“INNOVATING FOR SOCIAL IMPACT: A BUSINESS MODEL ANALYSIS OF HDI’S MOBILE GAME APP, GO NISHA GO IN INDIA”

Research Paper

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“Abstract”

This study explores how the Go Nisha Go (GNG) mobile game leverages digital innovation to empower adolescent girls in India. Using the Business Model Canvas framework, a three-year qualitative case study reveals that GNG’s success stems from its user-centred design, strategic use of mobile technology, and hybrid partnership model. GNG demonstrates the potential of digital solutions for delivering scalable, culturally sensitive, and cost-effective interventions to underserved populations, informing future digital health projects. The study reveals a critical challenge in digital health innovation: balancing traditional grant-making with insights on how new product development strategies and market viability can augment project and program goals. As funding landscapes shift toward market-based solutions, organizations must navigate the complex interplay between mission-driven objectives and fostering scalability and sustainability.

Keywords: Digital Health Innovation, Mobile Gaming, Business Model Canvas, Social Impact, Adolescent Health.

1. Introduction

Social innovations in public health, especially those leveraging digital technologies, are increasingly recognised as vital for tackling pressing health issues in developing nations (Aranda-Jan et al., 2014; Wilson et al., 2017). However, their success relies heavily on business models that balance social impact, cultural relevance, and market viability (Heeks, 2002; Osterwalder and Pigneur, 2010; Rogers, 2010). One such innovation is Go Nisha Go (GNG), a mobile game created by Howard Delafield International (HDI), a women-owned social enterprise, to educate adolescent girls in India on reproductive health. HDI secured a funder grant to develop this solution, initially exploring market-based models appropriate for the target audience, girls aged 15-19 years, who lacked the financial capacity to support such models. Furthermore, in pre-COVID times in 2019, mobile penetration in peri-urban areas was limited, posing additional challenges. Nevertheless, HDI recognized the growing potential of mobile technology (Telecom Regulatory Authority of India, 2022) to provide direct access to health information, especially in bypassing traditional gatekeepers like religious leaders and teachers.

India’s mobile penetration grew rapidly from 2020 to 2023, driven largely by the pandemic, with smartphone ownership in rural areas rising from 36% in 2018 to 74.8% in 2022 (New Indian Express, 2023). This trend created a robust foundation for digital interventions like GNG. Addressing cultural taboos (UNICEF, 2019) and limited access to reliable reproductive health information (Bhatia et al., 2020), GNG leveraged gamification to offer girls an interactive, stigma-free space to learn about topics such as menstrual health and contraception. GNG's success on Google Play with nearly 650,000 downloads within 18 months challenges assumptions about digital health education barriers. Despite limited phone access, 50% of female users accessed content through borrowed devices, proving phone ownership isn't essential for digital SRH programs.

2. Objectives

The study's primary objectives are twofold:

1. To analyse GNG's product value proposition through an examination of customer segmentation strategies and distribution channels that enable scalability.
2. To evaluate product effectiveness through a business model lens while considering reproductive health outcomes, contextualizing these within India's expanding digital penetration and enhanced demographic insights.

It should be noted that GNG's reproductive health outcomes were assessed through an encouragement-design randomized controlled trial (Raj et al., 2025) and are not elaborated here. Osterwalder and Pigneur (2010) established the critical relationship between sustainable organizational growth and viable business models, emphasizing the equilibrium between revenue generation and cost management. This analysis employs their Business Model Canvas (BMC) framework to evaluate GNG's business architecture.

3. Methodology

This research adopts a descriptive, single case study approach, focusing on the Business Model Canvas of GNG. Conducted over three years (2020-2023) it covers the period from GNG's development and launch from October 2018-November 2023 in India's complex public health landscape.

We employed a qualitative research approach based on comprehensive secondary data analysis. Yin's (2018) case study methodology was employed to investigate the nuances of building a business model for digital social innovation through multiple documentary sources that provided insights into the organization's strategic planning, development processes, and operational execution.

3.1 Data sources and collection

The analysis drew upon the following secondary data sources

1. Project Reports: These included detailed project documentation covering GNG game development cycles, work plans and implementation strategy documents including the projects' partnership strategy document, and annual work plans from 2018-2023 that outlined resource allocation and utilization metrics.
2. Semi-annual Reports: These included reports to funders on game development milestones, project management indicators including project and organizational performance indicators.
3. Game Design Document: This document was specifically reviewed to understand the technical specifications and development frameworks of the game development, including feature implementation roadmaps, sprint planning and execution records
4. Game Design Reports: These included documents outlining the principles of design thinking outlining the product development, game design philosophy and creative direction, the user experience frameworks, the design testing reports and presentations of the design testing outcomes.
5. Corporate Presentations: These included stakeholder communications including presentations of discovery research, strategic communication, marketing analysis and competitive positioning strategies, and the project's partnership strategy.
6. Additional documents reviewed included minutes of meetings of executive-level strategic discussions, product development team coordination and presentations to funders.

3.2 Data analysis process

The secondary data was analysed using a systematic approach:

1. Document Classification: Materials were categorized based on their type, time, and relevance to business model components.
2. Content Analysis: Systematic review of documents to identify patterns, trends, and strategic themes.
3. Cross-validation: Information was cross-referenced across multiple document types to ensure consistency and reliability.
4. Temporal Analysis: Data was analysed chronologically to understand the evolution of business strategies and decision-making processes.

3.3 Data reliability

To ensure reliability, only official organizational documents were included in the analysis; multiple sources were used to verify key findings. All documentation dates and versions were carefully tracked

by using the company's documentation system organized through Egnyte. Additionally, the context of document creation was considered in the analysis.

3.4 Supplementary interview tools and procedures

Additionally, semi-structured qualitative interviews (n=13) with key stakeholders, that included funders, HDI leadership, project staff, and product developers, provided qualitative insights into the strategic decisions and challenges encountered during GNG's development. Two semi-structured interview questionnaires were developed: one for internal stakeholders (consultants employed by HDI) and one for external stakeholders (consortium partners, funders, and vendors). Open-ended questions were used in both questionnaires to facilitate an in-depth exploration of experiences and perspectives of product development processes and leadership practices, project management and perceptions of innovation assessment contributing to information that fed into the Business Model. The questionnaires were reviewed and validated by multi-disciplinary qualitative research experts from academia and non-profit to ensure robustness and relevance. A research assistant with expertise in qualitative research methods conducted the interviews between October 15 and November 15, 2023, via Zoom. The key stakeholders were interviewed to ensure a wide variety of opinions was captured, and all aspects of the business/product were covered. Triangulation was done using the data from the interviews and the secondary documents. Each interview ranged from 60 to 120 minutes and was audio-recorded. Informed consent was obtained from all participants before the interviews.

3.5 Ethical considerations

The primary researcher, an employee of HDI, obtained written permission from her employers to conduct the study and use HDI's name. To minimize bias and coercion, all interviews were conducted by an external research assistant who anonymized all data. The researcher followed the Belmont Report's ethical protocols and completed CITI training for interviewing human subjects. All participants received information on the study's purpose, procedures, risks, benefits, privacy protections, and the voluntary nature of participation. Confidentiality was maintained throughout the process.

3.6 Data analysis

The relevant data was analysed through the nine components of the Business Model Canvas (see Figures 1A and 1B): **Customer Segments, Value Proposition, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, and Cost Structure**. To validate the analysis, preliminary findings were shared at HDI's annual retreat in New Delhi, India, where team members provided feedback to enhance the accuracy and depth of the study's conclusions.

4. Findings

This section outlines the key findings from the analysis of GNG through the lens of the Business Model Canvas (BMC), aimed at evaluating its market strategy, scalability, and sustainability. The objective of this analysis is to provide a clear understanding of whether each component of the BMC, from customer segmentation to cost structure, contributed to the project's success in delivering reproductive health education to underserved adolescent girls in India and if so, how. The findings from each BMC component reflect how GNG effectively combined innovation with social impact, ensuring both accessibility and cultural relevance. In the context of GNG, each of these elements offers insight into the strategic decisions and innovative approaches employed in developing the mobile game for adolescent girls in India.

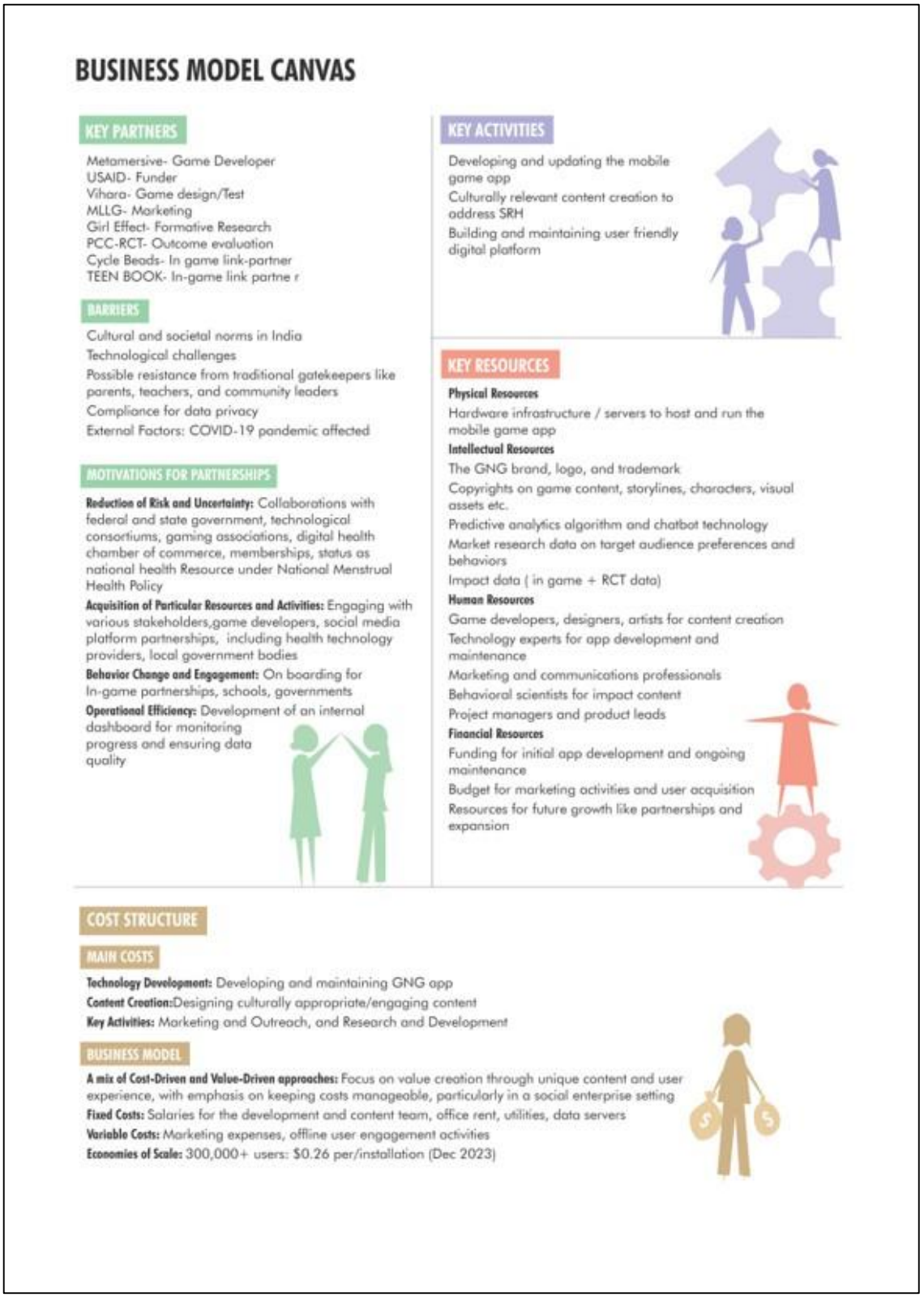

Figure 1A. Business Model Canvas for Go Nisha Go. (Source: Shankar, L., 2024. *Changing the Game: Insights from Howard-Delafield International's Digital Innovation for Social Impact in India*. DBA thesis. Swiss School of Business and Management Geneva.)

4.1 Customer segmentation

The GNG mobile game was developed with a clear focus on a specific and underserved segment of the population: adolescent girls aged 15-19, primarily from low-income backgrounds in northern India. This demographic often has limited access to reproductive health information due to sociocultural norms, stigma, and traditional gatekeepers such as parents, teachers and health providers (Jejeebhoy et

al., 2014). The adolescent girls in these regions are often financially dependent, and have low literacy levels and limited financial resources, making conventional pay-per-use models unsustainable for them. GNG targeted this population to address the gap in sexual and reproductive health (SRH) education (Paul et al., 2017), providing a gamified and culturally sensitive platform for learning in a stigma-free environment (Santhya and Jejeebhoy, 2015).

To further refine the segmentation of this target audience, psychographic profiling was employed to develop relatable avatars for the game (Raj et al., 2023). This method moved beyond basic demographic data to explore the attitudes, aspirations, and daily challenges of adolescent girls in India. The psychographic profiles revealed several distinct personas with varying levels of access to technology, different levels of education, diverse family structures and varying degrees of autonomy. These insights were crucial for designing a game that resonates with the lived experiences of the target audience and not just demographic assumptions about them (Raj et al., 2023).

In addition to targeting adolescent girls, GNG strategically engaged key stakeholders in the SRH promotion space. These secondary customer segments include non-governmental organizations (NGOs), private sector enterprises in health education and reproductive health and hygiene management products, and funders, who were instrumental in supporting the distribution and validation of the game. For instance, CycleTechnologies Inc. partnered with GNG to integrate their Cycle Beads period tracking app into the game, enhancing the educational value of the platform while cross promoting the game on their app. These stakeholders not only facilitated the broader cross-promotion of GNG, but this enhanced private-sector collaboration expanded the reach of an available product to a new audience/market, besides contributing valuable insights and data related to health interventions and user engagement. By addressing the needs of both its direct users and institutional partners, GNG created a well-rounded model that effectively combined education delivery with stakeholder collaboration, ensuring widespread impact and sustainability.

4.2 GNG's value proposition

It was centred on providing accessible, confidential, and culturally sensitive SRH education through a mobile game that was free for users. GNG's approach leverages a direct-to-consumer (D2C: or as it is known in markets as Business to Consumer (B2C) model), offering adolescent girls a safe platform to access crucial SRH information by creating an interactive environment where they could learn about menstrual health, contraception, consent, and sexual health without fear of judgment or stigma. The game's design and narrative are grounded in the real-world experiences of adolescent girls, making the educational content highly relatable and engaging. Shankar et al. (2023), have highlighted how GNG's Theory of Change model was developed through formative research with the target audience to directly reflect the needs and contexts of the users.

The value proposition also extended beyond the educational content. By addressing the cultural barriers surrounding SRH and a storyboard that reflected their lived experiences based on formative research, and continued user testing, GNG empowered young girls to take charge of their health and well-being. The game's protagonist, Nisha, navigates situations that directly mirror the target audience's daily realities, from managing menstrual health while pursuing sports to handling complex social dynamics around relationships and career choices. The game's narrative carefully weaves critical SRH education into realistic decision-making scenarios. For instance, players guide Nisha through a nuanced conversation with her boyfriend Ayush about consent and contraceptive choices, learning negotiation skills through interactive role-play. In another compelling storyline, Nisha must develop and apply communication strategies to convince her conservative father to let her accept a travel internship across India, addressing real-world challenges of gender norms and personal autonomy. These award-winning scenarios weren't merely created for entertainment; they were crafted from actual experiences shared during user research, equipping them to navigate real-life scenarios before they happen in real life.

For partners, GNG provided an innovative platform to engage with a hard-to-reach demographic. The app's design considered the technological limitations of its target audience, ensuring that it could be used on low-cost smartphones, many of which had limited memory or processing power. Predictive analytics and in-game metrics tracked user engagement through playtime patterns, dropout points, and choice-based decisions, enabling targeted improvements.

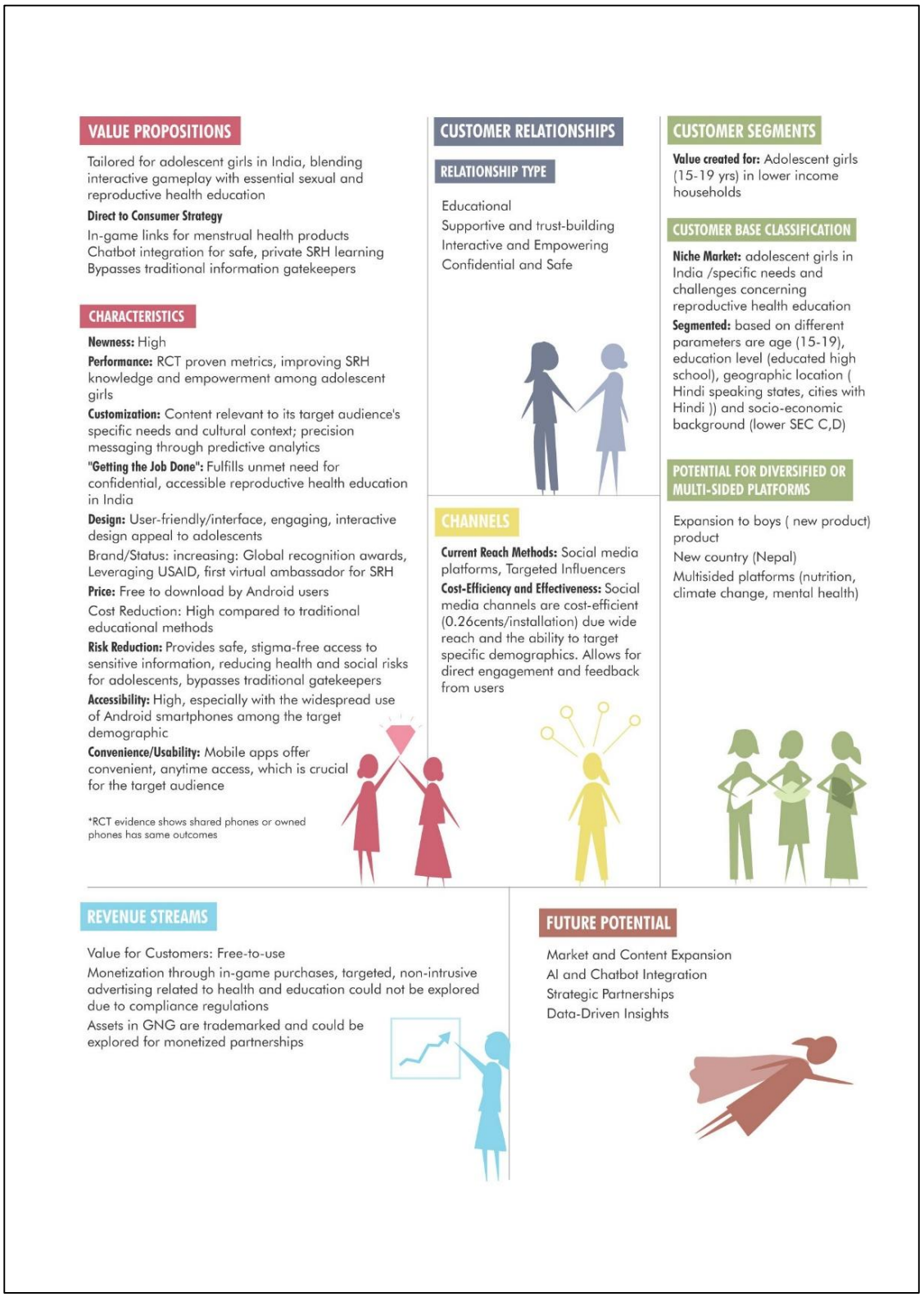

Figure 1B. Business Model Canvas for Go Nisha Go. (Source: Shankar, L., 2024. *Changing the Game: Insights from Howard-Delafield International's Digital Innovation for Social Impact in India*. DBA thesis. Swiss School of Business and Management Geneva.)

4.3 Channels

The channel strategy for Go Nisha Go was a comprehensive, multi-phase approach designed to reach adolescent girls aged 15-19 years in India, primarily from specific socioeconomic sections in urban and peri-urban areas in the Hindi-speaking states of northern India. This strategy evolved through four key phases: pre-launch, launch, sustenance, extended rollout, and scale-up. In the pre-launch phase, HDI

conducted extensive landscape analyses to understand the media consumption habits of adolescent girls in India, particularly those in rural and semi-urban areas. This was followed by brand development, which helped to position GNG as a relatable and trustworthy source of information for its target communities. At launch, GNG employed an extensive digital performance marketing campaign, leveraging influencers and online popularity with teenage girls. Hashtags like "#PuriKaroApniStory"(Complete Your Story) and "#MeriManzil" (My Goal) were used to create excitement and encourage downloads.

The channel strategy leveraged a sophisticated multi-platform approach with Google Play Store as the primary distribution channel, optimized through ASO/SEO techniques. A custom game anthem embodied empowerment themes, while performance marketing campaigns were meticulously tracked through a comprehensive conversion funnel, from impressions to downloads, enabling data-driven optimization of user acquisition.

The strategy evolved through distinct phases, focusing on user acquisition, engagement, and retention. The omnichannel approach integrated digital and offline strategies, recognizing that reaching adolescent girls required multiple touchpoints. Strategic in-game partnerships strengthened distribution by leveraging existing networks and providing market-based linkages to products and services.

After its launch in July 2022, GNG expanded to include a youth-led community outreach program targeting girls with limited smartphone access. This comprehensive approach yielded impressive results: close to 650,000 downloads and a 4.5-star rating on Google Play. Notably, many users accessed the app through borrowed devices, demonstrating the strategy's effectiveness in overcoming digital barriers while maintaining privacy. An RCT showed improved outcomes in menstrual health, contraception knowledge, and agency among intervention group participants. Moving forward, the successful GNG game has facilitated the creation and launch of a companion game for boys (www.gobrogame.com) to be allies of girls, and expand the GOC platform with more digital products and offerings beyond reproductive health such as nutrition, mental health, and climate change, thus expanding its reach further.

4.4 Customer relationships

These were a critical aspect of GNG's success, and the project employed several strategies to build and maintain strong connections with its adolescent users. The game was co-created with findings from formative research covering over 100 adolescent girls from three Indian states (Raj et al., 2023) followed by a series of design testing research sessions with adolescent girls from the target demographic, ensuring that the content, language, and design were aligned with the scenarios and storylines reflecting their lived experiences. This co-creation process not only helped to build trust but also ensured that the game was culturally and colloquially relevant and thus engaging.

To enhance user engagement, GNG incorporated several in-app features, including a dedicated microsite for user engagement. This microsite also had a help section with frequently asked questions (FAQs), contact information, and links to additional resources. A chatbot named AskParo was developed to answer users' questions in real time, offering immediate support on sensitive topics related to SRH. Predictive analytics and machine learning enhanced user experience by personalizing gameplay based on individual choices. The platform analysed decision patterns to identify potentially risky SRH behaviours, providing targeted feedback and prompting users to reconsider choices through customized messaging. Real-time analytics tracked user decisions to support those demonstrating high-risk patterns. The game also featured an achievement system with levels, rewards, and challenges, which incentivized continued play and knowledge retention. This system was designed to entertain and strengthen knowledge retention by encouraging repeated engagement with educational content. By combining these strategies, GNG was able to build strong, long-term relationships with its users, fostering both trust and sustained interaction with the platform.

4.5 GNG's revenue model

It primarily relied on external funding and strategic partnerships to ensure that the game remained free for end-users. Initially funded through a funder call for proposals for a Direct-to-Consumer Approach to Fertility Awareness and Reproductive Health Information for Adolescents', GNG was conceived as a proof of concept and made available as a free download on Android platforms. With maintenance costs estimated at $2 per user and download cost at 26 cents per user (excluding development, this was derived from tracking a conversion funnel for the marketing spend covering impressions, that led to clicks, and the ultimate download), this exponential reduction of costs as the downloads increase makes GNG a cost-effective and scalable solution for SRH education targeting adolescent girls in India.

Rather than adopting traditional sales or monetization strategies, GNG's funding approach focused on securing in-game partnerships to maintain its accessibility. As the first product from the GOC initiative, GNG tested a direct-to-consumer (DTC) model, aiming to deliver SRH information directly to users' hands. While the funder supported market-based approaches, there has not been much innovation in evaluation methods more appropriate for a digital market product, where RCTs are still considered the gold standard. Therefore, a randomized controlled trial (RCT) was implemented to provide robust evidence of the game's impact on SRH outcomes among adolescent girls.

Post-game launch, plans for future revenue generation included expanding in-game partnerships through tiered payment models and leveraging trademarked branded merchandise while ensuring free access for users. This diversified revenue strategy aimed to minimize dependence on any single funding source and ensure the project's sustainability while aligning with its social impact objectives. The game's design prioritized a free-to-use model, and strict data privacy regulations (which avoided collecting personal information) hindered targeted advertising opportunities, hence attempts made to consider Google's Ad Mob app that facilitates monetization through improved ad revenue were a no-go. As a result, external funding and partnerships continued to be the primary financial backbone, allowing GNG to fulfil its mission of providing free, accessible SRH education while exploring scalable solutions for future sustainability.

4.6 Key resources

The success of GNG was underpinned by several key resources, including a multidisciplinary team that included behavioural scientists, researchers, product developers and engineers, a robust technological infrastructure, and strong partnerships with external organizations. One of the most critical resources was GNG's strong foundation in user-centred research and design thinking process done by the in-house team (Raj et al., 2023; Shankar et al., 2023), which informed every aspect of the game's design and development. The team's emphasis on understanding adolescent girls' lived experiences, challenges, and aspirations shaped the game's narrative architecture and learning pathways. This research-driven design thinking approach was then brought to life by skilled developers, designers, and user experience (UX) specialists who translated these insights into engaging gameplay mechanics. Their research findings ensured that GNG could deliver on its value proposition by creating authentic scenarios that resonated with users' real lives while seamlessly integrating reproductive health education into the gaming experience.

The success of this approach lay in how the design directly reflected research findings, whether it was the choice of conversation styles and cultural nuances to the specific challenges Nisha faces. Every element was grounded in documented user experience rather than assumptions about what might engage adolescent girls. In addition to the technical team, public health experts, behavioural scientists and content creators played a vital role in developing the educational content for the game. These experts ensured that the information provided to users was accurate, up-to-date, and culturally sensitive, addressing the specific health challenges faced by adolescent girls in India. The content was carefully designed to be both informative and engaging, helping users retain critical health knowledge. Language translators played a critical role in preserving the colloquial language of the target audience while ensuring that the technical information remained accurate and accessible. This approach helped maintain the cultural relevance of the content without compromising on the educational value. Furthermore, an award-winning Bollywood music composer was retained to create the background score for the game, adding a familiar and engaging auditory experience that resonated with the users.

Another key resource deployed by GNG was data analytics, which provided crucial insights into user engagement patterns and learning pathways. Game analytics revealed critical dropout points, particularly during video interruptions and mandatory exploration sections for topics like contraception and menstrual hygiene. These insights drove specific improvements, such as streamlining content delivery and optimizing the balance between educational requirements and gameplay flow, leading to enhanced user retention and learning outcomes.

HDI also invested in technology infrastructure that included cloud-based servers based in India in compliance with Indian laws, content management systems, and development tools necessary for running and maintaining the app, including regulatory compliances. Local partnerships with community and social influencers also played an important role in user acquisition and providing contextual insights that informed the game's development. Additionally, GNG's intellectual property, including its proprietary game design, brand value, game content, and algorithms, formed the core of the product and provided a competitive advantage in the digital health space.

Finally, HDI also received additional funding for an outcome evaluation using research expertise from international research organizations for designing an RCT-based outcome evaluation (Raj et al., 2025) to demonstrate improved SRH outcomes related to menstrual health hygiene management, intended contraceptive use, and increased negotiation skills for decision-making with parents for delaying marriage or with partners for contraception use.

4.7 Key activities

The comprehensive game development included activities grounded in evidence-based research (Arnab et al., 2013) and a human-centred design thinking approach (Brown and Wyatt, 2010; Vechakul et al., 2015) to develop relatable avatars and scenarios for the game. The game's design was further shaped by social theoretical frameworks (Kuhn, 1962), game-based learning principles (Prensky, 2001), models such as the Proteus Effect (Yee et al., 2009) and Social Learning Theory (Bandura, 1977). Content creation and localization were also central to GNG's operations from the outset, utilizing co-design workshops with cohorts of adolescent girls to ensure the game's content, language, and design reflected their realities. The development followed a systematic product cascade incorporating an iterative design process that allowed for regular updates based on user feedback, ensuring authenticity and engagement. Localization efforts ensured that the game's content was available in Hinglish (with audio content in Hindi and English) and adapted to the cultural contexts of its users. The implementation strategy leveraged interactive chatbot and machine learning capabilities, analysing deanonymized data from over 1,000 players across three North Indian states to develop predictive analytics models. User acquisition strategies such as digital marketing, influencer partnerships, and youth-led community outreach programs were designed to build a strong user base and encourage long-term engagement with the game.

4.8 Key partnerships

Figure 2. Strategic partnerships for Go Nisha Go (Source: (2024) Howard Delafield International)

Multiple approaches evaluated GNG's effectiveness. In-game metrics tracked user engagement through playtime and choices, while predictive analytics enabled targeted improvements. A design-led Theory of Change framework, grounded in social, behavioural, and game-based learning theories, guided measurement pathways (Shankar et al., 2023). An encouragement design-led RCT across three Indian states with 2,000 girls demonstrated significant improvements, including increased contraception negotiation intention from 65% to 80% (Saha et al., 2023), validating evidence-based digital health interventions (Raj et al., 2025). The direct-to-consumer approach provided easy SRH access via in-game partnership links, ensuring continuous refinement and scaling potential.
GNG's strategic partnerships spanned menstrual hygiene manufacturers, content and technology developers, and community-based youth organizations. These partnerships were essential for accessing digital content, marketing, and game distribution. HDI collaborated with CycleTechnologies Inc. to integrate their Cycle Beads app as an in-game resource, providing users with reproductive health management tools while offering comprehensive educational experiences.

Over 25 partnerships were established as in-game linkages, including Tech Sakhi, Safetipin, PeeSafe, Boondh, EcoFemme, and PinkLegal. Technical partnership with Indusgeeks (now Metamersive) ensured app optimization for low-cost smartphones, making GNG cost-effective for delivering SRH education at scale. Throughout the project, the funder provided integral support for research, design thinking, product development, and implementation, offering experts in gender, youth, evaluation, and rapid reviews when required.

4.9 The costing structure

GNG reflected the project's focus on providing a high-quality, feasible, educational solution while keeping costs manageable. GNG's operational framework demonstrates a strategically balanced allocation of resources across four primary domains. The largest investment (40%) was directed toward Core Product Design, Development and Technical Infrastructure, encompassing technical design, user interface development, game mechanics, and interactive features including an interactive chatbot integration. Implementation and Market Engagement activities consumed 25% of resources, focusing on communication strategies, partnership development, content localization, and user acquisition through digital marketing and influencer collaborations. The Research and Analytics Framework, accounting for 20% of expenditure, supported comprehensive formative research, ethnographic studies, outcome evaluation, and data-driven optimization through predictive analytics. Management and Administration were maintained at a lean 15%, covering essential personnel, legal compliance, and administrative functions. This efficient cost structure, achieving an operational cost of 26 cents per download, positions GNG as a highly scalable digital health intervention in resource-constrained environments. The model exemplifies HDI's demonstration of the viability of digital health solutions in emerging markets through strategic content creation and efficient resource allocation for efficiency. Such cost-effectiveness aligns with emerging frameworks for sustainable digital health interventions (Garney et al., 2022), particularly where scalability and accessibility are paramount considerations for public health impact.

5. Conclusion

The business model for GNG's success hinges on several key design dimensions, including early discovery research, customer segmentation and enhanced value proportion as part of product development. Following an entrepreneurial, market-based approach that involved continuous refinement based on user feedback, GNG benefited from the multidisciplinary approaches, which led to the product's acceptability and effectiveness for the improvement of specific reproductive health outcomes.

GNG's business model illustrates the inherent tension between maximizing social impact and ensuring financial viability, particularly while maintaining balance between evidence-based product design, and strict data privacy standards for adolescent users. Nevertheless, the future of digital health interventions requires a shift toward integrating early-stage monetization strategies to ensure long-term viability, moving beyond reliance on traditional funder grants.

The BMC analysis of GNG (Figures 1A and 1B) serves as a valuable benchmark for future digital health innovations, showcasing the importance of leveraging mobile technology and designing evaluation frameworks that match the agile nature of digital interventions to create a value proposition that balances social impact while maintaining user privacy and engagement.

GNG's cost-effectiveness demonstrates digital health scalability potential. While interventions like mMitra's voice messaging service (Murthy et al., 2019) exist in South Asia, GNG's gaming approach to adolescent reproductive health presents unique opportunities. Its success in engaging youth while maintaining privacy offers insights for future interventions, highlighting the challenge of balancing user privacy, engagement, and sustainable revenue models in adolescent-focused digital health solutions.

As digital health evolves, future projects can adapt GNG's Business Model Canvas framework, integrating monetization strategies with long-term impact from initial design phases. Comparative evaluations of similar interventions will provide crucial insights for developing scalable, sustainable solutions that overcome socio-cultural barriers and reach underserved populations.

References

Aranda-Jan, C. B., Mohutsiwa-Dibe, N., and Loukanova, S. (2014) 'Systematic review on what works, what does not work and why of implementation of mobile health (mHealth) projects in Africa.' *BMC Public Health*, 14(1), 188. https://doi.org/10.1186/1471-2458-14-188

Arnab, S., Brown, K., Clarke, S., Dunwell, I., Lim, T., Suttie, N., Louchart, S., Hendrix, M., and de Freitas, S. (2013) 'The development approach of a pedagogically-driven serious game to support Relationship and Sex Education (RSE) within a classroom setting.' *Computers & Education*, 69, 15-30. https://doi.org/10.1016/j.compedu.2013.06.013

Bhatia, S., Gupta, A., and Kumar, R. (2020) 'Mobile phones and adolescents: Challenges and opportunities for sexual and reproductive health.' *Journal of Adolescent Health*, 67(4), 477-479. https://doi.org/10.1016/j.jadohealth.2020.07.010

Braun, V., and Clarke, V. (2006) 'Using thematic analysis in psychology.' *Qualitative Research in Psychology*, 3(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Brown, T., and Wyatt, J. (2010) 'Design thinking for social innovation.' *Development Outreach*, 12(1), 29-43. https://doi.org/10.1596/1020-797X_12_1_29

Business Standard. (2023) *Go Nisha Go wins Best Serious Game at the GALA2023 Serious Games Competition.* Press Release 2023-12-05. Business Standard. https://www.business-standard.com/content/press-releases-ani/go-nisha-go-wins-best-serious-game-at-the-gala2023-serious-games-competition-123120500503_1.html

Chaos Theory Games. (2023) Games for Change 2023 winners: Social impact games changing the world. Blog 2023-08-01.https://www.chaostheorygames.com/blog/games-for-change-2023-winners-social-impact

Denning, S. (2018) *The age of agile: How smart companies are transforming the way work gets done*. AMACOM.

Drummond, D., Hadchouel, A., and Tesnière, A. (2017) 'Serious games for health: Three steps forwards.' *Advances in Simulation*, 2(1), 3. https://doi.org/10.1186/s41077-017-0036-3

Feroz, A., Perveen, S., Aftab, W., Ummer, O., De Costa, A., and Fernald, L. (2019) 'Using mobile phones to improve young people's sexual and reproductive health in low and middle-income countries: a systematic review protocol to identify barriers, facilitators and reported interventions.' *Syst Rev*. 2019;8(1):117.

Garney, W. R., Wilson, K. L., Garcia, K. M., Muraleetharan, D., Esquivel, C. H., Spadine, M. N., Panjwani, S., and Ajayi, K. V. (2022) 'Supporting and enabling the process of innovation in public health: The framework for public health innovation.' *International Journal of Environmental Research and Public Health*, 19(16), 10099. https://doi.org/10.3390/ijerph191610099

Heeks, R. (2002) 'Information systems and developing countries: Failure, success, and local improvisations.' *The Information Society*, 18(2), 101-112. https://doi.org/10.1080/01972240290075039

Howard Delafield International (2024) 'Strategic partnerships for Go Nisha Go.' Presented by S. Swarup, K. Ayyagari, N. Mohandas, A. Raj and S. Howard at Game Changers' Fest 24, Evaluation Presentation, New Delhi, India, 24 January.

Ippoliti, N. B., and L'Engle, K. (2017) 'Meet us on the phone: Mobile phone programs for adolescent sexual and reproductive health in low-to-middle-income countries'. *Reproductive Health*, 14(1), 11. https://doi.org/10.1186/s12978-016-0276-z

Jejeebhoy, S. J., Santhya, K. G., and Zavier, A. J. F. (2014) 'Demand for contraception to delay first pregnancy among young married women in India.' *Studies in Family Planning*, 45(2), 183-201. https://doi.org/10.1111/j.1728-4465.2014.00384.x

Kato, P. M. (2012) 'Evaluating the efficacy and validating health games.' *Games for Health Journal*, 1(1), 74-76. https://doi.org/10.1089/g4h.2012.1017

Kuhn, T. S. (1962) *The structure of scientific revolutions*. University of Chicago Press.

Leischow, S. J., and Milstein, B. (2006) 'Systems thinking and modelling for public health practice.' *American Journal of Public Health*, 96(3), 403-405. https://doi.org/10.2105/AJPH.2005.082842

Murthy, N., Chandrasekharan, S., Prakash, M. P., Kaonga, N. N., Peter, J., Ganju, A., and Mechael, P. N. (2019) 'The Impact of an mHealth Voice Message Service (mMitra) on Infant Care Knowledge, and Practices Among Low-Income Women in India: Findings from a Pseudo-Randomized Controlled Trial.' *Maternal and Child Health Journal*, 23(12), 1658-1669. https://doi.org/10.1007/s10995-019-02805-5

Nambisan, S. (2017) 'Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship.' E*ntrepreneurship Theory and Practice,* 41(6), 1029-1055. https://doi.org/10.1111/etap.12254

New Indian Express. (2023) 'Number of Smartphones Doubled in Rural India from Pre-Covid Era: ASER.' *The New Indian Express*, January 21. Retrieved August 29, 2024 (https://www.newindianexpress.com/business/2023/Jan/21/number-of-smartphones-doubled-in-rural-india-frompre-covid-era-aser-2540034.html

Osterwalder, A., and Pigneur, Y. (2010) *Business model generation: A handbook for visionaries, game changers, and challengers*. John Wiley & Sons.

Paul, M., Chalasani, S., Light, B., Knuttila, A., and Kostrzewa, E. (2017) 'Transition from childhood to adolescence: A framework to identify health-care delivery gaps and barriers to adolescent health in India.' *Journal of Family Medicine and Primary Care*, 6(3), 447-452. https://doi.org/10.4103/2249-4863.222055

Prensky, M. (2001) *Digital game-based learning*. McGraw-Hill.

Raj, A., Shankar, L., Dixit, A., Saha, A., Battala, M., Khan, N., Ayyagari, K., Saggurti, N. and Howard, S., (2025) 'Enhancing reproductive health among adolescent girls in India: results of an individualized RCT to study the efficacy of the Go Nisha Go Mobile Game.' *Reproductive Health*, 22(1), pp.1-11.

Raj, A., Quilter, I., Ashby, E., Dixit, A., and Howard, S. (2023) 'Psychographic profiling — a method for developing relatable avatars for a direct-to-consumer mobile game for adolescent girls on mobile in India'. *Oxford Open Digital Health*, 1, Article oqad001. https://doi.org/10.1093/oodh/oqad001

Rittel, H. W., and Webber, M. M. (1973) 'Dilemmas in a general theory of planning.' *Policy Sciences*, 4(2), 155-169.

Rogers, E. M. (2010) *Diffusion of innovations* (4th ed.). Simon and Schuster.

Saha, A., Dixit, A., Shankar, L., Howard, S., and Raj, A. (2023) 'Study protocol for an individually randomized control trial for India's first roleplay-based mobile game for reproductive health for adolescent girls.' *Reproductive Health*, 20, Article 140. https://doi.org/10.1186/s12978-023-01665-1

Santhya, K. G., and Jejeebhoy, S. J. (2015) 'Sexual and reproductive health and rights of adolescent girls: Evidence from low- and middle-income countries.' *Global Public Health*, 10(2), 189-221. https://doi.org/10.1080/17441692.2014.986169

Shankar, L. (2024) '*Changing the Game: Insights from Howard-Delafield International's Digital Innovation for Social Impact in India.'* DBA thesis. Swiss School of Business and Management Geneva, pp. 104-105

Shankar, L., Dixit, A., and Howard, S. (2023) 'A Design-Led Theory of Change for a Mobile Game App (Go Nisha Go) for Adolescent Girls in India: Multimix Methodology Study.' *JMIR Formative Research*, 7, e43085. https://doi.org/10.2196/43085

Telecom Regulatory Authority of India. (2022) Annual report 2021-22. https://trai.gov.in/release-publication/reports/survey-reports

Trochim, W. M., Cabrera, D. A., Milstein, B., Gallagher, R. S., and Leischow, S. J. (2006) 'Practical challenges of systems thinking and modelling in public health.' *American Journal of Public Health*, 96(3), 538-546. https://doi.org/10.2105/AJPH.2005.066001

UNICEF (2019) Adolescents overview. UNICEF Data. https://data.unicef.org/topic/adolescents/overview/

United States Agency for International Development. (n.d.). *Private Sector Engagement*. Retrieved November 29, 2024, from https://www.usaid.gov/work-funder/private-sector-engagement

Vechakul, J., Shrimali, B. P., and Sandhu, J. S. (2015) 'Human-centred design as an approach for place-based innovation in public health: A case study from Oakland, California.' *Maternal and Child Health Journal*, 19, 2552-2559. https://doi.org/10.1007/s10995-015-1787-x

Wilson, K. L., Garney, W. R., Hays, C. N., Nelon, J. L., Farmer, J. L., and McLeroy, K. R. (2017) 'Encouraging innovation in teen pregnancy prevention programs.' *Creative Education*, 8, 294-303. https://doi.org/10.4236/ce.2017.82023

Yin, R. K. (2018) *Case study research and applications: Design and methods* (6th ed.). Sage Publications.