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## Generative AI for (Forecast) Innovation of Marine Spares – Will it be a Game Changer for better Operational readiness of Indian Navy

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### Abstract :

Generative artificial intelligence (AI) is revolutionising the use of AI in innovation management and may significantly change the way how we work and innovate. This paper attempts to highlight how large language models (LLMs), such as generative pretrained transformer (GPT), can augment speedy early phases of innovation, in particular, exploration, ideation, and digital prototyping. The work on this paper is a fallout of work done on experimenting with LLMs, and we share the initial experiences and concrete examples of AI-assisted approaches. The paper highlights a plethora of use cases for generative AI. Moreover, the Authors argue that, generative AI may become a game changer in early prototyping in Marine domain as the delegation of tasks to an artificial agent can result in faster iterations and reduced costs. Our experiences also provide insights into how human innovation teams purposively and effectively interact with AIs and integrate them into their workflows.

**Key words:** AI-augmented innovation management, artificial intelligence (AI), digital prototyping, generative AI, idea generation, innovation, large language model (LLM), need identification, no-code prototyping, UX/UI

### Setup

1. In the Indian Navy, innovation is driven at all levels and steered by the Directorate of Indigenisation which has offices at various theatre commands and undertakes indigenous development of complete equipment/sub-assemblies/ components beyond the delegated financial powers of Commands, in consultation with the Professional Directorates. Since product development is a highly technically challenging and professional task, the multitude of agencies in development of equipment and systems for the Naval platform is not only within

the Navy, but also outside the Navy, and demands a very high degree of patience, perseverance and deep understanding for the equipment/sub system to function effectively in the most demanding marine environment.

2. We are witnessing an unprecedented global phenomenon of end-users and employees experimenting with AI to boost productivity. Historically, AI has been deemed suitable for analytical tasks [1], [2]. Creative and generative tasks, however, were thought to be reserved for the beautiful minds of human beings. A study conducted among innovation managers a few months before the barnstorming rise of GPT-3 in the last quarter of 2022 revealed that the idea generation, idea evaluation, and prototyping were considered the least important areas for AI application in the innovation process [3]. Within months, the emergence of transformer language models and generative AIs has changed this perception, and the use of AI in creative tasks, such as idea generation, has moved to the center of attention of both practitioners and academics [4], [5], [6]. Despite the hype about and widespread experimentation with ChatGPT, research on the use of generative AIs in the corporate world is still scarce. This article aims to shed light on how LLMs can enhance innovation activities within companies.

3. Over the past six months, we have experimented intensively with generative AIs in the context of innovation. Our experiences are based on both internal development of innovation methods and external projects with clients. Specifically, we want to provide insights into specific use cases of LLMs, such as ChatGPT, in the early phases of innovation, i.e., exploration, ideation, and prototyping. While we share a brief overview of the use cases for LLMs in the first two phases, our focus will be on AI-augmented prototyping of digital products. While LLMs can improve and accelerate the process of exploration and ideation, they add an entirely new capability to nontechnical individuals that do not have any software skills. LLMs can operate as a text-to-code generator empowering users to embrace early prototyping without writing code themselves. Users simply describe the digital product (e.g., a website) in natural language, which the LLM then turns into programming code (e.g., HTML code). This puts nontechnical users in a position to close the gap between conceptual work (i.e., ideas and concepts) and early look- and feel-like prototypes that can be tested with users.

### **How can Generative AI be used in Marine Industry**

4. Generative AI is already being used by some of the world's largest companies, including Google, Facebook, and Microsoft. And it's only going to become more popular in the years to come. The possibilities for using generative AI in business are endless. Here are just a few examples:

- Generative AI can be used to create new products or improve existing products. It can also be used to create new marketing materials or improve existing marketing materials.
- Generative AI can be used to accelerate R&D cycles in a variety of industries, from medicine to product creation.
- Generative AI can be used to create new forms of creative content, such as videos.

• Generative AI can be used to generate new leads for businesses or help businesses improve their customer retention rates.

One of the most exciting applications of generative AI is its ability to create new images, videos, and other forms of media. For example, a generative AI system could be trained on a dataset of images of faces, and then used to generate new faces that look realistic but are completely artificial. This could be used to create new characters for movies or video games, or to create synthetic images that can be used for training other AI systems.

Generative AI can also be used to create new versions of existing data. For example, a generative AI system could be trained on a dataset of images of houses, and then used to generate new houses that are similar to the originals but have different colors, sizes, or shapes. This could be used to create a more diverse dataset for training a machine learning algorithm, or to create new images for a website or app.

Another example of generative AI is creating new images based on a dataset of existing images. This can be used to create products that don't exist yet, or to design products that are better optimized for specific purposes. For instance, generative AI could be used to create customized prosthetics for people with different body types.

The potential for generative AI is immense, and businesses that start using it now will be at a competitive advantage in the years to come.

## **Proposed Front End AI-Augmented Innovation**

### **5(A). Exploration**

In the exploration phase of innovation projects, companies try to understand the context in which they intend to innovate and gather important impulses, e.g., get a deep understanding of users, technologies, and regulatory forces to identify opportunities and potential threats. LLMs can support a variety of tasks in this phase. Among others, general influencing factors in the environment of a company can be gathered asking ChatGPT to perform a PESTEL analysis. ChatGPT can also help innovation teams explore the user perspective. You can ask ChatGPT to list key challenges or needs users face in specific contexts or while using a certain product. To differentiate between different user segments, LLMs can generate an overview of user groups, such as Warships, Cruise Liners, RORO etc in the marine context. ChatGPT can also provide methodological support. For instance, it can generate a first draft of a customer interview structure, including typical agenda points and specific questions.

### **5(B). Ideation**

In the ideation phase, companies typically try to use creative techniques to generate ideas that address user needs and to make use of the stimuli collected in the exploration phase [7]. Working with ChatGPT, you can directly ask for ideas and specify your area of interest by adding a particular context, user segment, or user needs. In most cases, a prompt asking directly for ideas provides a very good overview of some of the key idea areas;

however, ideas usually appear to be a bit superficial and bland. Follow-up questions are a good strategy to enrich ideas and add details if the answer was not sufficient or satisfactory. For example, you can ask for a technology that could support the idea. Besides asking LLMs directly for ideas, you can also have ChatGPT apply creativity techniques, such as the SCAMPER method (acronym of Substitute, Combine, Adapt, Modify, Put, Eliminate, and Reverse) [8].

### **AI-Augmented Digital Prototyping**

6. Prototypes are designed to enable acceptance testing and concept validation with users after generating initial ideas and concepts. Software prototyping typically entails complex processes, including comprehending functionalities and customer needs, crafting seamless user journeys and designing wireframes and prototypes. Developing a high quality, lifelike click dummy in a UX/UI prototyping software, such as Figma, requires the collaboration of various professions and methods in a multiweek process. LLMs have the potential to accelerate the process from an idea to a (semi-) functional prototype. In this chapter, we illustrate possibilities for users with no technical background in prototyping to apply LLM functionality by going through a fictitious example of a marine app.

7. An initial idea was generated by prompting “Suggest an innovative app for marine spares innovation.” In the answer, we received a suggested name “MarinePartsHub,” an overview of the app and a list of key features. To make the idea more concrete, we mapped the proposed features to a potential structure. We intentionally avoided using UX terms, such as “wireframe” or “information hierarchy” in our test, to explore possibilities for non-UX/UI-educated innovators. The output was a table that outlines various sections (e.g., home screen) and the elements they could include (e.g., overview of app features). Next, we asked for advice to understand which design options to opt for and received an answer that follows the common patterns of a style guide by defining colors, typography, icons and illustrations, imagery, layout, animations, and even a dark mode.

8. When trying to directly create a prototype by prompting “Create a prototype that I can open without installing anything,” we just got a static prototype and we were told that we won't be able to input real data or experience the full functionality of a live app, since it was just for demonstration purposes. To ensure the generated content was focused on creating a basic web app instead of a Figma click dummy, we provided a specific prompt: “Guide me through the process of creating the code for a simple prototype that I can open with my browser.” This resulted in detailed instructions for creating a basic HTML/CSS prototype, with the generated code formatted and color coded according to the programming languages used. While the instructions did not require advanced knowledge, they did assume the reader was familiar with text editors, such as Notepad (preinstalled on Windows) or VS Code.

9. The generated website initially appeared to be very basic, with placeholder elements and headings. We then requested the addition of previously suggested features, resulting in a new iteration of the generated code and instructions for placement.

10. We realized that some features previously suggested were still missing, so we requested ChatGPT to include all suggested elements and noted that subpages could be added as well. This resulted in instructions for creating subpages and adding missing content. However, the advice for adding a navigation bar lacked specific placement instructions, so we asked for further details and received more specific instructions on where to place the provided code. ChatGPT recommended adding a dropdown menu to the main menu that linked to new pages featuring sub features. However, the now suggested sub features did not match the ones previously suggested. They were placed too long back in the conversation history and were, therefore, no longer taken into account.

11. Following the system's previous advice to refine and improve the rather basic content and styling of the pages, we returned the task to ChatGPT and the generated code included comments indicating where additional functionality could be added. Additionally, the response suggested software libraries, such as Chart.js, for implementing functionality, providing instructions, and code snippets for rendering charts with exemplary maintenance events. We encountered a mistake in the suggested workflow that prevented the chart from rendering properly. We described the issue and received debugging support, eventually resolving the issue and rendering the chart correctly.

12. As a final experiment, we explored the potential of image-generating AI models. We asked ChatGPT for a suitable prompt, which was then fed into Adobe Firefly and iterated within the tool.

## Looking Ahead

13. The Authors opinion that Generative Artificial Intelligence (GAI) which is the most prevalent GAI technique being used today can well be used for accelerating Marine innovation so as to create a revolution in management of spares for Indian Navy. A GAN uses a pair of neural networks. One, known as the *generator*, synthesizes the content (for example, an image of a human face). The second, known as the *discriminator*, evaluates the authenticity of the generator's content, (that is, whether the face is natural or fake). The networks repeat this generate/discriminate cycle until the generator produces content that the discriminator cannot discern between real and synthetic.

14. The Authors opine that with the implementation of Gen AI for forecast of marine spares, the requirement of right spare at the right time will be obviated.

## How will Indian Navy be benefitted ?

15. The Indian Navy needs to develop and assimilate new Artificial Intelligence (AI) technologies that are being used by the Indian military and industry. The Navy's goals of transforming into a 200-ship force and maintaining optimal combat capability, are being put to test by diminishing capital and manpower shortages. It needs to leverage the benefits of AI and Machine Learning (ML) to improve organisational efficiencies at various levels.

## Discussion and Outlook

16. Our experimentation with LLMs in the early phases of innovation and prototyping revealed three major insights.

First, there is a plethora of use cases ranging from user journey mapping to idea generation and prototyping. LLMs proved to be helpful in two regards: instruct users how to perform a certain task (e.g., methodological support for how to design an interview guideline) and apply knowledge and perform tasks themselves (e.g., direct question answering for needs along the user journey). This unique combination of capabilities foreshadows the promising role LLMs may play in future knowledge management systems once external sources can be tapped by LLMs.

17. Second, generative AI may be a game changer in early prototyping as the delegation of tasks to an artificial agent can result in faster iterations and reduced costs [9]. However, task definition, requirements, and workflow integration significantly influence the outcome. While the lack of expert input may limit the spectrum and quality of results, this approach allows users to acquire competencies in new fields and prototype functionalities outside their area of expertise. To evaluate the effectiveness of this procedure, we distinguish between use cases. While it can help evaluate general feasibility and functionality, it may not guide design and development or test product acceptance in user interviews due to a limited visual quality. Nonetheless, we anticipate rapid progress in the development of new, specialized AI design tools that can create prototypes with both conceptual depth and high-quality design and render obsolete the better part of manual digital prototyping in early phases.

18. Third, our experiences show that LLMs ask for a rethinking of the way human innovation teams purposively and effectively interact with AIs and integrate them into their workflows. Human teams often use LLMs as a jump start in the process and build on AI-generated information, correct it, or use it as inspiration for further development. Managers in our projects noted that AI-generated information often resembles a draft version created by a skilled human assistant. The benefit of this approach is that it is easier and less time-consuming to edit a version than to produce the initial thoughts. As a result, innovation methods, such as design thinking, need to be revised to leverage the new opportunities presented by generative AI.

19. While individuals across the globe are embracing LLMs, organizations and, in particular, nontechnology companies are still in the early stages of tapping the potential of generative AI. The learning curve in most organizations is predominantly based on the experimentation of individuals. Companies may start systematizing their AI efforts by supporting cross-departmental AI initiatives, such as communities of interest, establishing a knowledge management system that supports the AI learning journey, redefining the required skillset and roles of their innovation teams, and developing a coherent AI strategy [10].



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