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SAILING TOWARD SUSTAINABLE HORIZONS: A CASE STUDY of A SOLAR-POWERED BOATYARD'S BUSINESS MODEL CANVAS

M. Usman Sikandar [1)], Pharindra Pathak [2)], M. Asib Mundekkatt [3)]

[1)]Lloyd's Maritime Institute, 191 Main St #2066, Port Washington, NY 11050, United States
[2]Auburn University, Auburn, AL 36849, United States
[3)] Seaway 7 Germany GmbH, Bavinkstraße 23, 26789 Leer (Ostfriesland), Germany

Email: usmansikandarmalik@gmail.com

Abstrak

Studi ini menyajikan analisis mendalam terhadap kanvas model bisnis yang diusulkan untuk perintis galangan kapal bertenaga surya (Koshi, Nepal). Studi kasus ini menggali kerangka strategis, struktur organisasi, dan metodologi operasional galangan kapal, menyoroti pendekatan inovatifnya dalam industri maritim. Menekankan pengembangan kapal Solar Hybrid, galangan kapal ini mengintegrasikan teknologi mutakhir dan praktik berkelanjutan untuk menawarkan kapal yang mendefinisikan ulang standar industri. Abstrak membahas komponen penting model bisnis, mulai dari kemitraan strategis hingga alokasi sumber daya, dan segmen pelanggan, semuanya divisualisasikan dalam Kanvas Model Bisnis. Studi ini mengeksplorasi keunggulan kompetitif yang diperoleh melalui teknologi inovatif, proposisi nilai, dan kelayakan pasar yang mendasari strategi bisnis. Selain itu, analisis ini membahas peluang perluasan pasar galangan kapal, potensi risiko, dan strategi mitigasi, yang mencerminkan posisinya di garis depan pasar perahu tenaga surya. Melalui representasi dan analisis visual, artikel ini memberikan eksplorasi komprehensif terhadap kanvas bisnis, yang berfungsi sebagai panduan navigasi bagi transisi industri maritim menuju praktik berkelanjutan dan inovatif.

Kata Kunci: Perahu Tenaga Surya, Inovasi Berkelanjutan, Analisis Model Bisnis, Kelayakan Pasar, SWOT, Kekuatan Porter

Abstract

This study presents an in-depth analysis of the business model canvas proposed for a pioneering solar-powered boatyard (Koshi, Nepal). The case study delves into the strategic framework, organizational structure, and operational methodology of the boatyard, highlighting its innovative approach in the maritime industry. Emphasizing the development of Solar Hybrid boats, the boatyard integrates cutting-edge technology and sustainable practices to offer vessels that redefine industry standards. The abstract discusses pivotal components of the business model, from strategic partnerships to resource allocation, and customer segments, all visualized within the Business Model Canvas. The study explores the competitive edge gained through innovative technologies, value propositions, and the market feasibility underlying the business strategy. Additionally, the analysis discusses the boatyard's market expansion opportunities, potential risks, and mitigation strategies, reflecting its position at the forefront of the solar boat market. Through visual representation and analysis, this article provides a comprehensive exploration of the business canvas, serving as a navigational guide for the maritime industry's transition toward sustainable and innovative practices.

Keywords: Solar Boats, Sustainable Innovation, Business Model Analysis, Market Viability, SWOT, Porter Forces

1. INTRODUCTION

Solar-powered boat development prioritizes sustainability in marine transportation over rapid technological advancements due to the maturity of existing technologies and focus on environmental and social needs [1]. Within the context of this case study, boatyards serve as pivotal hubs, central to the construction, maintenance, and repair of vessels for a diverse clientele comprising government bodies, shipping corporations, private owners, and entities in transportation and tourism. Operating in response to client specifications, these boatyards tailor their services, executing a spectrum of activities to meet varying vessel needs. Central to these operations are the diverse maritime equipment categories—ranging from mechanical, electrical, and electronic tools to automation systems. These are complemented by essential auxiliary support equipment, encompassing lubricants, paints, cables, and other necessities

integral to the holistic process of boat construction and maintenance.

In the realm of conventional marine transportation, diesel-powered vessels have long been prevalent, causing environmental pollution, substantial vibration, noise, and high operational costs. In this context, the focal point of this case study is the introduction of the Solar Hybrid boat. This pioneering solution integrates solar panels with LNG, presenting a hybrid engine model. This initiative aims not only to mitigate environmental impact but also to enhance operational efficiency and cost-effectiveness in the maritime domain.

Traditional fuels like LNG are increasingly considered alongside alternatives like electric propulsion to enhance the environmental sustainability of the shipping industry. Although high initial costs are impeded in 2021, the substantial expansion is more influenced by environmental impacts rather than just cost considerations. It is anticipated that by 2030, high-emission vessels will become nearly as costly to operate as zero-emission ships [2]. The first solar-powered sea vessel, MS Turanor Planetsolar, embarked on its journey from Monaco on September 27, 2010. Over 585 days, it voyaged through 28 countries, marking a significant milestone in solar-powered travel [3]. Another notable innovation is the Ecoship, unveiled in 2020 and recognized as the most environmentally sustainable ocean cruise ship. The Ecoship, operating on solar and wind power, can visit 100 ports annually and accommodate up to 6000 passengers. Impressively, it aims to save nearly 20% in energy consumption and reduce CO2 emissions by 40% [4].

The global electric ships market is projected to surge from USD 5.5 billion in 2021 to USD 10.82 billion by 2030, marking a remarkable 11.5% Compound Annual Growth Rate (CAGR) within the forecast period of 2022-2030. This empirical data collectively underscores the burgeoning market demand for solar-powered boats, a driving force behind the motivation to specialize in constructing Solar Hybrid boats within this boatyard, leveraging innovative technologies.

2. METHODE

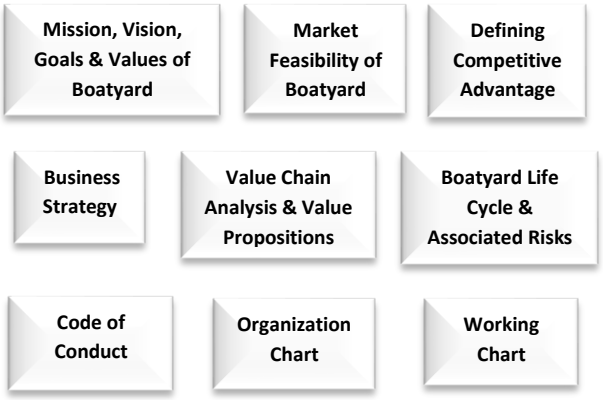

Figure 1. Methodology Chart

2.1 Mission, Vision, Goals & Values

Mission: In the competitive landscape of boatbuilding, Koshi Boatyard commits to a dedicated focus on client satisfaction, directing innovation into the design, construction, maintenance, and repair of high-quality vessels. The mission entails a commitment to delivering excellence and service beyond vessel delivery, establishing an enduring relationship with the clientele.

Vision: The envisioned global leadership in specialized boatbuilding markets seeks step-by-step growth, constructing not just boats but also a reputation for superior quality, innovation, and reliability. The aim is to exceed expectations, catering to a diverse clientele, including top-tier customers and governmental bodies, while prioritizing a safe and healthier environment.

Goals: With an ambitious pursuit to lead in the maritime industry, the goals necessitate long-term commitment. To achieve this, there's a priority on developing a robust company profile, readiness to take calculated risks, and an unwavering commitment to

providing innovative, top-notch products and services.

Values: Values serve as guiding principles that underpin the ethos of Koshi Boatyard. Paramount is attention to the client, emphasizing active collaboration and communication to translate client needs into tangible outcomes. Innovation is a constant pursuit, urging adaptation, embracing change, and continuous improvement in products and methodologies. Integrity forms the bedrock of operations, emphasizing ethical conduct, accountability, and professionalism. The people within the company are the heartbeat, and dedication to their growth, training, and well-being remains integral. Safety is non-negotiable, ensuring a workplace that upholds high occupational safety and health standards. At Koshi Boatyard, the essence of "Together we can" underscores the significance of teamwork, uniting the workforce across departments to ensure efficient and harmonized operations. This collective spirit enables the navigation of challenges and triumph as a unified entity.

2.2 Market Feasibility

The concept of a solar boatyard in Nepal emerges as a response to diverse market needs and the strategic impetus from both government initiatives and private sector demands. The viability of such an endeavor is underscored by several key factors:

Government Initiative & Support: An ongoing project linking the India-Bangladesh Ganga River to the Koshi River, supported by the World Bank, has opened new avenues for boat accessibility in Nepal. The government's dedicated efforts and allocated budget for studying boat accessibility signify a compelling drive to establish the boatyard in Nepal. The objective is to reduce the country's reliance on neighboring nations for transportation. The government's vision also includes leveraging these boats for national and international trade, thereby encouraging self-sufficiency and profitability. Considering the world's focus on sustainable development, there are expected business ease and encouragement through various international initiatives addressing that area.

Private Market: As Nepal boasts several navigable rivers, residents living in proximity to these waterways utilize navigation services provided by local initiatives and private agencies. These services encompass the use of country boats and motorized watercraft, facilitating transportation along the river corridors. As far as commercial sea linking is concerned, the Goods coming to Nepal from the Americas, Europe, and Africa are unloaded in Colombo, and those coming from Australia, South Korea, and other East Asian countries are unloaded at Singapore or Port Klang in Malaysia. It takes around a week to bring the goods to Kolkata in feeder vessels even from Singapore and Malaysia. There is an opportunity to serve the feeder transport through sustainable boats. In the future there is a possibility of sea transport extending to Nepal, India, and Bangladesh and the World Bank is currently working on a project to operate boats in Ganga and Brahmaputra. Such small vessels can be brought not only up to the Eastern part of Nepal but even to the southern via the Narayani River and the western part through Karnali after dredging showing the growth potential of sustainable boatyard business in longer terms [6].

Inland transport & Tourism: Nepal's picturesque landscapes and tourist destinations demand safer alternatives for exploration. Presently, wooden rafts, though commonly used, pose safety concerns, leading to accidents. The tourism sector and local transport companies seek safer options & and sustainable solar-powered hybrid boats would be a viable alternative. Additionally, in regions where land transport is perilous, there's a demand for smaller boats for passenger transportation. Some water transport routes include the Koshi River from Chataraghat to Simle Via Tribeni about 12 km, recreational purpose motor boat in Kulekhani Dam of about 7 km and through local initiatives of Parbat in

Kali Gandaki from Mirmi to Seti Beni about 4.5 km, the Arun River linking Tumlingtar with Chatara. From this fact, it can be known that water transport in Nepal is at the initial stage and there is growth potential that can be served through this Solar Boatyard [6].

The convergence of government support, escalating private market needs, and safety concerns in tourism and local transport collectively signify a strong market feasibility for Koshi Boatyard's solar boat business in Nepal. The diverse market demands and the government's & international strategic vision underscore a viable market opportunity for the establishment of a boatyard that caters to both commercial and safety-driven transportation needs within the region.

2.3 Competitive Edge (Porter 5 & SWOT)

Competitive Edge:

1) By employing virtual reality, the solar boatyard offers clients an in-depth inspection and modification opportunity for their vessel designs without requiring physical visits. This not only meets client expectations but also aids in pilot training for boat safety, ensuring precise design implementation.
2) The integration of augmented reality within the boats' control rooms enhances safety during voyages by alerting captains about potential obstructions. Furthermore, this technology supports both manufacturing and maintenance processes, aiding in quality control, inventory management, and yard layout optimization.
3) The boatyard distinguishes itself by utilizing laser cladding technology to produce vessel outfitting components. This process not only enhances aesthetics but also safeguards against corrosion and environmental damage, improving the overall durability and appearance of the boats.
4) The incorporation of LNG (liquefied natural gas) & and Soler System for propulsion provides an environmentally friendly and energy-efficient alternative for the vessels. Additionally, the introduction of the Fuel Optimization System (FOS) optimizes fuel consumption, enhancing the overall efficiency of the boats.
5) The labor structure is designed to reward expertise and experience, offering increased hourly wages based on qualifications, job categories, and tenure. The managerial and engineering roles focus on optimizing boat designs and ensuring productivity through labor refinement.

The following are the sources of competitive advantage for this business.

- Reducing job site safety risks
- Better technology and innovation
- Competitive price and best after-delivery services
- Building and maintaining strong relationships with clients and shareholders
- Standardization and customization of the product.

Porter’s 5 Force Analysis:

1) Threat of New Entrants: Limited threat due to the pioneering status and specialized industry knowledge.
2) Bargaining Power of Suppliers: Moderate influence due to the dependence on specialized technology and materials.
3) Bargaining Power of Buyers: Clients have substantial power given the emphasis on customization and stringent safety measures.
4) Threat of Substitutes: Low due to comparatively unique & and

sustainable technology applications and limited alternatives in the market.

5) Industry Rivalry: Low initial rivalry, primarily facing competition from boat companies in neighboring countries.

Cost leadership strategy, differentiation or segmentation strategy, government subsidization, incentives, and facility reduction can play important roles.

SWOT Analysis:

1) Strengths: Innovative technology applications, strong client relationships, and the advantage of being a pioneer in the market through location.
2) Weaknesses: Dependence on specialized suppliers and technology, potential limitations in scalability.
3) Opportunities: Room for market expansion, the potential for government support and collaboration, and further technological advancements.
4) Threats: Potential market saturation, challenges in sourcing and retaining skilled labor, and evolving regulatory pressures.

The competitive advantage of the solar boatyard is underpinned by innovative technology, strong client relations, and a distinct market positioning. Porter's Five Forces and SWOT analysis underscore the unique advantages and potential challenges faced by the pioneering boatyard.

2.4 Life Cycle Stage & Associated Risks

Life Cycle Stage: The company embarks on its business operations within Phase I, focusing on boat construction.

Challenges during Phase I include:

- High initial infrastructure investment
- Emphasis on marketing to target customers, highlighting competitive advantages and values
- Initial revenue generation not exceeding investment, resulting in no immediate profit.

Risks: Risk assessment for the Koshi Boatyard involves evaluating factors affecting the company, both positively and negatively. These risks are categorized as:

- Internal

1) Infrastructure
2) Workplace safety
3) Human resources
4) Management

- External

1) Community
2) Shareholders
3) Government regulations
4) Market dynamics

- Client

1) Advance and stage payments
2) Work scope and objectives

- Project

1) Cost management
2) Scheduling and planning
3) Task allocation
4) Manhour distribution

Risk breakdown structures (RBS) for risk assessment are derived from the following categories:

1) Inefficient design of passenger seating
2) Improper cargo space allocation within the vessel
3) Unstable legislative regulations
4) Force Majeure

Table 1. Risk Register

No.	Risk	Risk Category	Sustainability impact
1	Inefficient Design of the passenger seating arrangement	Project	Time
2	Improper allocation of cargo spaces inside the vessel	Project	Time
3	Unstable legislative rules	External Factors	Time / Cost
4	Force Majeure	External Factors	Time

Level of Risk for Sustainability Impact is ranked as, Insignificant (0), Low (1), Medium (2), and High (3).

The above risk factors affect the sustainability of the project in terms of Cost, Quality, and Time, we finally calculate the impact made by risk factors in these terms.

$$Impact = n\,x\,(t + c + q) \quad (1)$$

Where:
n = number of repetitions of the risk factors
t= time
c=Cost
q= Quality

$$PI = p \quad (2)$$

Where:
P= Probability of occurrence.
PI = PI score

Table 2. Probability impact

Risk	n	t	C	q	Impact	P	PI
Inefficient Design of the passenger seating arrangement	1	1	1	1	3	2	6
Improper allocation of cargo spaces inside the vessel	1	1	1	1	3	2	6
Unstable legislative rules	1	2	1	1	4	1	4
Force Majeure	1	3	2	2	7	1	7

From the above analysis of the risk factors and P-I score, we could see that risk associated with Force Majeure e.g. pandemic, political instability is slightly more as compared to the next 2 in the ranking.

2.5 Value Chain Analysis

From the production point of view, we divided business activities into primary and supportive as listed below in Table 3. Value Chain Analysis. The value proposition is given below:

Newness: The solar boatyard leads in the construction of solar hybrid boats, introducing cutting-edge technological innovations to elevate boat quality and safety standards within the maritime industry.

Performance: LNG hybrid vessels alleviate engine strain, amplifying performance, efficiency, and longevity. Designs prioritize unparalleled comfort, high performance, and adaptability across all aspects.

Customization: The solar boatyard excels in adaptability, catering to unique customer demands such as specialized hull painting,

custom interior works, and tailored upholstery jobs.

Getting the job done: Aligned with customer perspectives, the approach ensures job completion that encompasses:

a. Onsite supervision
b. Transparent processes
c. Cultivation of a safe environment and culture
d. Leveraging experience and knowledge
e. Commitment to quality
f. Realistic time schedules

Cost Control: Optimizing cash flow involves implementing advance and stage payments. Additionally, to bolster financial stability and cover operational expenses, the business secures subsidized loans from government and private banks, while also leveraging initial public offerings to fortify capital and guarantees.

2.6 Business Strategy

The business strategy for the boatyard focuses on several key areas:

Product & Service Differentiation: By offering tailored products and services, the boatyard aims to lead in cost-effective strategies, enhancing sales and financial resilience. This includes comprehensive post-delivery services spanning repairs, maintenance, and modifications across varied niches. Sales departments are strategically aligned with specific niche markets like government, private, and tourism sectors.

Innovation, Customization, and Standardization: The boatyard plans to offer customized, high-performance products at reasonable prices, emphasizing higher resale value. By facilitating equipment interchangeability and introducing standardized production methods, they aim to reduce maintenance costs and provide rapid, competitively priced responses to customer demands. The finance department supports clients in financial matters, encouraging further investment.

Growth and Market Expansion: The boatyard's success lies in product enhancements through autonomous advancements and regional dominance. It aims to extend its global service network, focusing on cost-effective client services. The reinforcement of research and development capacities, engineering, project management, and procurement supports their growth strategy.

Quality Assurance: Commitment to high-quality, customer-friendly products is a primary focus. They aim to ensure maximum boat uptime and minimal operational costs, providing high residual value to clients. Continuous research and development drive innovation in the solar hybrid boat industry, offering solutions to market challenges.

Cost Leadership: Cost efficiency through standardization is a core strategy. Emphasis on reduced costs, efficient production, and standardized processes aims to optimize worker efficiency and raw material usage. All production occurs in cost-efficient regions with high technical expertise.

This comprehensive approach manages production, ensures quality, and offers competitive pricing within the market.

2.7 Code of Conduct

In the envisioned boatyard's business model, the code of conduct prioritizes adherence to established principles and values. Each individual within the organization holds the responsibility to maintain company ethics during professional engagements. This code extends to shareholders, clients, suppliers, and subcontractors. Key aspects encompass compliance with regulatory standards, respect for all involved parties and communities, commitment to green initiatives, ensuring a safe work environment, upholding ethical standards, promoting open communication, enforcing accountability, selecting partners based on performance, conducting transparent

financial audits, advocating for fair competition, refraining from external interference or political involvement, and safeguarding sensitive information and intellectual property.

2.8 Organization Chart

Figure 2 displays the organization chart for the solar boatyard, providing a concise visual representation of the hierarchical structure, role allocations, and interdepartmental connections critical for operational efficiency.

2.9 Working Chart

Figure 3 illustrates the working chart details interdependencies and collaborative workflow within the solar boatyard. This visual representation showcases the coordinated efforts, task sequences, and collaborative processes instrumental in the efficient functioning.

Table 3. Value Chain Analysis

<table>
<tr><td rowspan="4"><u>Support Activities</u></td><td colspan="6"><u>Company Infrastructure</u> (Management, Finance & Accounting, Schedule & Planning)</td></tr>
<tr><td colspan="6"><u>Human Resource Department</u> (Recruiting, training and development)</td></tr>
<tr><td colspan="6"><u>Research & Development Department</u> (Technical Innovation, Quality Improvement)</td></tr>
<tr><td colspan="6"><u>Purchasing & Logistics Department</u></td></tr>
<tr><td></td><td><u>Engineering & Production Support Department</u> (Basic Design & calculation)</td><td><u>Operations</u> (Fabrication, mechanical jobs, Painting, Carpentry Jobs, Hydraulic works, electrical, electronic and automation jobs, machining works)</td><td><u>Service</u> (Docking/undocking, afloat repairs, and after-delivery services)</td><td><u>Sales & Marketing Department</u></td><td><u>Inventory Department</u></td><td><u>Commercial & Estimation Department</u></td></tr>
<tr><td colspan="7"><u>Primary Activities</u></td></tr>
</table>

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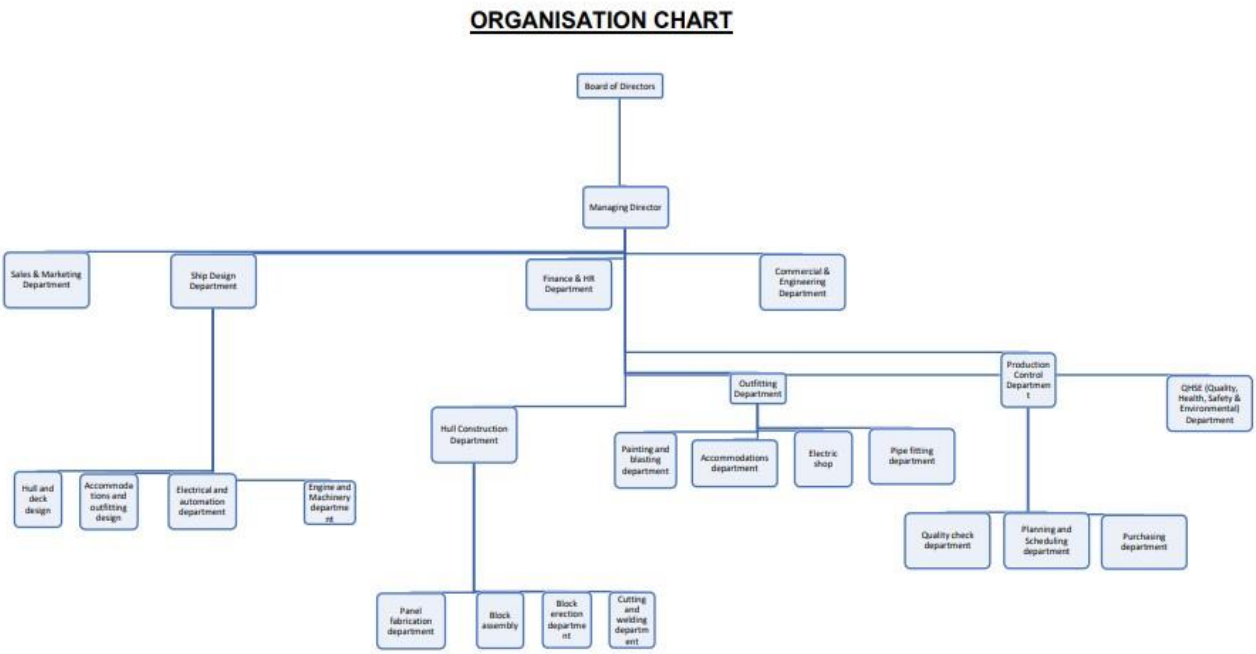

Figure 2. Organization Chart (Adobe Illustrator)

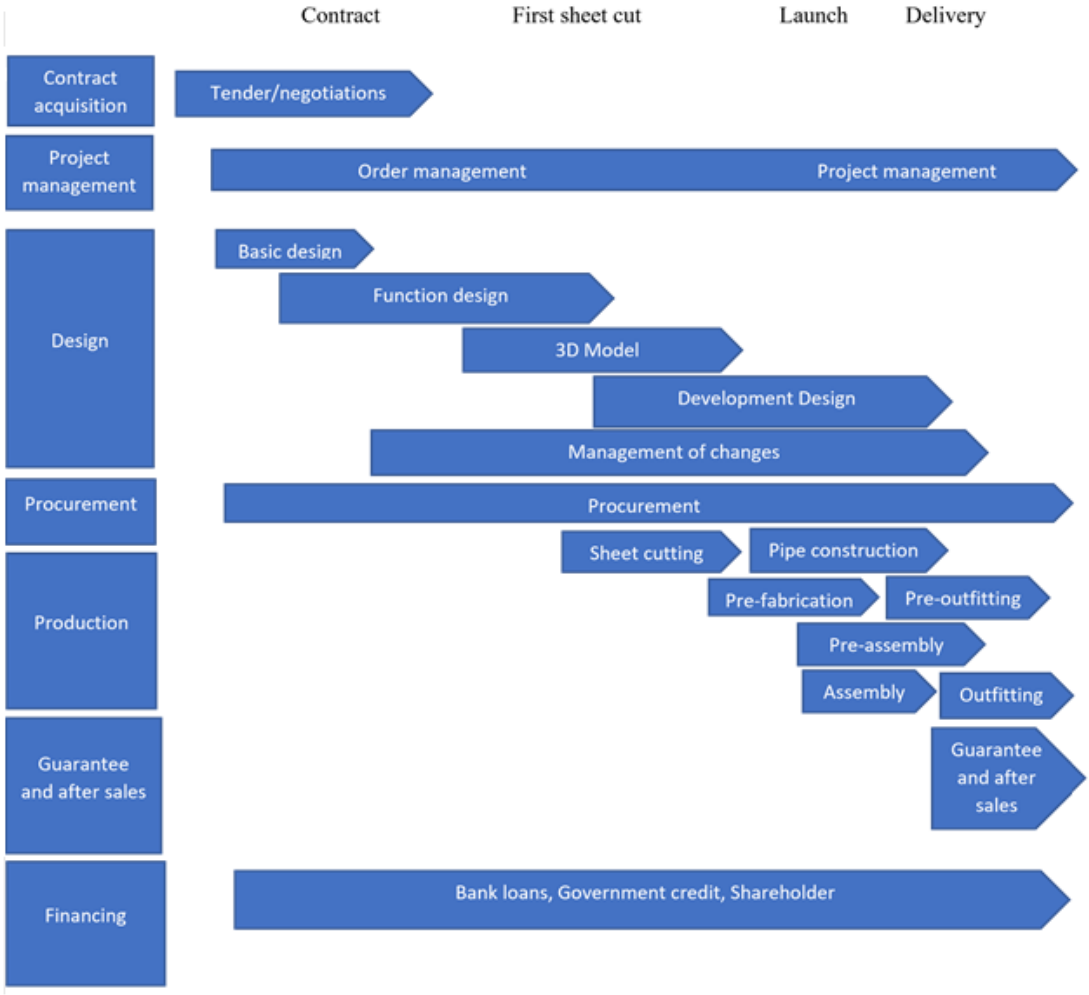

Figure 3. Working Chart (Adobe Illustrator)

3. RESULTS & DISCUSSION

The visual representation of the Business Model Canvas, as depicted in Figure 4, serves as a comprehensive blueprint encapsulating the strategic architecture of the solar boatyard. Through the utilization of Canvanizer 2.0, this canvas meticulously organizes and visually communicates the fundamental elements critical to the operational structure. It provides an intricate yet clear insight into various business components, spanning customer segments, value propositions, revenue streams, and cost structures.

By leveraging this tool, we've articulated a unique value proposition that centers around the development and delivery of Solar Hybrid boats, emphasizing their exceptional quality, heightened performance, and adaptability. This canvas not only captures the essence of this innovative approach but also delineates strategic partnerships, resource allocations, and delivery channels crucial for the operational success of the solar boatyard.

This representation isn't merely a visual aid; it's a strategic compass offering a bird's-eye view of this business model. It helps identify key revenue streams while finely delineating cost structures, ensuring the establishment's financial stability. Moreover, it functions as a pivotal tool in comprehending the intricacies of the business strategy and operational dynamics, offering a roadmap for success in this specific case study.

The canvas, in its visualization, acts as a guiding framework, steering focus towards a model that aligns with the value propositions & and customer needs, revenue generation, and cost management, fostering a comprehensive understanding of the business approach. Its strategic significance lies in providing a visual story of the business strategy, enriching the depth of the analysis, and offering a clear direction for the operational success of the solar boatyard.

While the Business Model Canvas provides a valuable overview of the key elements of a boatyard business, there are a few areas where it could be further refined. One area for potential improvement is the incorporation of a more nuanced emphasis on scalability and adaptability. The boatyard industry is dynamic and subject to a range of factors, such as economic conditions, technological advancements, and changing consumer preferences. It is therefore important for boatyards to have a business model that can be scaled up or down as needed and adapted to changing market conditions.

Based on the above analysis, the following recommendations are made for refining the Business Model Canvas for a boatyard:
Scalability and Adaptability:

a) Identify and assess the key factors that could impact the scalability and adaptability of the business model.
b) Develop contingency plans to address potential challenges and opportunities.
c) Regularly review and update the Business Model Canvas to ensure that it remains aligned with the evolving market landscape.

The Business Model Canvas developed from the analysis of a proposed Koshi Soler Boatyard is given below:

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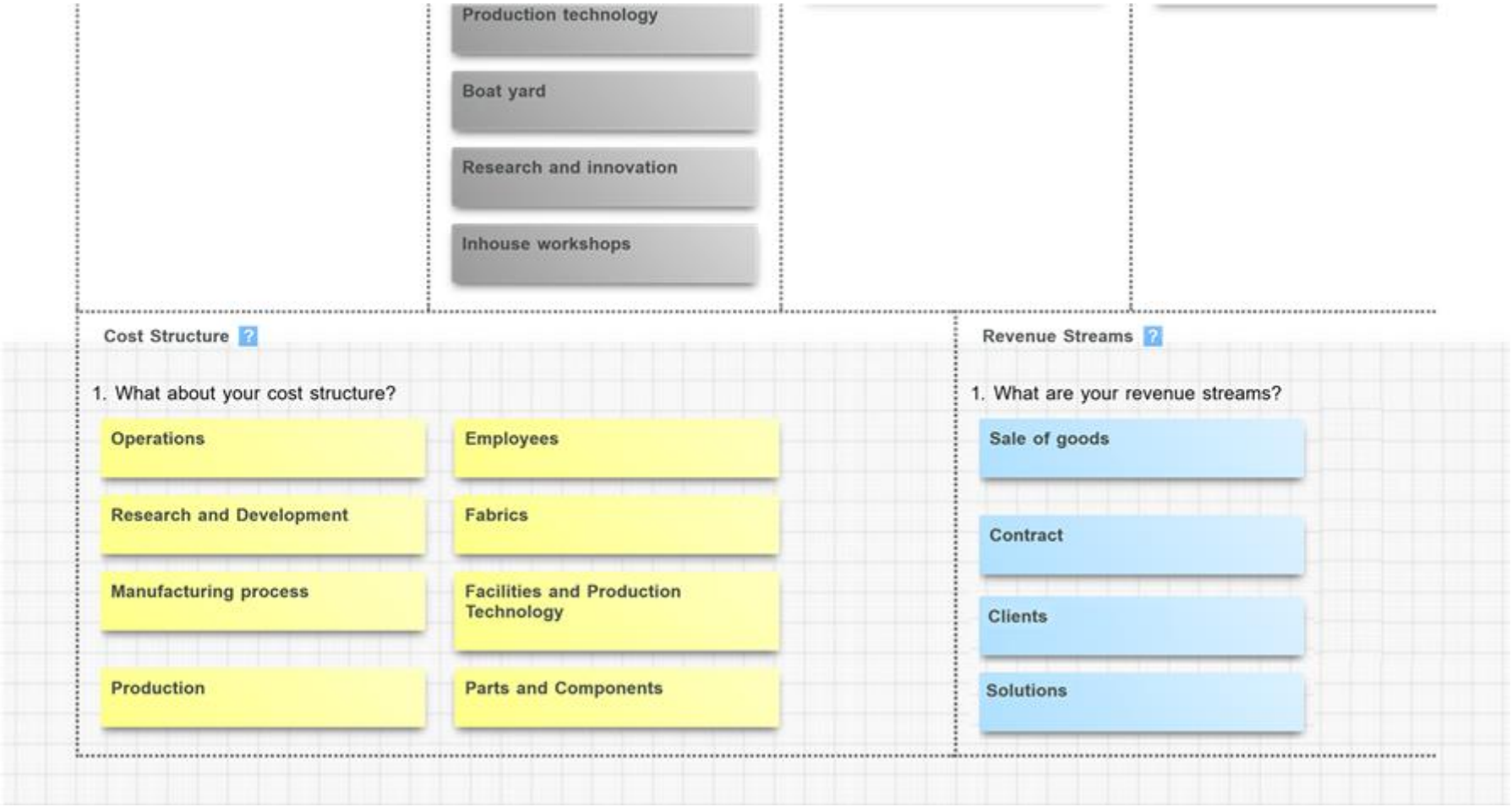

Figure 4. Business Model Canvas

4. CONCLUSION

The solar-powered boatyard's business model canvas underscores the transformative potential in the maritime industry. It emphasizes innovation, market viability, and strategic positioning, highlighting a pioneering venture dedicated to sustainability. This study sheds light on the critical shift towards renewable energy and innovative propulsion methods in marine transportation, offering promising insights into the solar boat industry.

By exploring market feasibility, competitive analysis, and industry dynamics, this research showcases the significance of solar-powered boats in addressing environmental concerns and their economic advantages. Porter's 5 Forces, SWOT analysis, and risk assessments provide valuable insights for informed decision-making in future endeavors.

The value chain analysis and business strategy outline the importance of quality, cost management, and differentiation in sustainable boat construction. Additionally, the ethical commitment and collaborative spirit within the boatyard's operations, as highlighted in its code of conduct and mission, vision, goals, and values, underscore its operational ethos.

This case study pioneers a practical approach to solar-powered boats, offering a navigational map for economically feasible and sustainable ventures. It stands as a testament to innovative technology applications, balancing profitability, market growth, and environmental responsibility. The study forecasts a sustainable future for the maritime industry, advocating for the global adoption of solar boat technology in sustainable transportation models.

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REFERENCES

[1] Minak, G, “Solar Energy-Powered Boats: State of the Art and Perspectives”, *Journal of Marine Science and Engineering*, 11(8), 1519, 2023.

[2] Serra, P., & Fancello, G, ”Towards the IMO’s GHG goals: A critical overview of the perspectives and challenges of the main options for decarbonizing international shipping”" S*ustainability*, 12(8), 3220, 2020.

[3] Zuhal, E. R., & Doguhan, A. T. E. S. “Evaluation of Electric Ships and Considered New Design Marine Cabin Combined with Solar Power”, *Journal of Maritime Transport and Logistics*, 4(1), 1-10, 2023.

[4] EchoShip,” The world’s greenest cruise ship sailing in 2020”. Retrieved October 2, 2023.https://ecoship-pb.com/c/uploads/2017/11/Ecoship-Project-Description-2017.pdf, 2017

[5] Global Electric Ships Market, Report-Brochure,https://www.sphericalinsights.com/request-sample/1361, 2021.

[6] Nepal Pvt Ltd, Ec. J., & Durbar, S, Feasibility Study of Water Transport along Koshi, Gandaki, and Bheri River Basins, 2011.