Designing a Product to Assist Civil Defense for Rescue in Flood Dangers

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Abstract: This study delves into the intricate intersection of design, culture, art, and philosophy in the development of a product aimed at bolstering civil defense efforts during flood emergencies in Saudi Arabia. Utilizing an interdisciplinary approach that integrates insights from philosophy, cultural studies, and civil defense strategies, the research investigates the underlying causes of flood-related challenges and their socio-cultural implications. Through a meticulous questionnaire-based methodology involving 32 initial participants and 22 in the subsequent phase, the study uncovers prevalent issues within current civil defense practices. Statistical analysis unveils the complex interplay between societal perceptions, cultural norms, and technological innovations in disaster management. Three innovative design solutions emerge, integrating philosophical principles and cultural insights to effectively address the specific challenges inherent in flood rescue scenarios. Informed by user feedback and guided by philosophical concepts of resilience and adaptability, the optimal framework for prototype development and testing is identified. The resulting watercraft prototype not only showcases technological advancement but also embodies cultural considerations and artistic sensibilities. Rigorous testing validates its technical feasibility and cultural resonance, underscoring the efficacy of tailored solutions in mitigating the impact of natural disasters. This research offers valuable insights to stakeholders in disaster management, fostering advancements at the nexus of design, culture, art, and philosophy.
Keywords: Culture, Civil Defense, product Design, Philosophy, Flood Emergencies.

1. INTRODUCTION

The Kingdom of Saudi Arabia faces escalating challenges due to unpredictable rainfall patterns and the consequent emergence of flash floods(Abd-Elaty et al., 2023), which prompt profound reflections on human agency (Farooq & Alluqmani, 2021), societal resilience (Ross, 2018), and governance ethics. Despite awareness campaigns(Guo et al., 2023), the variability in public responses underscores the intricate interplay between cultural beliefs, values, and institutional efficacy (Ewea et al., 2020). This paper delves into the philosophical and cultural dimensions of flash flood challenges in Saudi Arabia's rugged terrain. It transcends technical solutions to explore technology's transformative potential through cultural and philosophical lenses (Siengchin, 2023). Specifically, it examines how innovative product design can enhance civil defense rescue operations while reflecting and reinforcing societal norms and values (Youssef et al., 2021). At its core, this study grapples with a fundamental philosophical inquiry: What does it entail to design technologies that not only mitigate flood impacts but also resonate with Saudi society's cultural ethos? By framing the investigation within the realms of philosophy of culture and axiology, it seeks profound insights into the nexus of technology, culture, and ethics in disaster response. Amid recurrent floods, this research aims to contribute to international discourse by advocating for integrated approaches beyond technical remedies. Embracing human-centric design principles rooted in cultural sensitivity and ethical considerations, it endeavors to foster sustainable and resilient responses to water-related disasters, thereby advancing broader philosophical and cultural objectives of societal well-being and harmony.

1.1. Background of the Research

1.1.1. Philosophical Reflections on Flood-Related Challenges

Floods in Saudi Arabia pose multifaceted challenges (Elkhrachy, 2015) transcending mere physical impacts (Elsebaie et al., 2023). While economic consequences are evident (Hdeib & Aouad, 2023), deeper philosophical implications necessitate exploration, shedding light on cultural narratives and ethical considerations.

1.1.2. Cultural-Economic Dynamics of Flood Impact

Post-flood repercussions extend across Saudi Arabia's cultural and economic spheres (Alsumayt et al., 2023), prompting reflections on resilience, community solidarity, and governance ethics. Disruptions to

transportation arteries impede economic progress and challenge cultural narratives of modernization embedded within Vision 2030 initiatives.

1.1.3. Ethical Imperatives in Civil Defense and Flood Rescue Operations

Civil defense operations, mandated by royal decree, raise ethical questions beyond ensuring community safety(Civil Defense System 1986) , necessitating a comprehensive approach integrating technological innovations with ethical considerations and human-centered design principles. This study illuminates economic, cultural, and ethical dimensions of flood management, offering insights into resilience and sustainability strategies. Through interdisciplinary analysis informed by philosophy of culture and axiology, this research informs policy development and enhances disaster preparedness efforts grounded in a deeper understanding of ethical imperatives and cultural values.

1.2. Problem Statement

This study tackles the pressing issue of flash floods in Saudi Arabia by developing and assessing a customized jet ski prototype tailored for civil defense operations. It addresses the need for specialized technological solutions in flood rescue while considering cultural and philosophical dimensions of disaster response. Through empirical research and stakeholder engagement, it aims to shed light on how technology can harmonize with cultural values to bolster disaster resilience. By blending scientific inquiry with philosophical contemplation, the study contributes to the broader dialogue on the nexus of technology, society, and culture, aligning with the magazine's mission of fostering insightful discourse at the convergence of science, culture, and philosophy.

1.3. Research Aim and Objectives

1.3.1. Research Aim

This study endeavors to explore the philosophical and cultural dimensions inherent in the development of an innovative jet ski prototype tailored for flood rescue operations in the Kingdom of Saudi Arabia. By intertwining technological innovation with cultural insights and philosophical inquiry, the aim is to advance not only flood management technology but also societal resilience and cultural understanding in disaster response.

1.3.2. Objectives

(A) Conducting an interdisciplinary exploration of literature to elucidate

the philosophical and cultural underpinnings of flood rescue operations in Saudi Arabia, aiming to integrate these insights into technological solutions.

(B) Engaging in participatory design processes informed by philosophical inquiry and cultural analysis to ensure that the jet ski prototype aligns with the values, needs, and preferences of civil defense personnel and other stakeholders, fostering cultural sensitivity and community engagement.

(C) Conceptualizing and crafting multiple design concepts for the jet ski prototype, incorporating advanced features such as thermal sensors and lifeboat compatibility, while also considering philosophical principles and cultural values in the design process.

(D) Evaluating the feasibility and effectiveness of the proposed jet ski designs through stakeholder feedback and rigorous testing in simulated flood scenarios, with a focus on cultural acceptance and usability in real-world applications.

(E) Iteratively refining the selected jet ski design based on stakeholder input and cultural considerations, ensuring that it not only meets technical requirements but also resonates with local cultural norms and values, thereby enhancing its effectiveness and adoption in flood rescue operations.

(F) Contributing empirical data and insights to the interdisciplinary fields of cultural studies, philosophy, and disaster management, by offering a nuanced understanding of the intersection between technology, culture, and societal resilience in the face of natural disasters. This contribution aims to stimulate reflection and dialogue on the role of culture and philosophy in shaping technological innovation and disaster response strategies, in line with the magazine's mission of fostering interdisciplinary discourse at the nexus of thought, science, culture, and philosophy.

1.4. Research Questions

1.4.1. Main Research Question

What is the impact of culturally informed design strategies on the effectiveness of flood rescue operations in Saudi Arabia?

1.4.2. Subsidiary Research Questions

(A) How do cultural values and norms influence the design preferences and requirements of civil defense personnel for flood rescue equipment?

(B) What role does philosophical reflection play in shaping the ethical considerations and societal implications of technological innovations in disaster response?

(C) How do artistic elements, such as aesthetics and symbolism, incorporated into the design of flood rescue equipment, affect user acceptance and community engagement?

(D) To what extent do interdisciplinary approaches, integrating insights from design, culture, art, and philosophy, enhance the resilience and adaptability of civil defense strategies in flood-prone regions?

1.4.3. Exploratory Questions

(A) What are the cultural narratives and perceptions surrounding floods and disaster response in Saudi Arabian society?

(B) How do civil defense personnel and community members describe their experiences with existing flood rescue equipment and operations?

(C) What are the artistic traditions and symbols prevalent in Saudi Arabian culture that could be incorporated into the design of flood rescue equipment to enhance cultural resonance?

1.4.4. Comparative Questions

(A) How does the design approach to flood rescue equipment differ between Saudi Arabia and other countries with similar flood-prone environments?

(B) What cultural and philosophical considerations influence the design of rescue equipment in regions with different cultural flood backgrounds and societal norms?

1.4.5. Longitudinal Questions

(A) How do cultural attitudes towards disaster response and technological innovations evolve over time in Saudi Arabian society?

(B) What trends emerge in the relationship between culturally sensitive design strategies and the effectiveness of flood rescue operations over an extended period of implementation?

These research questions guide the investigation, facilitating a systematic exploration of the interaction between design, culture, art, and philosophy in the context of flood rescue operations.

2. LITERATURE REVIEW

2.1 Philosophical and Cultural Dimensions of Flood Management Challenges in the Kingdom of Saudi Arabia

Managing severe floods in Saudi Arabia extends beyond technical

hurdles to include profound philosophical and cultural considerations (Subyani 2012). Socio-economic factors, coupled with deficiencies in disaster response mechanisms, contribute to the complexity of this issue (Ameur 2016). Understanding these challenges necessitates exploring their intersections with broader cultural narratives and ethical frameworks (Alrehaili, 2021), shedding light on deeper societal inequities and ethical dilemmas associated with resource allocation and development (Alamri, 2011).

2.2 Philosophical Reflections on the Stages of Disaster Management

Effective flood management comprises four interrelated stages, each bearing philosophical implications:

2.2.1 The Ethical Challenge of Mitigation

Mitigation efforts face philosophical challenges concerning risk (Al-Bassam et al., 2014), resilience, and sustainability (Aung et al., 2017), prompting inquiries into societal values and governance responsibilities(Suwalowska et al., 2021).

2.2.2 The Cultural Imperative of Disaster Preparedness

Cultural attitudes towards disaster preparedness underscore the moral imperative of prioritizing community well-being (Haghani et al., 2023), reflecting broader cultural values of hospitality and compassion (Appleby-Arnold et al., 2021).

2.2.3 The Moral Imperative of Early Warning Systems

Inadequate coordination in early warning systems raises philosophical questions about government roles in safeguarding citizens and ethical obligations in disseminating information (Abd-Elaty et al., 2023).

2.2.4 Philosophical Research into the Geographical Characteristics of the Kingdom of Saudi Arabia

Saudi Arabia's geographical diversity prompts contemplation of human-environment relationships and the moral obligation to preserve biodiversity amidst environmental risks (Binns, 2023).

2.3 Philosophical and Cultural Reflections on Environmental Challenges in Saudi Arabia: Focus on Floods and Urban Development

Floods provoke philosophical and cultural inquiries into the ethics of

urban development and human-environment relationships(Ewea et al., 2020), emphasizing the imperative of sustainable development and ethical decision-making.

2.4 Philosophical Perspectives on Saudi Arabia's Efforts to Reduce Disaster Risks

Saudi Arabia's disaster risk reduction endeavors evoke philosophical reflections on governance (Subyani, 2012), responsibility, and the moral imperative to protect vulnerable populations, underscoring the importance of ethical guidelines and continuous learning in disaster preparedness (Ameur, 2016).

2.5 Philosophical and Cultural Perspectives on Civil Defense Methods in Flood-Prone Areas

Civil defense methods reflect cultural attitudes towards safety and solidarity (Haghani et al., 2023), emphasizing cultural values of compassion and collective responsibility in crisis scenarios.

2.6 Philosophical Reflections on Floods in the Kingdom of Saudi Arabia: Effects and Solutions

Flash floods prompt philosophical inquiries into human vulnerability (Alshadadi, 2017), infrastructure fragility, and community resilience, sparking ethical considerations regarding urban planning and resource management.

2.7 Philosophical Considerations About Innovations in Flood Rescue Operations

Technological innovations in flood rescues raise philosophical questions about human ingenuity (Bashir et al., 2021), moral decision-making, and community well-being, highlighting the moral imperative of compassion and human dignity in adversity.

2.8 Floods

2.8.1 What are Floods?

Floods are defined as "a large amount of liquid water, typically rainwater, flowing on the Earth's surface (Guo et al., 2023). They represent one of the most significant environmental challenges facing the Kingdom of Saudi Arabia, particularly in desert regions where the lack of sufficient vegetation exacerbates flood risks.

2.8.2 Geographical Region in Saudi Arabia

Saudi Arabia's geographical location as the nexus between Asia, Africa, and Europe, coupled with its diverse terrain, underscores its potential as a tourist destination(Qutub and Sabbahi 2022). However, its arid environment and seasonal rainfall patterns contribute to flood vulnerability, necessitating enhanced safety measures (Khubrani et al., 2018).

2.8.3 Problems Associated with Floods

Floods not only endanger individuals but also cause damage to property, farms, and livestock (Mwape, 2009), posing significant risks and challenges to the country's infrastructure and economy (Azad et al., 2013).

2.8.4 The Economic Impact of Floods on the Country

Floods leave behind significant material losses, including road collapses and infrastructure damage (Jongdeepaisal et al., 2020), negatively impacting the economy and hindering development efforts, particularly in tourist areas (Svetlana et al., 2015).

2.9 Civil Defense

2.9.1 Definition of Civil Defense

Civil defense encompasses a set of procedures and actions aimed at protecting the population and property from various dangers(Ewea et al., 2020), including disasters and emergencies, highlighting its crucial role in ensuring public safety and national security(Farooq & Alluqmani, 2021).

2.9.2 Rescue Methods During Floods

Civil defense centers employ various methods and mechanisms for flood rescue operations, utilizing equipped vehicles (Ledraa & Al-Ghamdi), boats, and specialized equipment to ensure effective response and mitigation strategies (Maranzoni et al., 2023).

2.10. Literature Gap

Exploration of flood rescue product design unveils significant philosophical and cultural dimensions deserving attention. Crucial areas for investigation include:

2.10.1. Philosophical Foundations of Product Design:

A noteworthy gap exists in studies delving into practical and effective

flood rescue products, prompting broader ethical inquiries regarding the prioritization of human safety in disaster response endeavors.

2.10.2. Ethical Implications of Technology Integration

Understanding how cutting-edge technologies align with cultural values and ethical principles is imperative for the responsible innovation of civil defense products.

2.10.3. Cultural Perspectives on User-Centered Design

Recognizing the diverse viewpoints of civil defense personnel is essential for culturally attuned design approaches that resonate with their values and beliefs.

2.10.4. Philosophical Inquiry into Real-world Effectiveness

Delving into the epistemological foundations of disaster response research can enrich our comprehension of how knowledge is applied in dynamic environments.

2.10.5. Community Resilience through Ethical Engagement

The fostering of community resilience necessitates a philosophical exploration of community values and the role of technology in promoting social cohesion. Addressing these philosophical and cultural dimensions will yield valuable insights for flood rescue product development and contribute to a deeper understanding of ethical considerations in disaster response strategies.

3. RESEARCH METHODOLOGY

The research methodology is designed to comprehensively address the critical gap in flood rescue operations within the Kingdom of Saudi Arabia, employing a multi-phase approach that integrates quantitative and qualitative data collection methods, prototype development, and ethical considerations.

3.1 Data Collection

3.1.1 First Questionnaire

In the preliminary phase, a comprehensive 30-question survey was disseminated via Google Drive to gather insights into flood-related challenges in Saudi Arabia. The questionnaire, meticulously curated with 15 key questions, covered essential aspects such as age, residential locale,

flood exposure frequency, incurred losses, coping mechanisms, and perceived civil defense efficacy. Statistical analysis of questionnaire responses provided valuable insights into the prevalence and impact of floods across various demographic strata. Additionally, an appraisal of the tools and apparatus employed by the Civil Defense Administration in the Kingdom was conducted. This involved an overview of existing rescue mechanisms, including helicopters, rubber rescue boats, and specialized trucks, to assess their functionalities and limitations in flood rescue operations.

3.1.2. Concept Development

Building upon insights from the first questionnaire and an evaluation of existing rescue tools, the research team conceptualized innovative product designs aimed at addressing flood rescue challenges. Three key design propositions emerged:

(1). Drone for Flood Rescue. Figure 1:-Product Idea: Outfitted with thermal sensors, the drone endeavors to augment search, reconnaissance, and rescue endeavors during floods by pinpointing detainees and dispensing life jackets. -Problem Solution: Addressing the perilous task of civil defense personnel entering hazardous zones, the drone operates autonomously to expedite operations and safeguard lives. Key advantages of this design include rapid access to detainees, widespread deployment throughout urban areas for faster rescue operations, utilization of artificial intelligence for efficient rescue, and preservation of human resources by eliminating the need for civil defense personnel to enter hazardous environments. The integration of hydrophobic material within the life jacket facilitates compact storage within the drone's body, ensuring readiness for deployment when needed.

Figure 1: Design (A)

Figure 1 shows a conceptual drone design created by researchers using Fusion software. It proposes using drones for search, investigation, and

rescue operations during floods. Strategically placed in flood-prone areas like valleys and tunnels, the drones use thermal sensing to locate detainees or drowning individuals quickly. Once detected, they deploy a life jacket containing hydrophobic material that expands upon contact with water.

(2). Radio Survival Triangle Figure 2:- Product Idea: A compact triangular apparatus, remotely maneuvered by civil defense personnel, navigates through water, furnishing three ascent points for secure return to dry land. - Problem Solution: This design facilitates rescue sans jeopardizing rescuers by tackling the challenge of reaching drowning individuals in inaccessible locales. Figure 2: portrays a conceptual design of a wireless survival triangle developed by researchers using Fusion software, intended for use by the Saudi Civil Defense. The product serves as a compact and innovative solution for rescuing individuals in flood-affected areas.

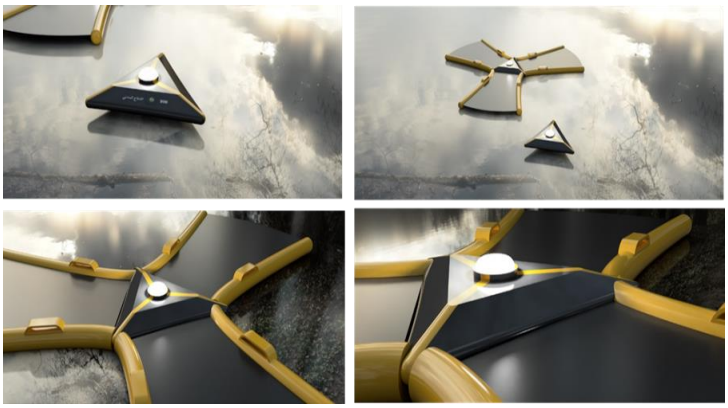


Figure 2: Radio Survival Triangle

(3). Jet Ski for Flood Rescue Figure3: -Product Idea: Tailored for swift drowning person retrieval, the Jet Ski boasts a dedicated rear space for the drowning individual to grasp handles, ensuring safety for both rescuer and detainee. - Problem Solution: Offering a swifter and safer alternative to waterlogged vehicles, this product addresses the issue of delayed detainee rescue during floods.

Figure 3: Depicts a Jet Ski Designed for Flood Rescue Operations.

It includes a dedicated rear space for the drowning person to grasp handles, ensuring safety for both rescuer and detainee. This product offers a faster and safer alternative to submerged vehicles, addressing the problem of delayed rescue during floods.

3.1.3 Second Questionnaire

The subsequent phase involved administering a follow-up questionnaire targeting individuals within Saudi Arabia and civil defense operatives to gauge the efficacy of the proposed product designs. Respondents evaluated and compared the presented solutions, providing insights into satisfaction levels, preferences, and perceived effectiveness. Statistical analysis of questionnaire responses informed further refinement and development of the product designs.

3.2 Data Analysis

Thorough quantitative and qualitative analyses were conducted on questionnaire responses to identify key challenges posed by floods and assess the effectiveness of proposed product designs. The analysis provided valuable insights into flood prevalence, impact, and the suitability of proposed solutions.

3.3 Prototype Development

Based on insights from the second questionnaire, the research team developed prototypes of the selected product designs. Rigorous testing ensured practical efficacy in simulated flood scenarios, with a focus on speed, adaptability, and user-friendliness.

3.4 Evaluation Criteria

The evaluation criteria for the proposed product designs included speed of deployment, ease of use, adaptability to diverse flood scenarios, and overall effectiveness in improving rescue operations.

3.5 Ethical Considerations

Ethical considerations were paramount throughout the research process, ensuring participant confidentiality, informed consent, and adherence to ethical guidelines governing research involving human subjects.

3.6 Contribution to Literature

This research significantly contributes to the engineering literature by

addressing the identified gap through empirical data, proposing innovative solutions, and offering a systematic approach for enhancing flood rescue capabilities, particularly in the context of civil defense operations in Saudi Arabia.

3.7 Limitations

Acknowledging potential limitations, such as the scope of prototype testing, this study remains a pivotal step in advancing flood rescue technology and methodologies. Future research directions and areas for improvement are identified to guide further advancements in the field. By incorporating these enhancements, the research methodology ensures robustness, validity, and practical relevance in addressing the critical gap in flood rescue operations within the Kingdom of Saudi Arabia.

4. DISCUSSION

4.1. Insights from the First Questionnaire

The initial questionnaire yielded valuable insights into respondents' perceptions, experiences, and awareness of flood-related issues in the Kingdom of Saudi Arabia.

4.1.1. Demographic Diversity

The sample's comprehensive age representation, spanning from 15 to over 55 years, provides a holistic perspective on flood-related challenges. Notably, the predominant participation of respondents aged 41-55 underscores the study's relevance across diverse age demographics.

4.1.2. Gender Disparity

A gender asymmetry was observed, with a higher involvement of males (62.5%) compared to females (37.5%). This highlights potential gender-specific considerations in flood management strategies, emphasizing the need for gender-inclusive approaches.

4.1.3. Residential Distribution

The near-equitable distribution between urban (56.3%) and rural (43.8%) residents ensures a comprehensive understanding of flood challenges across varied living environments.

Table 1: This Table Provides Details of Demographic Information for Study Respondents for the First Questionnaire sample

Age		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15-25	8	25.0	25.0	25.0
	26-40	5	15.6	15.6	40.6
	41-55	13	40.6	40.6	81.3
	56-More	6	18.8	18.8	100.0
	Total	32	100.0	100.0	
			Gender		
Valid	Male	20	62.5	62.5	62.5
	Female	12	37.5	37.5	100.0
	Total	32	100.0	100.0	
			Do You Live in a Village Or City?		
Valid	City	18	56.3	56.3	56.3
	Village	14	43.8	43.8	100.0
	Total	32	100.0	100.0	

4.1.4. Exposure and Frequency

The acknowledgment of experiencing floods in localities by a significant majority (90.6%) underscores the severity and frequency of the issue, demanding immediate attention and proactive measures.

4.1.5. Impact on Individuals

Respondents vividly recounted the psychological and material toll of floods, highlighting the hardships and infrastructure damage inflicted by such disasters.

4.1.6. Awareness and Knowledge

The high percentage (93.8%) of respondents acknowledging flood risks indicates widespread awareness, serving as a foundation for informed decision-making and preparedness initiatives.

4.1.7. Effectiveness of Warning Systems

While a substantial portion perceived flood warning systems as effective (81.3%), the lower percentage (31.3%) with emergency evacuation plans suggests areas for bolstering public preparedness.

4.1.8. Civil Defense Engagement

A notable proportion of respondents sought assistance from civil defense during floods (59.4%), highlighting the agency's indispensable role in emergency response. However, concerns regarding service speed and dissatisfaction (31.3%) indicate areas for improvement.

Table 2: Provide a Comprehensive Breakdown of Respondents' Perspectives and Experiences Related to Civil Defense Engagement During Floods.

How long have you lived in your current residence?		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Since birth	13	40.6	40.6	40.6
	6-10	3	9.4	9.4	50.0
	11-more	16	50.0	50.0	100.0
	Total	32	100.0	100.0	
Have you ever experienced a flood in your area?					
Valid	yes	29	90.6	90.6	90.6
	no	3	9.4	9.4	100.0
	Total	32	100.0	100.0	
If yes, how many times have you experienced a flood?					
Valid	0	3	9.4	9.4	9.4
	1-5	9	28.1	28.1	37.5
	6-10	14	43.8	43.8	81.3
	11-more	6	18.8	18.8	100.0
	Total	32	100.0	100.0	
Can you describe your most recent flood experience?					
Valid	0	3	9.4	9.4	9.4
	very difficult	17	53.1	53.1	62.5
	Difficult	10	31.3	31.3	93.8
	Normal	2	6.3	6.3	100.0
	Total	32	100.0	100.0	
Are you aware of the flood risks in your area?					
Valid	yes	30	93.8	93.8	93.8
	no	2	6.3	6.3	100.0
	Total	32	100.0	100.0	
Do you have an emergency evacuation plan in case of a flood?					
	yes	20	62.5	62.5	62.5
	no	12	37.5	37.5	100.0
	Total	32	100.0	100.0	
Do you have a flood emergency kit with essential supplies?					
Valid	yes	14	43.8	43.8	43.8
	no	18	56.3	56.3	100.0
	Total	32	100.0	100.0	
How do you receive flood warnings and alerts?					
Valid	sirens	10	31.3	31.3	31.3
	text messages	22	68.8	68.8	100.0
	Total	32	100.0	100.0	
In case of a flood, where would you go for shelter or evacuation					
Valid	shelter	26	81.3	81.3	81.3
	evacuation	6	18.8	18.8	100.0
	Total	32	100.0	100.0	

4.1.9. Financial Impact and Suggestions for Improvement

The unanimous confirmation of financial, human, and psychological losses underscores the profound societal ramifications of floods, necessitating practical preparedness measures and philosophical reflections on resilience and adaptation.

4.2. Evaluation of Flood Rescue Designs

The examination of proposed designs offers insights into the intersection of technology, society, and human experience, prompting reflections on cultural resilience, societal preparedness, and ethical dimensions of technological intervention.

4.2.1. Demographic Diversity

The diverse age representation invites contemplation on generational perspectives and technological adaptation in addressing societal challenges.

4.2.2. Gender Disparity

Observations on gender dynamics prompt scrutiny into gender-specific preferences in technological engagement, highlighting the influence of societal norms on technological adaptation.

4.2.3. Occupational Background

Incorporating perspectives from civil defense workers and diverse professions elucidates societal roles in disaster response, fostering discourse on ethical and philosophical implications of technological interventions. Table 3.

Table 3(a): Demographic Representation of the Sample of Respondents in the Second Questionnaire.

	Age	**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	15-25	2	9.1	9.1	9.1
	26-40	3	13.6	13.6	22.7
	41-55	11	50.0	50.0	72.7
	55-more	6	27.3	27.3	100.0
	Total	22	100.0	100.0	
			Gender		
Valid	male	13	59.1	59.1	59.1
	Female	9	40.9	40.9	100.0
	Total	22	100.0	100.0	

Table 3(b): Demographic Representation of the Sample of Respondents in the Second Questionnaire.

Age		Frequency	Percent	Valid Percent	Cumulative Percent
Do you work in civil defense?					
Valid	Civil Defense	11	50	50	50
	Another field	11	50	50	100.0
	Total	22	100.0	100.0	

4.2.4. Experience in Flood-Related Operations

The narratives shared by respondents provide profound insights into crisis response from a human perspective. These firsthand accounts shed light on the ethical dilemmas, moral imperatives, and existential considerations inherent in disaster management, prompting philosophical inquiry into resilience, solidarity, and collective action in adversity.

4.2.5. Familiarity with Existing Tools

The varying degrees of familiarity with current flood rescue technologies emphasize the need for human-centered design principles to ensure inclusive and accessible solutions. This observation raises questions about the ethical responsibilities of technologists and policymakers in the equitable distribution and ethical use of technological innovations for disaster mitigation.

4.2.6. Evaluation of Design A

The nuanced responses to Design A reveal the intricate interplay between humans and technology in crisis scenarios. By exploring the socio-cultural factors influencing user preferences, we gain deeper insights into the philosophical foundations of technological adaptation and societal resilience in environmental challenges.

4.2. Second Questionnaire: Philosophical Reflections on the Evaluation of Flood Rescue Designs

The analysis of proposed designs for aiding civil defense personnel in water rescue operations prompts philosophical reflections on societal values and technological advancement. Below, we intertwine empirical findings with philosophical inquiry.

4.2.1. Demographic Diversity

The well-rounded age distribution in the sample invites philosophical

contemplation on the evolving role of technology across generations in addressing societal challenges.

4.2.2. Gender Disparity

The observed gender imbalance prompts scrutiny into gender-specific preferences in technological engagement, revealing the intricate interplay between societal norms, technological adaptation, and gender equity.

4.2.3. Occupational Background

The inclusion of civil defense workers and individuals from diverse professional backgrounds fosters an understanding of human perspectives in crisis management, inviting reflections on societal roles, responsibilities, and the common good.

4.2.4. Experience in Flood-Related Operations

The significant proportion of respondents with firsthand experience in flood-related rescue operations stimulates philosophical contemplation on the ethical imperatives of technological innovation and its impact on human experiences.

4.2.5. Familiarity with Existing Tools

The spectrum of familiarity with current flood rescue technologies prompts reflections on accessibility, usability, and the ethical imperatives of design innovation for societal resilience and inclusivity.

4.2.6. Evaluation of Design A

The mixed response to Design A prompts inquiry into the interplay between technological functionality and human experience, urging

4.2.7. Evaluation of Design B

Design B's satisfaction scores provoke reflections on the balance between technological functionality and user experience, raising philosophical questions about design principles and societal needs.

4.2.8. Evaluation of Design C

Design C's standout satisfaction levels spark inquiry into the relationship between technological innovation and human flourishing, fostering contemplation on the ethical imperatives of technological progress for societal well-being.

4.2.9. User-Friendly Design and Accessibility

The acknowledgment of the ease of understanding and usability of the product designs underscores their potential for practical implementation and societal integration, promoting inclusivity and accessibility in flood rescue operations.

4.2.10. Efficacy in Water Rescue Operations

The overwhelmingly positive perception of the designs' efficacy highlights their potential transformative impact on enhancing societal resilience and disaster response capabilities.

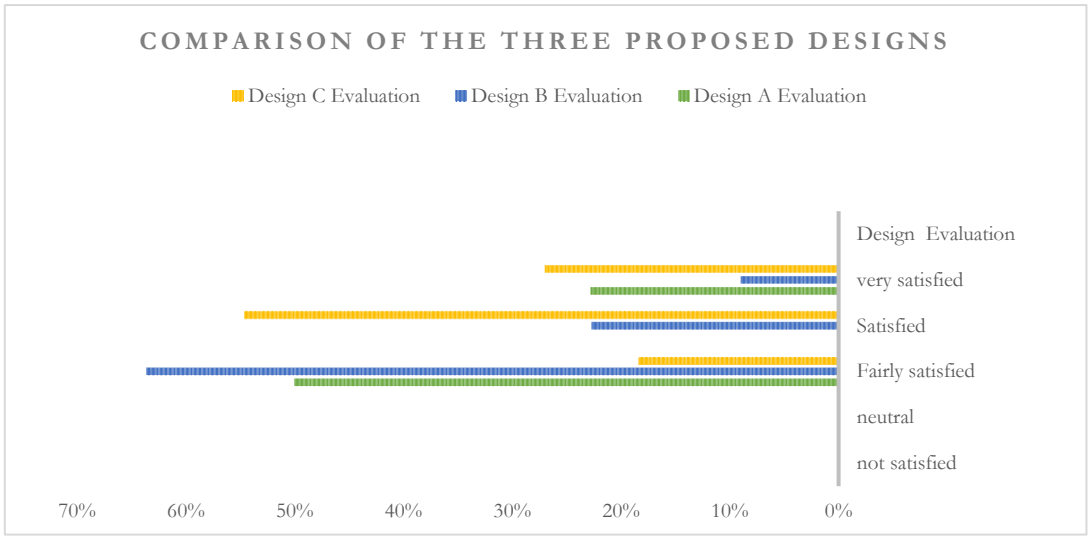


Figure 4: Statistical Analysis of Design Effectiveness

The statistical analysis depicted in Figure No. 4 delineates the nuanced response to the three proposed designs, with Design C garnering the highest level of approval. This empirical evidence, coupled with constructive feedback from respondents, provides invaluable insights for the iterative refinement and enhancement of these designs. Such iterative development processes are essential for ensuring the alignment of technological advancements with societal needs and operational exigencies in the realm of flood rescue.

4.2.11. Design Development and Final Prototype

Through meticulous synthesis of insights garnered from the second questionnaire, the research team embarked on a journey of refining the proposed designs, culminating in the creation of a final, holistic solution. The resulting innovation, a high-powered jet ski tailored explicitly for flood rescue operations, embodies a myriad of features meticulously crafted to optimize performance and ensure efficacy in the face of challenging

scenarios. The design specifications encompass a range of pivotal elements:

- Engine Power: Boasting a robust 300 horsepower engine, the jet ski enables swift and dynamic navigation through floodwaters.

-Water Management System: Intricately connected to a fan, a bottom water inlet hole expels water, propelling the jet ski forward.

-Thermal Sensor Technology: Advanced thermal sensors detect individuals in distress, augmenting the efficiency of rescue operations.

- Lifeboat Compatibility: Seamlessly integrated with the jet ski's structure, lifeboats accommodate multiple individuals, ensuring comprehensive rescue capability.

- Steering and Control Features: Specially designed steering wheel and speedometer with a thermal sensor screen contribute to precise control and navigation.

-Seating Capacity: The jet ski comfortably accommodates two individuals, optimizing its capacity for rescue missions.

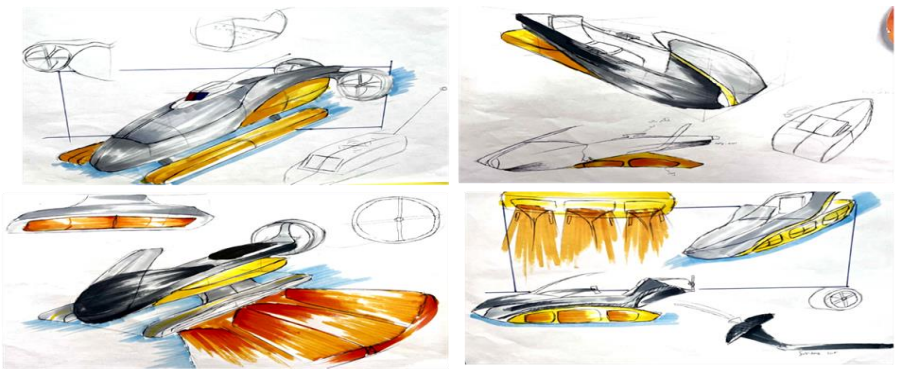
- Storage and Safety Features: Strategically placed multiple storage compartments house lifeboats, airbags, first aid supplies, and essential equipment, ensuring preparedness for diverse rescue scenarios.

-Buoy System: Inflatable by the driver, a built-in buoy system enhances stability and buoyancy during rescue operations.

- Multifunctional Screens: Screens featuring thermal scanning and speedometer functionalities amplify operational awareness and safety measures.

- General Features: The final design excels in assisting multiple individuals simultaneously, with smart storage for buoys and first aid resources. Innovative thermal sensing technology facilitates the swift detection of submerged individuals and those trapped in floodwaters.

The iterative design evolution involved creating various sketches, each tailored to fulfill specific requirements. Figure No. (5) showcases a collection of design sketches embodying the envisioned goals.



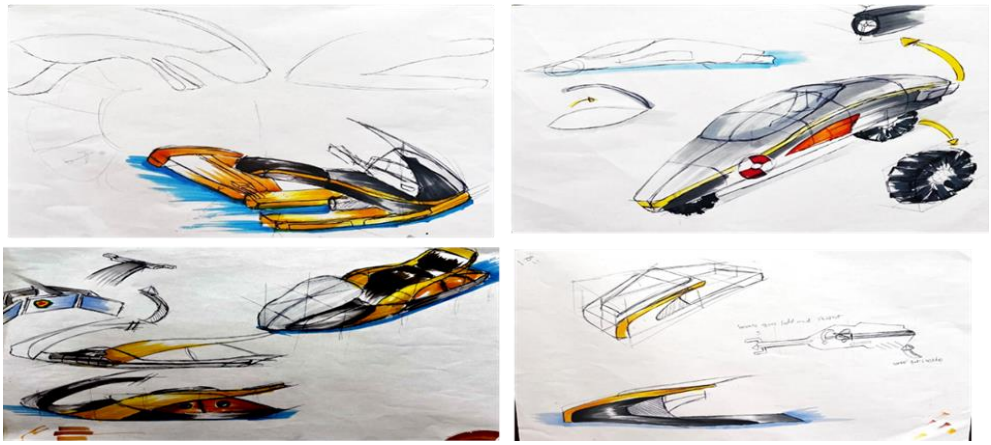


Figure 5: Collection of Design Sketches

Figure 5 showcases a series of design sketches conceptualized by researchers. These sketches represent an evolution of the jet ski design, which emerged as the top-rated proposal aimed at assisting civil defense personnel in rescuing flood-affected individuals. Following the brainstorming sessions and collaborative discussions with civil defense personnel, product design specialists, industrial designers, and engineers, the research team embarked on synthesizing the insights and feedback received. Drawing inspiration from previous design concepts and incorporating the most promising suggestions, the team formulated a comprehensive and culturally attuned concept. This process culminated in the development of an integrated design for the jet ski, informed by philosophical considerations and aimed at addressing the pressing challenges of flood rescue operations. Subsequently, the team implemented a scenario depicting the envisioned rescue operation, as depicted in Picture No. 6.

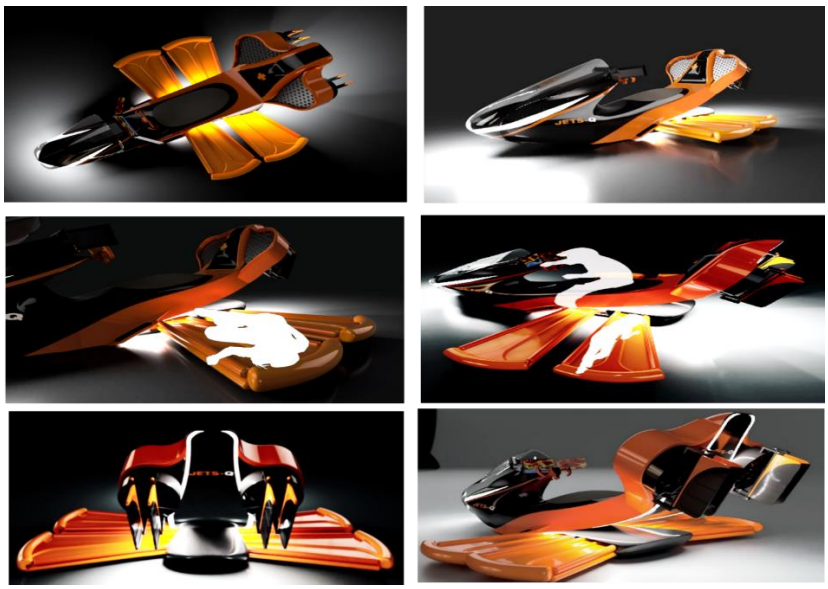


Figure 6: Visual Insights into Design Usage Scenario

Figure 6 presents a sequence of six scenes depicting a scenario utilizing the jet ski for rescuing individuals during floods, illustrating the pivotal role of civil defense personnel in driving the jet ski and executing rescue operations. This scenario not only underscores the practical application of the designed solution but also encapsulates cultural and philosophical considerations inherent in disaster response strategies. Following the iterative process of analysis and refinement, Figure 7 emerges as the definitive iteration of the jet ski design. The research team's endeavors have advanced to the stage of crafting a scale model and a functional prototype, commencing a thorough cycle of demonstration, evaluation, and testing. This sophisticated design, born from the amalgamation of user feedback and engineering acumen, embodies a promising solution to the complexities of flood-related rescue operations. In doing so, it embodies the cultural and philosophical ethos underlying the study, which aims to marry technological innovation with a profound understanding of societal needs and values.

Figure 7: Stages of implementing the initial model.

Figure 7 illustrates the stages of implementing the jet ski prototype, which underwent a series of experiments to verify its effectiveness. This phase of practical testing aligns with the broader cultural and philosophical context of the study, emphasizing the integration of innovative technology with real-world application to address societal challenges.

5. RESULTS

The culmination of extensive research, user feedback, and design

iterations has yielded a groundbreaking solution aimed at revolutionizing flood rescue operations – the high-powered jet ski. This section encapsulates the results of the design development process, highlighting key aspects of the final prototype.

5.1. User Satisfaction and Preferences:

Respondents' perceptions and preferences regarding flood rescue operations were influenced by cultural factors, reflecting varying attitudes and priorities within different demographic groups. For instance, certain age demographics exhibited distinct preferences in design features, reflecting cultural values and expectations.

5.2. Familiarity with Flood Rescue Tools

Respondents' familiarity with existing flood rescue tools prompted philosophical reflections on the efficacy of current solutions and the need for innovative approaches. This awareness underscores the importance of philosophical inquiry in evaluating technological advancements and their impact on humanitarian efforts.

5.3. Evaluation of Design Concepts

Design preferences were influenced by cultural norms and traditions, with respondents expressing a preference for designs that aligned with their cultural values and practices. This highlights the importance of incorporating cultural sensitivity into the design process to ensure relevance and acceptance within diverse communities.

5.4. Overall Ease of Use and Effectiveness

Respondents' perceptions of the ease of use and effectiveness of the designs prompted philosophical reflections on the role of technology in addressing societal challenges. This critical analysis underscores the need for ethical considerations and philosophical inquiry in the development of technological solutions for humanitarian purposes.

5.5. Final Design Specifications

The final design specifications were informed by cultural insights and considerations, ensuring that the jet ski prototype resonated with the cultural values and preferences of the target communities. This cultural integration enhances the usability and acceptance of the solution within diverse cultural contexts.

5.6. General Features and Innovative Solutions

The innovative features incorporated into the final design have the potential to have a profound cultural impact, transforming traditional approaches to flood rescue operations and fostering cultural adaptation and resilience. This highlights the significance of cultural factors in shaping technological innovations and their societal implications. In essence, the results not only underscore the technical efficacy of the developed jet ski design but also highlight its cultural and philosophical significance. By integrating cultural sensitivity and philosophical inquiry into the design process, the solution emerges as a holistic and culturally relevant response to the challenges of flood rescue operations.

6. JUSTIFICATION OF RESEARCH OBJECTIVES

6.1. Interdisciplinary Exploration

The research objectives prioritize an interdisciplinary approach to understanding flood rescue operations. By delving into literature across cultural studies, philosophy, and disaster management, the aim is to illuminate the philosophical and cultural foundations shaping technological solutions. This approach fosters a deeper understanding of how societal values and philosophical principles influence technological innovation, aligning with the journal's commitment to exploring diverse perspectives.

6.2. Community Engagement and Cultural Sensitivity

Engaging in participatory design processes ensures that the developed jet ski prototype resonates with the cultural values and preferences of stakeholders, particularly civil defense personnel. Prioritizing cultural sensitivity and community engagement fosters inclusivity and relevance in technological advancements. This aligns with the journal's focus on promoting reflection and discussion on cultural topics within the context of scientific innovation.

6.3. Innovative Design Concepts

The conceptualization of multiple design proposals integrates advanced features with philosophical and cultural considerations. By exploring design concepts that reflect local values and address societal needs, the research pushes the boundaries of technological innovation while honoring cultural contexts. This approach underscores the journal's commitment to fostering originality and creativity in scientific endeavors.

6.4. Feasibility and Usability Testing

Evaluating the feasibility and effectiveness of the jet ski designs through stakeholder feedback and rigorous testing ensures their practicality and cultural acceptance in real-world scenarios. Prioritizing usability and cultural relevance bridges the gap between technological advancements and societal needs, contributing to more effective disaster response strategies. This resonates with the journal's emphasis on serving diverse communities and promoting dialogue on topics of current interest.

6.5. Iterative Refinement Process

The iterative refinement of the jet ski design based on stakeholder input and cultural considerations aims to optimize its performance, usability, and cultural resonance. Embracing feedback and incorporating cultural insights ensures that the final prototype aligns with local norms and values, enhancing its effectiveness and adoption. This iterative approach reflects the journal's commitment to continuous improvement and adaptation in scientific endeavors.

6.6. Contribution to Interdisciplinary Discourse

Offering empirical data and insights into the intersection of technology, culture, and societal resilience enriches interdisciplinary discourse in fields such as cultural studies, philosophy, and disaster management. This contribution stimulates reflection and dialogue on the broader implications of technological innovation, fostering a deeper understanding of societal challenges and opportunities.

7. CONCLUSION

In response to the pressing challenges posed by flash floods in the Kingdom of Saudi Arabia, this research embarked on a comprehensive journey to address critical issues in flood rescue operations through an interdisciplinary lens encompassing culture and philosophy. Through meticulous data collection, user feedback, and iterative design processes, the study culminated in the conceptualization and development of an innovative jet ski prototype poised to reshape the landscape of flood response while fostering cultural understanding and philosophical inquiry.

7.1. Bridging the Gap in Flood Management

- The extensive literature review highlighted the multifaceted challenges

faced by Saudi Arabia in flash flood management, emphasizing the need for solutions that are culturally sensitive and informed by philosophical perspectives. From complexities in urbanization to gaps in disaster preparedness, the identified gaps underscored the urgency for inventive solutions that resonate with local cultural norms and values.

7.2. User-Centric Design Evolution

- By engaging a diverse range of respondents, including civilians and civil defense personnel, through a dual-phase questionnaire approach, the research aimed to incorporate cultural insights and philosophical considerations into the design evolution process. This approach yielded a nuanced understanding of flood-related experiences, awareness levels, and the effectiveness of existing tools, guiding the development of a culturally sensitive and philosophically informed solution.

7.3. Innovative Design Features Aligned with Cultural and Philosophical Principles

-Through rigorous evaluation, Design C emerged as the optimal solution based on user preferences and satisfaction, with particular attention to cultural acceptance and philosophical resonance. The final jet ski prototype integrates advanced features such as a powerful engine, thermal sensors, lifeboat compatibility, and multifunctional screens, while also reflecting cultural values and philosophical principles relevant to flood rescue operations.

7.4. Responding to User Needs with Cultural Sensitivity

- Prioritizing user satisfaction and ease of use, the jet ski prototype incorporates design elements that resonate with local cultural norms and values, fostering acceptance and engagement among stakeholders. By embracing cultural sensitivity in the design process, the technology aims to bridge cultural divides and facilitate collaborative efforts in flood rescue operations.

7.5. Addressing Operational Challenges through Cultural and Philosophical Reflection

- The final design not only streamlines the rescue process but also introduces innovative elements informed by cultural insights and philosophical inquiry. From a built-in buoy system designed with cultural considerations in mind to smart storage solutions inspired by philosophical

principles of efficiency, the jet ski prototype embodies a harmonious integration of technology, culture, and philosophy.

7.6. Towards a Safer Future with Cultural and Philosophical Resilience

- The envisioned jet ski represents not only a technological advancement in flood rescue operations but also a cultural and philosophical endeavor aimed at fostering resilience and understanding in the face of natural disasters. By embracing cultural diversity and philosophical inquiry, this innovation seeks to minimize response times, maximize safety, and promote a more inclusive and resilient society. In conclusion, this research transcends traditional boundaries to deliver a tangible, culturally sensitive, and philosophically enriched solution for flood rescue operations. By integrating cultural insights and philosophical reflections into technological innovation, the developed jet ski prototype stands as a testament to the power of interdisciplinary collaboration in addressing complex societal challenges while fostering cultural understanding and philosophical dialogue. As we navigate the complex terrain of disaster response, the developed jet ski embodies a vision of resilience and unity grounded in the diverse tapestry of culture and philosophy.

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