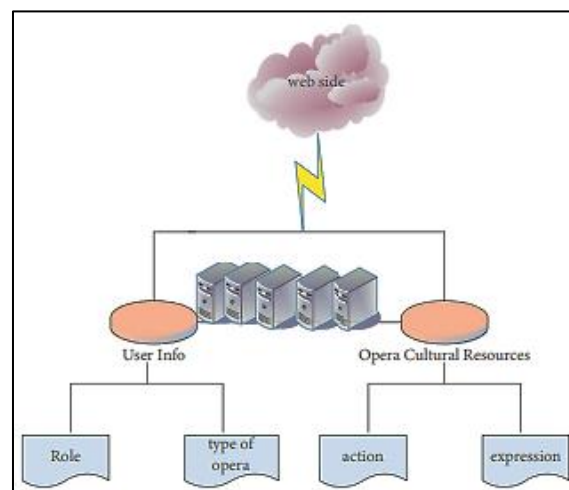


Fig. 2 Functional Flow Chart on The Web.

The management learning and teaching are the primary players in the opera entering the campus, as shown in Figure 2. As a result, the system of the digital platform's mobile terminal has to be created with the requirements of various users in mind. Of these, the major management body mostly uses the web terminal to handle the opera culture's resources.

Sichuan Opera as an Example: Platform Functional Specifications and Implementation

The system should feature experience upper management, real-time experience, and experience communication functions via the Sichuan Opera user experience platform's functional framework.

Function of Experience Management

The system's function is tailored to the requirements of the subject matter being taught. Through the terminal, the teaching subject may carry out the appropriate management control on the immersive module. It mostly entails setting up the data resources needed for the multimedia project and updating the data on a regular basis, such Facebook and attire. It adapts multiple unique experience kinds according to demands, gathers experience emotions, and resolves issues in the experience in addition to Sichuan Opera face-changing and the Sichuan Opera costumes.

Experience Function in Real Time

The system's primary purpose is to carry out this duty. The subject of instruction may utilize it to engage with relevant material based on individual interests and can also use it to gain experience. It mostly contains unique experiences such as dressing like a Sichuan opera, face-changing like a Sichuan opera, and other unique experiences. Face-changing art is more important in the promotion of Sichuan Opera since it is the core of the art form. To allow people to choose the experience they want, it will be offered apart from the distinctive Sichuan Opera experience.

The Function of Interactive Communication

This feature allows the teaching subject to communicate with the subject of teaching about the particular scenario of a particular material and to exchange sentiments with each other based on the experience situation. The topic of instruction provides answers to the topic's queries. This role is crucial for instructors to guide and manage the learning process in the well-liked Sichuan Opera situational education activities [19]. It mostly consists of experience forums, post-experience messages, experience material bombardment exchanges, etc. The features of data resource allocation and update, experience content setup and modification, experience information statistics, and experience exchange management must all be included in the experience management module.

A vital first step in achieving a future powered by renewable energy is the development, testing, and validation of technology capable of converting and delivering electricity from the ocean to the electrical grid. Cycled testing and performance assessment in open water coastline and tidal settings are necessary for the development of new maritime renewable energy sources and the ongoing enhancement of already-existing equipment. The unclear environmental implications of innovative marine energy sources and the geographical overlap of these electromagnetic surroundings with significant marine species habitats, however, worry regulatory and regulatory decision-makers. The Triton Initiative's Triton Field Trials (TFIT) activities, which are covered in this specialized publication, provide suggestions and use cases for tracking environmental technologies and procedures related to the deployment of marine energy devices. In order to help industry developers, investigators, and the regulatory community by providing meaningful and cost-effective data collection to support future permitting and licenses of future renewable energy projects, the suggestions should include examples of monitoring applications of technology at marine energy sites.

Triton modified the project website and launched a Triton tales blog to provide tales and information about the organization's researchers and projects in order to show the value of a communications program. The purpose of these tales was to inform, enlighten, and build an audience. By relating technical developments in maritime energy environmental surveillance to the researchers studying the subject, the tales gave the website a personal touch. There was a noticeable rise in website traffic after the publication of three Triton Stories over a period of several months. The capacity for management and financial sponsors to monitor Triton operations and link the study's progress to the team was one of the other value-added features. Members of the Triton team were able to distribute links among themselves, raising awareness among academic audiences and paving the way for more partnerships and collaborations. The project functioned as a proof of concept for creating a formal task devoted to outreach, communication, and engagement, with the goal of informing and linking players in the marine energy business to Triton's research.

Objectives Of the Study

- Carry out a thorough investigation to pinpoint the communication obstacles that now impede Pingjiang Opera's global distribution.
- Examine the tastes, expectations, and demographics of possible foreign Pingjiang Opera audiences.
- Assess current multimedia tools, digital platforms, and communication technologies that may be used to promote Pingjiang Opera globally.
- Uses language localization techniques to ensure that platform content is relevant and accessible to users worldwide by translating and localizing it into different languages.

Literature Review

(Bai, B., 2023) [20] A strategy for incorporating knowledge graphs into the analysis of Chinese culture is suggested in order to use them in a fully developed, freshly built application. The fusion of information technology and culture is now popular. Knowledge graphs are one of the most promising options available in terms of technology. The following are the contributions made by this paper: It creates a domain knowledge base, offers a knowledge graph in the cultural sector of Beijing, the historic capital, for the first time, and builds a platform for interactive question and answer and visual analysis. This procedure summarizes a framework for using knowledge graphs in cultural research and offers suggestions for future cultural research.

(FAN, J. 2022) [21] Because of the close relationship between the innovation and industrial chains in the big science age, the underlying logic of the "linear model" and the "Pasteur's quadrant" is continuously evolving. Global scientific research is progressively moving toward the systemic integration of diverse components and the cooperative interaction of novel topics. SIAT focuses on developing a closed-loop ecosystem of the innovation chain and industrial chain based on a thorough examination of the linear model and Pasteur's quadrant. SIAT has created a "butterfly pattern" by combining science and industry from conception to advancement. This pattern combines and reconstructs the "0-1-10" at the vertical level and consolidates the "10-∞" at the horizontal level via intricate cross-border element interaction. Additionally, SIAT has conducted additional methodical research and practice, which has successfully aided in the development and growth of new sectors and forms.

(Tang, L., 2023) [22] Community practices is an efficient platform for the professional development of teachers, and it plays a significant role in enhancing talent nurturing and increasing teaching efficiency. English Teaching of selected Chinese Culture, a college English cross-cultural communication naturally, adopted Kolb's Experimental Learning Cycle Theory to build and run communities of practice on teaching and research projects, with the goal of promoting "mutual engagement," "joint enterprise," and "shared repertoire" as a viable approach to its faculty professional development. Communities of practice had varying but beneficial effects on faculty members' professional development in terms of conducting teaching reflections, updating teaching practices, and putting teaching research into practice. The results of these follow-up case investigations with professional development for teacher's consequences, reflected journals, and interviews were anticipated to provide some insight into teacher professional development practices.

(Qiu, Q., 2021) [23] The tourist sector pertaining to Intangible Cultural Heritage (ICH) is experiencing growth, with social media playing a crucial role in advancing this trend. Even though ICH tourism is developing remarkably in China, non-Chinese speakers find ICH difficult to grasp due to the language barrier and social media use restrictions. This research uses text analysis to examine the organization and connections between cognitive components of ICH tourism using 9074 blogs that were posted on Weibo.com, one of the most widely used social media platforms in China, between 2011 and 2020. Semantic

network analysis, dimension categorization, and matrix building made up the primary analytic procedure. The research revealed seven characteristics that may be used to categorize the cognitive picture of ICH tourism on social media: institutions, ICH and the inheritors, tourist goods, customary occasions and times of year, tourism infrastructure and amenities, visitors, and locations.

(Giordano, S. 2017) [24] Western operas have gained a reputation for being highly respected internationally, and in recent years, producers and performers have relocated to opera houses all around the globe. However, opera has never been examined in terms of methods to support this career path in accordance with the growth of non-European developing markets. When it comes to building expansive theatres that can present both Western opera and a robust local opera heritage, China is one of the most advanced.

(Hong, X., 2022) [25] The prospects of augmented reality (AR) for the preservation of national cultural art, encouraging the use of Chinese instruments for music among young people, and satisfying tourists' curiosity about China's cultural legacy in an interesting interactive format are examined in this article. The authors have created an augmented reality application that is suitable for both educational and tourism reasons, using the database that was created with details on the historic musical instruments of the Guizhou region. The main objective was to introduce people to traditional Chinese musical instruments while also introducing them to Chinese national culture. Students from Guizhou Minzu University College of Tourism and Steward, College of Media, College of Music and Dance, and College of Data Science and Information Engineering tested the developed application as part of the National Cultural and Visual Arts study obviously.

(Wang, Z. 2015) [26] In Chinese universities and colleges, video resources are widely used in EFL instruction for students who do not major in English. However, there are many sensitive concerns in classroom practice that need careful consideration and reflection because of the practice's inadequate theoretical underpinning. In an effort to facilitate EFL instruction for non-English majors, this paper first explores the objectives of using video content in EFL classrooms and the benefits of video content in EFL teaching. Based on this exploration, a framework of teaching principles, strategies, and advice on particular techniques of using video content is proposed.

(Deng, J., 2023) [27] The unique phantom manufacturing and image production of short videos have drawn a lot of users. However, because data collection and analysis are limited, the process of creating short videos has not received sufficient consideration, which has led to an improvement in dissemination efficiency that still primarily depends on improving marketing strategies. It should be highlighted, nonetheless, that marketing will become less and less successful over time. After all, only excellent short films will keep viewers interested as traffic advantages vanish. Meanwhile, considerable progress has been made in eliminating duplicate data and providing causal interpretability in data analysis thanks to recently established causal reasoning, which has opened up a new avenue for examining the causative elements impacting the effective distribution of short movies.

(Zhu, Y. 2022) [28] In order to strengthen its soft power in the face of international competition, the Communist Party of China (CPC) and the government have placed a greater emphasis on China's cultural projection during the last ten years. Using CCTV-9 and China Global Television Networks as two case studies, this chapter explores the ways in which China's media organizations shape the country's modern identity (CGTN). It examines the discrepancy between the regime of cultural regulation and its execution in state media using document analysis, in-depth interviews, and participant observation, bringing into consideration the interactions between broadcasters, governmental authorities, producers, and global audiences.

(Wu, K. 2023) [29] This research explores the complex relationship between innovation and tradition in Chinese youth musical theatre, providing insight into the genre's creative development and educational significance. It presents musicals as effective means of encouraging young people's creativity, critical thinking, and social skills. These performances, which are adorned with state-of-the-art technical innovations and a rich fusion of creative components, emerge as forums for international cultural exchange and resonate with the changing social and educational environments.

(Meng, X., 2020) [30] The idea of national image is multifaceted, intricate, and loaded with meaning. It is made up of smaller pictures that depict the public, government, economics, culture, and security of a nation. There are many different ways to convey Chinese culture via symbols. A certain cultural symbol may be used over a given time period to support one sub-image while simultaneously working against other sub-images, particularly the core image. Cultural artefacts like as the Terracotta Army and displays of the imperial court, for instance, are important in creating the impression of "an ancient civilization."

Method

The following communications objectives were established by Triton using the project mission and purpose as a guide for creating a framework:

- Raise public knowledge of marine energy and the environmental monitoring studies being conducted to lower obstacles obtaining marine energy system permits;
- Create and improve strategies to notify interested parties about Triton's research.

Following goal-setting, the Triton team identified success indicators based on targeted, prioritized audiences and the channels and content that would best serve them [31]. In order to enhance information accessibility and organization on the many initiatives under Triton, a general website upgrade was part of the communications channel development process. In order to reach more people and amplify information, we also made advantage of the social media platforms that Triton's parent company, [31, 32], Pacific Northwest National Laboratory (PNNL), already uses. We have introduced events like conferences, webinars, and podcasts to broaden and vary our reach. We created a newsletter highlighting Triton's research endeavours' that was sent on a monthly basis to a subscriber list. Finally, via the monthly Triton Stories blog, the team consistently made information on Triton's research and crew available. A communication strategy that defined how related activities would engage with target audiences carefully articulated these efforts [33].

With assistance from a sibling project, Ocean Energy Systems–Environmental, which primarily focuses on data exchange and outreach to marine energy stakeholders, the Triton interaction team mapped target audiences [33, 34]. The intended end-users of Triton goods were also identified with the assistance of outreach collaboration with partner organisations and strategic discussions with the project sponsor. During this approach, research partners, stakeholders in marine energy, and general audiences were selected as Triton's primary audience groups. Table 1.

Table 1 Important Audiences for The Triton Initiative.

Audience Group	Target audience members
Research Partners	Members of the federal, state, and private sectors of government.
Marine Energy Stakeholders	Developers, legislators, regulators, consultants, and end users of marine energy.
General Audience	Public interested in science, non-profits, residents living along the coast, proponents of the ocean, and towns and businesses having close links to sites used for marine energy testing.

Audience Analysis

The process of identifying and comprehending priority audiences, including their responsibilities, levels of expertise about study subjects, [35], and interests, is known as audience analysis. One approach to include important audiences and get input is via online questionnaires.

- *Website*

In the digital era, a web presence is often a fundamental and crucial building piece for promoting a communication strategy. Websites are primary stores of information. Having an internet presence makes it easier to address the problem of providing non-scientist audiences with affordable, easily available information. In order to increase visibility and facilitate the creation of new websites, the communications activities and channels were executed starting with website modifications and the project's migration from a tiny, stand-alone website to a project page on PNNL's central platform.

- *Triton Stories Blog*

A blog may help maintain audiences interested, update websites with fresh or relevant information, and further the goal of the program as a whole. They also provide a chance to add a human aspect to a website devoted to science and technology and explain technical research or technological themes in easy terms.

- *Newsletter*

Delivering comprehensive project information and resources and interacting with self-selected audiences are made possible by newsletters. A subscription form was used to gather newsletter subscribers, and it was advertised via reaching out to stakeholders directly, posting on social media, and using a website lead generator. In order to classify subscribers for audience composition monitoring, the form requested the subscribers' name, email address, and affiliation.

- *Social Media*

There are many different ways that different audiences choose to get information, including via informal, non-technical channels like social media. Reaching important stakeholders using social media at a reasonable cost might help to further promote high-investment projects like blogs or videos. Using PNNL's platforms, Triton created a social media presence on Facebook, Instagram, LinkedIn, Twitter, and Facebook. Project-related material was scheduled on Sprout Social media and uploaded on a regular basis (bi-weekly to monthly). Posts included links to website information, highlighted Triton's research, monthly Triton Stories, and included PNNL's audiences in the project's goals.

- *Webinars and Presentations*

Key outreach and engagement initiatives included webinars, seminars, and presentations by Triton researchers and the communications team in order to customize message for particular, targeted groups and provide chances for candid conversation and survey-based feedback. The project website included recorded films as freely available materials, and these events were publicized via social media, the newsletter, and the website.

Results

Growing interest in Triton's research findings has coincided with current developments in marine energy technologies, particularly from non-science audiences. Preliminary results from Triton's first trial launch of three Triton Stories in July 2020 included higher website traffic and increases in page views that corresponded to the publication dates of the Triton Stories. Owing to this uneven performance, there was want to expand communications activities more thoroughly and strategically. Triton started constructing

the communications structure, which expanded to include social media, a newsletter, monthly scientific blogging, website growth, and audience survey work.

Thirty percent of the respondents (n = 20) to Triton's poll on the "Collaboration for Marine Renewable Energies Environmental Monitoring Regulations" workshop were developers, twenty percent were researchers, and twenty percent were consultants. The other respondents were policy leaders, agency employees, or members of the industry. Consultants were identified as active players in this role composition and were subsequently included as an intended audience. Regarding Triton's mission's end customers, 25% of the respondents were engaged in environmental permits, and 40% were in some capacity with environmental impact assessments.

Despite the fact that decision-makers were adequately represented, 26% of respondents had never heard of wave energy devices, and 54% had never heard of tidal devices (fig. 3). Regarding the subjects of Triton's marine energy research, the respondents knew the least about electromagnetic fields (32%), more than half knew about the effects of noise from the water (58%), and 42% knew about habitat changes associated with the deployment of marine energy devices. One respondent said, "It's the cost of such instruments and technologies that needs to be brought down significantly," in answer to a question about the need of instruments for monitoring. This comment, where possible, guided study decisions. For instance, the TFiT underwater noise research team's pursuit of low-cost hydrophone technologies for their field testing was motivated by the need for cost-effective equipment; this factor will continue to influence the selection of equipment for future projects.

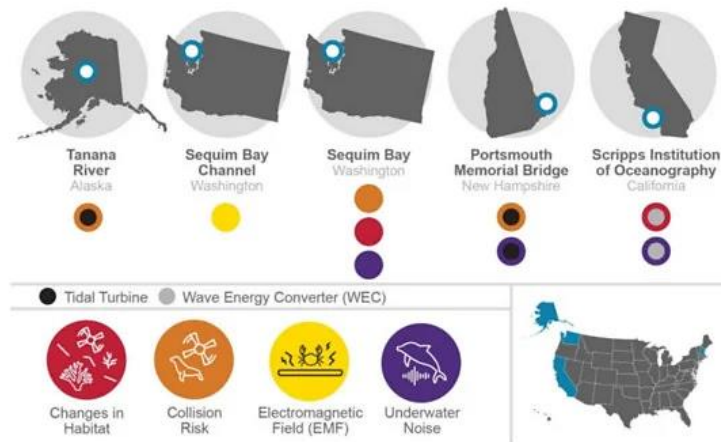


Fig. 3 Triton's Selection of Social Media Postings Examples Include.

Table 2. Triton Social Media Analytics Summarized by Platform for The Period of November 2020–September 2021.

Social media platform	Number of Post	Total impressions	Av. Impressions/post	Total triton link clicks	Total Engagements
Facebook	18	21,263	1821	154	1008
Twitter	27	18,165	684	ND ¹	941
Instagram	16	59,164	2296	589	976

LinkedIn	18	78,265	2876	79	289
Total	79	1,76,857	ND ¹	822	3214

Industry-specific open and click-through rates vary significantly; government organizations often have open rates of between 20 and 25 percent and click-through rates of between 1 and 2 percent. The average open rate for Triton's newsletter was 50.5%, whereas the average open rate for government publications was 25.5%. The Triton newsletter's click-through rate of 27.6% above the industry average of 3.9%. Data on subscribers, open rates, and click-through rates for each month from all Triton newsletters released between March 2021 and September 2021 is shown in Table 3. The newsletter served as a useful medium for introducing the Triton Stories blog to important audiences, and its distribution dates coincided with increases in the blog's website page visits.

Table 3 A Monthly Overview of Triton Mailing Stats from March 2021 to September 2021.

Month	March	April	Special Issue	May	June	July	August	September
Subscribers	59	82	85	98	102	112	114	162
Open rate	28%	49.6%	54.6%	41.6%	54.9%	39.4%	42.6%	68.9%
Click-Thought	41%	32.6%	18.9%	25.6%	32.6%	20.9%	25.6%	35.9%

Discussion

Formulating a Project Objective and Why

The goal and aim of a project should act as a communication compass. Research projects often begin with a proposal that explains how and why the study will address a difficult subject. Establishing project objectives and outlining the significance of the study to the funding organization or project sponsor are steps in the proposal process [36]. The early stages of meaning identification are also crucial for providing guidance for communication initiatives. It is possible for a project's scope to vary, therefore its goal must be flexible.

A project's communications strategy should change along with its goals and objectives. It may be very expensive, time-consuming, and resource-intensive for research programs that are not well-established or integrated into a larger organization to implement a framework and create subsequent material. Regardless of the scope of a communications campaign, the processes in Triton's architecture assist in selecting platforms and material [37].

It is advised to begin modest and expand gradually. Building a website that showcases the team and the goal of the project, starting a newsletter, putting a lead generator on the website to gather email addresses from newsletter subscribers, and curating content for a single social media platform are a few examples of starting small. It might take many months to a year to organize and construct these fundamental elements of communication. For instance, Triton Communications began with a few blog posts and an already-existing standalone website. A few months passed while the communication program was being worked

on, [38], updates were made to the website, and further tales were posted and featured on PNNL's Instagram account. As Triton gathered traction, it spread to more PNNL social media channels and produced enough material for a monthly newsletter.

Conclusion

We want to enhance our scientific communication strategy by using the Triton communicator's framework to draw from the corpus of current research in fields like marketing, public relations, communications theory, and social sciences. Triton is a large-scale investigation that has shown how effective a communications framework can be for involving important stakeholders, disseminating findings, and achieving project objectives. For the remainder of the decade and beyond, Triton will continue to benefit from this framework as further studies on maritime energy and environmental surveillance are conducted. We plan to provide tools to marine energy research projects and other groups aiming to improve scientific communications by making the early findings and outputs of the Triton communications architecture publicly accessible.

Compared to other renewable energy sources like offshore wind and solar, the marine energy market is still rather modest. We suggest that those who are enthusiastic in engaging and promoting marine energy issues get together to work together in partnerships.

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