

Modular Innovation Proposal on Beautiful Patterns

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Executive Summary

Beautiful Patterns (BP) is a social initiative dedicated to bridging the educational gap in STEM careers by providing high-quality, accessible learning opportunities. Since its inception in 2018 at the Massachusetts Institute of Technology, BP has empowered young Latin American girls to pursue STEM careers and fostered a culture of collaboration and lifelong learning within the STEM women's community.

This proposal introduces a transformative innovation: the development of a self-service platform for BP's core Bootcamp. This interface and new delivery system will automate processes, enabling stakeholders to deploy the Bootcamp without reliance on BP's internal team. By leveraging modular innovation, the system will retain its core architecture while integrating new communication and operational technologies. This approach ensures scalability, reduces resource dependency, and positions BP for expansion into new markets, product development and diversification.

The initiative addresses key barriers, including implementation challenges and stakeholder adoption. To overcome these, BP will adopt a phased approach, starting with compatible partners like MISTI, and foster co-creation with stakeholders to ensure seamless integration. Effective strategic management and leadership will be critical, with transparent monitoring and transformative style guiding the project. This innovation will allow BP to scale its impact, ensuring long-term sustainability while fostering a culture of creativity and continuous improvement within the organisation.

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1. Introduction

Beautiful Patterns aims to bridge the educational gap in STEM careers by providing high-quality, accessible education. The initiative is driven by a mission to inspire young Latin American women to pursue STEM careers through meaningful learning experiences, while fostering a culture of collaboration, empowerment, and lifelong learning within the STEM women's community.

Since its inception in 2018 at the Massachusetts Institute of Technology (MIT), Beautiful Patterns (BP) has embraced a culture of exploration and adaptability, encouraging participants to identify and pursue growth opportunities. With a small, agile team of fewer than ten members, BP has built an educational portfolio, including micro-knowledge capsules, and online courses. Its flagship bootcamp, nowadays delivered in collaboration with MISTI (MIT Global Experiences) and Mexican universities, exemplifies BP's ability to innovate and deliver impact despite resource constraints and external challenges, such as the 2019 pandemic.

As a volunteer-driven initiative, BP relies on participants' commitment and availability, creating both momentum and operational instability. While its laissez-faire culture has fostered creativity and risk-taking, it has also posed challenges, as research by Bass (1985) highlights a negative correlation between laissez-faire leadership and organisational effectiveness. Sustaining core programmes like the bootcamp has become increasingly challenging, highlighting the urgent need for a more structured and scalable approach to secure BP's long-term impact.

Currently, BP prioritises exploration over exploitation within its innovation stages. While this emphasis encourages creativity, it has also led to diminished team motivation, cohesion, and impact. As noted by Chen and Katila (2008), an imbalance between exploration and exploitation can hinder success, with excessive focus on either leading to failure (Smith 2015). Motivated by problem-related thinking, this innovation addresses inefficiencies and scalability challenges by leveraging automation to streamline processes, scale offerings, and expand BP's reach. This transformation is crucial to realising BP's vision of sustainable and inclusive educational opportunities.

2. Modular Innovation Proposal

This initiative proposes the development of a self-service platform to revolutionise the delivery and management of BP's Bootcamp. By integrating a customer-centric interface and automated delivery system, dimensions of Den Hertog's (2000) model of service innovation (see Appendix C), this service and process innovation redefines stakeholder interactions, empowering users to adopt a more active role (Tidd and Bessant 2020).

The self-service platform reduces BP's reliance on volunteer-led operations, addressing the resource dependency that has historically constrained its growth. By automating BP's Bootcamp, this modular innovation introduces new components (an automated system) that enhance the existing architecture without a complete overhaul. This approach enables the replication of the innovation process across other learning offerings while reallocating talent to expand core products into additional Latin American markets (see Appendix B). By decreasing dependence on human resources, this innovation positions BP to scale its impact and adapt to evolving educational needs.

The implications of this innovation are transformative, benefiting multiple actors across BP's ecosystem. Directly, BP's internal team will experience reduced workload and increased efficiency, enabling them to focus on strategic initiatives. Key stakeholders such as MISTI and partner universities will gain streamlined processes that enhance collaboration and delivery capabilities. Indirectly, teaching assistants, educators, and students will benefit from smoother workflows and improved operational quality, enriching the overall learning experience.

The rationale for choosing modular innovation lies in its balance of consistency and transformation. By retaining the existing architecture and stakeholder roles, which are well-positioned according to internal perspectives (See Appendix D), the system introduces new methods of communication and interaction to modernise and future-proof operations. This degree of innovation is particularly effective as it preserves BP's core values and processes while enabling significant advancements in scalability and sustainability. Ultimately, this strategic renewal supports BP's transformation into a more agile, resource-efficient organisation capable of addressing both current challenges and future demands in EdTech.

2.1. Implementation

2.1.1. Current Position, Resources and Capabilities

BP has a proven track record of navigating organisational change with agility and resilience, driven by its strong culture of innovation. This commitment to continuous improvement, experimentation, and learning underscores BP's readiness to embrace this transformative innovation, even as it introduces complexities beyond previous undertakings.

The resources required for this initiative are well within BP's current capabilities (see Appendix A). The all-women team excels in IT, AI, and software, leveraging No-Code tools and scalable low-code alternatives for innovation. The organisation's strong component and system knowledge—spanning software expertise, sector-specific experience, and cohesive workflow integration—supports the innovation's implementation (Henderson and Clark 1990; Smith 2015). This foundation, combined with a focused technology strategy prioritising automation and AI, ensures BP's technological investments align with long-term organisational goals and competitive advantage (Dodgson 2000; Smith 2015).

Using an incremental resource commitment model (Tidd and Bessant 2020), BP will start with a minimum viable product (MVP), testing feasibility and iterating based on feedback. This approach, aligned with the innovation funnel (See Appendix E), ensures resources are allocated strategically, minimising risks while refining the solution. Although this proposed transformation is unprecedented in its scale and technical requirements, BP is well-prepared to overcome the challenges it presents. By leveraging its existing component and system knowledge (Smith 2015), BP can make significant progress while laying the groundwork for a sustainable, scalable solution.

2.1.2. Innovation Process and Stages

The implementation process will follow an iterative approach, beginning with process mapping and diagnosis. This stage leverages existing workflows to identify inefficiencies and areas for improvement, providing the foundation for defining the requirements needed to integrate technology effectively. By ensuring that the proposed system aligns with both operational needs and stakeholder expectations, this diagnostic phase sets a clear direction for the next steps.

Once the requirements are established, prototyping will be undertaken to test the integration of system components. Given the complexity of the platform and the numerous components interacting, prototyping will serve as a controlled environment to experiment, refine, and ensure functional alignment. This trial-and-error process reflects the inherent uncertainty and risk involved in innovation, where testing and iterative learning are vital to overcoming technical and design challenges (Smith 2015).

Building on the insights from prototyping, market research and testing will validate the platform's usability and user experience. This stage will include a trial deployment with MISTI, enabling BP to gather valuable feedback on the platform's design and functionality. The findings will guide refinements to the system and shape a marketing strategy tailored to stakeholder needs. Moreover, this stage acts as a critical milestone, providing measurable progress while reducing uncertainty and risks associated with service delivery innovation. As highlighted by Tidd and Bessant (2020), integrating strategy, processes, tools, and systems (SPOTS framework) ensures a comprehensive evaluation of service innovations, reinforcing BP's ability to adapt and refine its offerings.

Embracing the principle that failure is an integral part of learning, as noted by Dodgson and Gann (2010), BP sees early failures as opportunities to iterate and improve rapidly. Perseverance and collaboration, as underscored by Smith (2015), are crucial for navigating the adjustments necessary to achieve this innovation's full potential.

By combining process mapping, requirement definition, prototyping, and market testing, BP ensures that its innovation process is both technically robust and user-centred. Rooted in the principles of the Innovation Funnel, this structured pathway reduces uncertainty and risk while refining the platform through iterative stages (Tidd and Bessant 2020).

2.2. Fostering Innovation: Barriers and Leadership

To foster innovation, BP will focus on barrier removal and strong leadership—two key themes identified by Goldsmith and Clutterbuck (1985) as critical for driving innovation effectively. The two primary barriers for this initiative lie within the implementation and adoption phases, both centred on people-related challenges. First, successful implementation depends on motivating the team to achieve meaningful goals within timelines. And the second barrier: diffusion, the rate at which the innovation is adopted requires fostering engagement and collaboration among diverse stakeholders during the initiative's development and deployment (Rogers 2003; Smith 2015).

Internal resistance is unlikely, as the team recognises the necessity of this change to achieve BP's broader goals. However, maintaining commitment will require an active change into transformational leadership, which will be addressed in the following section. Presenting the project as straightforward, modular, and value-driven will be critical in dispelling perceptions of undue complexity. By targeting communication strategies to both internal teams and external stakeholders, BP can maintain alignment, sustain momentum, and secure the buy-in essential for the initiative's success.

Adoption presents a more significant challenge, particularly in managing relationships with BP's diverse stakeholders. Resistance may arise as BP transforms the system through which it interacts with all their stakeholders, making customer-centric design and strong relationships are critical to the innovation's success.

According to Rogers (2003) the diffusion of an innovation is a function of several characteristics, including its compatibility with existing values and practices, simplicity and ease of use, and observable results. BP's decision to begin with MISTI as early adopters is grounded in these principles. MISTI's cultural compatibility with BP ensures alignment with current practices and values, while the limited scope of processes makes the innovation simpler to implement and more likely to yield observable results. This makes MISTI an ideal starting point for automation.

To facilitate successful diffusion, it is essential to involve stakeholders early and actively during the development process, creating a co-creation environment that encourages their participation and investment in the change (Rogers 2003). This approach will help stakeholders feel as integral contributors to the project, reducing resistance and fostering long-term engagement. Starting with MISTI offers a low-risk, high-reward pilot phase that can

build internal momentum, increase team confidence, and generate insights for subsequent phases.

This modular development approach, which divides the project into the smallest possible units while still delivering measurable value, will minimise disruption to staff, facilitate smooth adoption, and create a roadmap for engaging more dynamic and traditional stakeholders in later stages. By addressing both implementation and diffusion challenges systematically, BP will ensure the innovation achieves its intended impact while reinforcing stakeholder cooperation.

2.2.1. Management and Transformational Leadership

As highlighted, the greatest risks to the success of this proposal are people-related, making effective project management and leadership pivotal. Managing this initiative requires establishing and communicating a unified vision that aligns all participants, ensuring consistency across BP's departments. Clear timelines and proactive efforts to address resistance to change will create the necessary structure to sustain progress and maintain momentum.

Transparency and monitoring are critical for success. Regularly tracking progress through well-defined metrics ensures alignment with project goals while celebrating milestones reinforces team motivation and commitment. This transparent approach builds trust and secures stakeholder engagement by demonstrating the initiative's value and encouraging their continued support. New control processes will be essential to evaluate the automated system's success. While manual processes currently enable task tracking, automation demands a structured framework to ensure workflows function seamlessly.

The success of this initiative will be measured by seamless adoption of the automated interface, reduction of manual processes, and improved scalability. Key indicators include stakeholder satisfaction, increased efficiency, and measurable impact from automation. These processes and control system will allow BP to measure effectiveness, track progress, and refine operations based on data-driven insights, ensuring iterative improvements.

Leadership will play a decisive role in overcoming challenges and driving success. Given the complexity and innovative scope of this project, a transformative leadership style is essential. By maintaining its flat hierarchy, BP can ensure a unified direction, where leaders act not just as managers but as motivators and enablers who inspire to do more than initially believed possible (Carreiro and Oliveira 2019). The interactive vision of transformational leaders—

emphasising effective communication, shared values, and an encouraging environment for innovative teams (Carreiro and Oliveira 2019)—is what BP requires to navigate the complexities of this initiative and achieve its ambitious goals.

We recommend appointing two key leadership roles. First, a Project Leader, acting as the technical champion (Tidd and Bessant 2020), will drive progress by addressing technical challenges and maintaining focus on objectives. Second, a Godfather, comparable to an organisational sponsor, will provide strategic guidance, influence decision-making, and align the initiative with BP's broader mission and long-term goals (Smith 2015; Tidd and Bessant 2020). This dual-leadership structure balances technical expertise with strategic oversight, fostering collaboration and accountability within the team.

2.3. The Future of BP's Innovation

This innovation represents a milestone for BP, enabling it to overcome operational constraints and achieve scalable, sustainable growth. The self-service platform is more than a tool; it is a catalyst for streamlining operations. Effective leadership will be essential to sustaining this progress. By prioritising leadership development aligned with BP's strategic goals and maintaining a collaborative flat hierarchy, the organisation can ensure resilience and adaptability. Embedding continuous feedback loops informed by Kolb's learning cycle, as outlined by Tidd and Bessant (2020), will enable BP to iteratively evaluate outcomes, codify lessons, and refine strategies. Cultivating a double-loop learning system (Tidd and Bessant, 2020) will further enhance BP's ability to adapt its innovation processes to changing environments, fostering the dynamic capabilities essential for sustained growth.

Through this effort, BP establishes a replicable model that integrates adaptive learning with strategic foresight, making its processes more sustainable, strengthening partner relationships, and enhancing leadership—key improvement areas identified in the audit results. Building on this strong foundation, BP will be positioned to expand its internal capabilities, diversify its product offerings, and engage with broader geographical stakeholders, creating a more extensive innovation ecosystem. This will ensure that its mission of fostering inclusive STEM education continues to inspire and empower communities worldwide.

3. Appendices

3.1. Appendix A. Resources and Capabilities Analysis

The team, composed entirely of women with engineering degrees in applied computer science, includes specialists in IT project management, artificial intelligence, and software development, proficient in automation, DevOps, and Agile methodologies. Additionally, BP can leverage No-Code tools included in Microsoft 365 licences and, if necessary, explore open-source or low-code alternatives for cost-effective scalability.

High Capability and Low Importance No-code, Low-code and open-source tools	High Capability and Importance - Software expertise - Sector-specific experience - Niche knowledge
Low Capability and Low Importance Outdated or manually reliant processes (will be replaced by automation)	Low Capability and High Importance - Strong and consistent leadership Scalability of current workflows - Human resources dependency Sustainable operations speed

Insights from the analysis:

- Component Knowledge: Software expertise and sector-specific experience enable BP to optimise individual innovation elements.
- System Knowledge: Integration of components into cohesive workflows supports alignment with broader architecture (Henderson and Clark, 1990).
- Technology Strategy: Focused on automation and AI to ensure technological investments drive competitive advantage (Dodgson, 2000).
- Human Resources: Expertise in IT project management, AI, and Agile methodologies.
- Tools and Infrastructure: No-Code tools (e.g., Microsoft 365), with options for open-source or low-code alternatives to maximise flexibility and efficiency.
- Innovation Approach: Incremental resource commitment starting with an MVP, minimising risks and refining solutions before scaling (Tidd and Bessant 2020).

The organisation possesses extensive *component* knowledge, including advanced software expertise and sector-specific experience, and *system* knowledge, which involves the integration of these elements into cohesive workflows and processes to support seamless operations (Smith, D. 2015). This distinction between component and system knowledge, as highlighted by Henderson and Clark (1990), underscores BP's ability to optimise individual elements while ensuring alignment with the broader architectural framework of the innovation. Additionally, BP's approach reflects a focused technology strategy, as described by Dodgson (2000), which emphasises the development and application of core technological competencies. By concentrating on key enabling technologies, such as automation and artificial intelligence, BP ensures its investments are strategically aligned with long-term goals, enhancing both scalability and competitive advantage (Smith, D. 2015). These resources and capabilities are integral to developing the minimum viable product (MVP) and establishing a foundation for scalable implementation.

3.2. Appendix B. Ansoff's Matrix

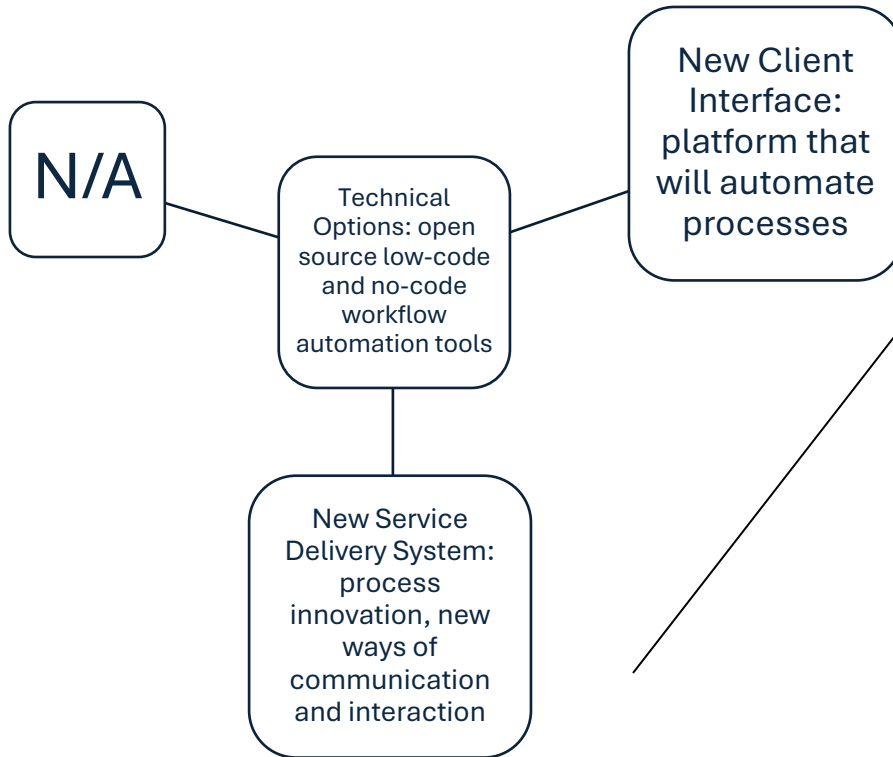
BP consolidates its flagship Bootcamp in existing markets (Mexico). The automation innovation ensures a self-service system that supports better delivery and accessibility in its current user base. This strengthens BP's market presence and operational efficiency. The development of a modular, automated interface for the Bootcamp is a new service designed to improve the delivery of existing programmes within BP's current markets. This initiative introduces advanced technology for stakeholders, process optimisation and efficiency, while retaining the Bootcamp's core educational content.

	Existing Products	New Products
New Markets	Market Development Expand to Chile, Perú and other Latin American countries. This innovation will enable scalability to offer existing products in new regions.	Diversification - Customised learning programmes for different cultural or economic contexts - Digital and gamified learning experiences
Existing Markets	Protect and Build - Computational Thinking Bootcamp (delivered in collaboration with MISTI and Mexican universities) - Online courses - Micro-knowledge capsules	Product Development Modular service and process innovation to automate Bootcamp offering

BP's innovation aligns with the **product development** and **market development** quadrants of the Ansoff Matrix. Automating the Bootcamp enables the enhancement of existing offerings, driving product development by improving scalability and efficiency. Simultaneously, the platform supports market development by reallocating resources to expand BP's reach into new Latin American countries, addressing untapped educational needs. This dual focus ensures sustainable growth and broader impact while minimising operational risks.

3.3. Appendix C. Dimensions of Service Innovation

Den Hertog's (2000) model outlines four dimensions of service innovation, three of which are central to BP's proposed self-service platform: the client interface, service delivery, and technology.



The **client interface dimension** transforms the user experience by shifting the role of stakeholders—such as universities, teaching assistants, and educators—from passive recipients to active participants (Tiidd). BP's platform achieves this by enabling stakeholders to directly interact with an intuitive and automated system, fostering engagement and reducing reliance on BP's core team.

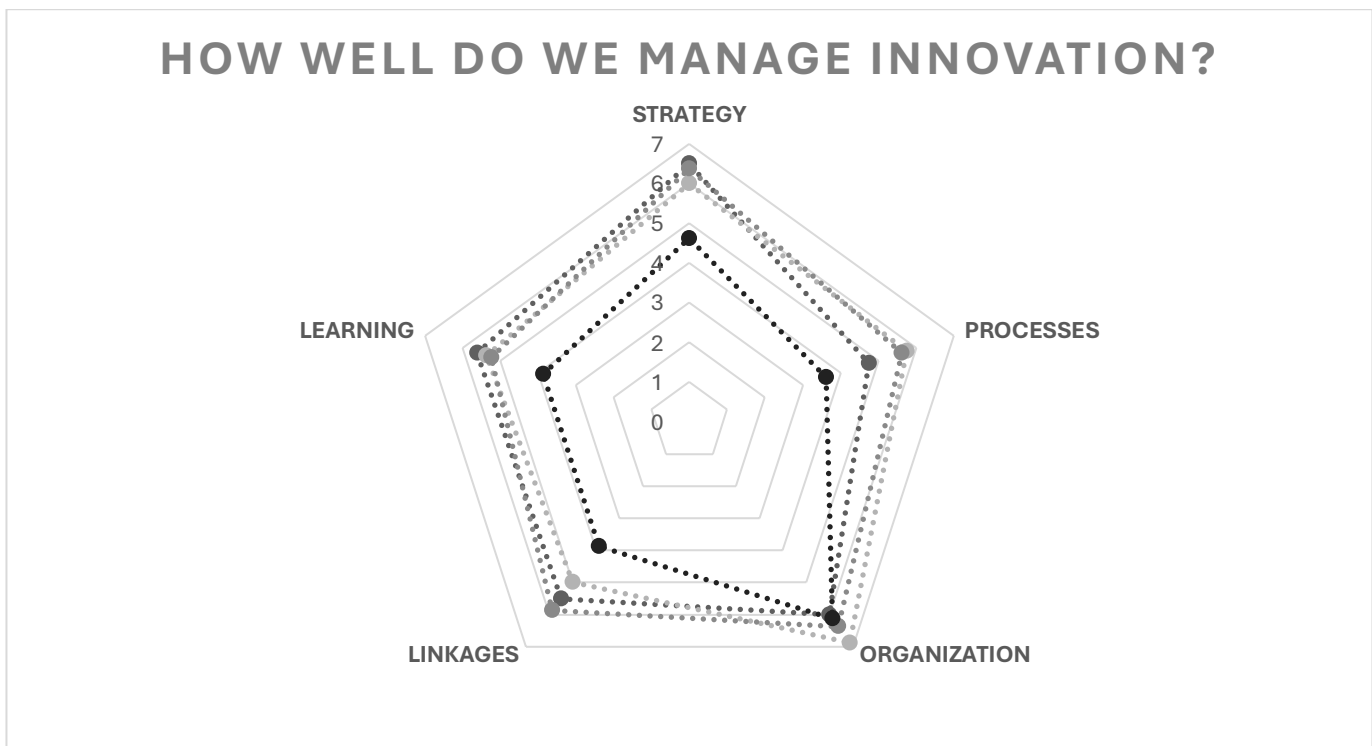
The **service delivery dimension** focuses on reorganising how services are provided. BP's innovation employs automation to streamline processes, ensuring seamless workflows and efficient delivery of its Bootcamp. This transformation aligns with the dimension's emphasis on modernising operations to enhance service efficiency and scalability.

The **technology dimension** underpins the platform's success, as it integrates cutting-edge tools and automation technologies to enable these innovations. By leveraging new technologies, BP enhances its operational capacity and ensures the platform remains adaptable to future challenges and evolving needs in STEM education.

3.4. Appendix D. Innovation Audit

A self-assessment exercise was conducted using the tool included in *Managing Innovation* by Tidd, Bessant, and Pavitt (2005). The assessment was shared with BP's core team, collecting four of the six leaders' responses, with each graphed series (or row for the table displayed) representing the responses of individual leaders.

STRATEGY	PROCESSES	ORGANIZATION	LINKAGES	LEARNING
6.5	4.75	6	5.5	5.625
6	5.75	6.875	5	5.375
6.375	5.625	6.375	5.875	5.25
4.625	3.625	6.125	3.875	3.875



Overall, the series displayed similar trends, forming a consistent pattern across most areas. Interestingly, the black series, which recorded the lowest scores, represented the perception of the strategy leader. This perspective appeared noticeably more pessimistic compared to other areas such as learning production, course delivery, and course development. It would be valuable to confirm this information with other strategic leaders within the organisation to determine whether their perceptions align.

In general, the assessment revealed that all leaders felt comfortable with the organisation and its overarching strategy. However, areas for improvement were most evident in processes, relationships, and learning. The proposed innovation initiative directly addresses these identified areas by formalising and automating processes, strengthening existing relationships with universities and other stakeholders, and providing an opportunity to learn from this initiative. This learning process could then inform future expansions, knowledge-sharing mechanisms, and efforts to preserve and leverage institutional knowledge.

The self-assessment further reinforced that BP possesses a culture and ecosystem conducive to innovation. The areas targeted by the proposed initiative directly tackle the challenges highlighted in the assessment, confirming its strategic relevance and potential impact. This alignment makes the effort even more worthwhile as a strategic move to enhance BP's operational and innovative capacity.

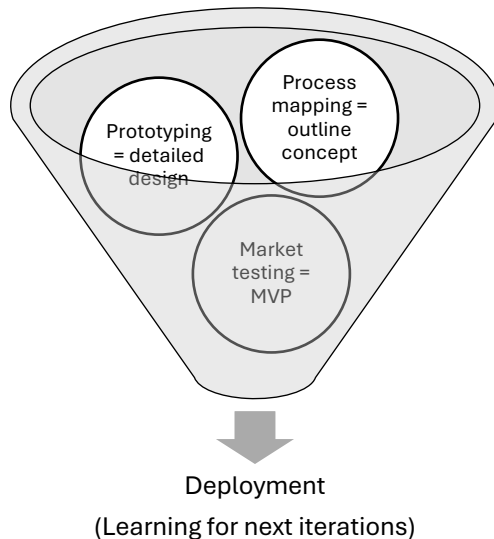
Key Insights:

- The innovation aligns with the identified opportunities in processes, relationships, and learning.
- BP demonstrates a strong cultural foundation and readiness for innovation, validating the initiative's importance.
- The tool confirmed the strategic importance of addressing these gaps through the proposed innovation.

This analysis reinforces the rationale for pursuing a **modular innovation** approach, as it confirms that, from an internal perspective, BP's strategy and organisational culture possess the necessary foundation for growth and innovation. It highlights key areas for improvement, particularly in relationships, knowledge retention and expansion, and process optimisation. The current innovation proposal—**focused on a new interface, client delivery systems, and process improvements**—effectively addresses these opportunities and aligns with the organisation's present position.

3.5. Appendix E. Innovation Funnel

BP's innovation process follows a structured pathway aligned with the Innovation Funnel (Tidd and Bessant 2020), beginning with process mapping and diagnosis and progressing through prototyping, market testing, and final launch. This ensures a disciplined approach that balances creativity with precision and risk management.



BP's adoption of an incremental resource allocation model, similar to the Innovation Funnel (Tidd and Bessant 2020), ensures that resources are strategically committed as confidence in the platform increases. Starting with an MVP allows BP to test assumptions early, refining the system and minimising risks before full-scale deployment.

In line with the Funnel of Uncertainty framework, BP's phased approach prioritises early knowledge acquisition through prototyping and testing. This iterative process ensures the platform is designed to meet stakeholder needs while progressively reducing technical and market risks. Drawing from the Funnel of Uncertainty, BP's innovation process will focus on reducing risk and validating decisions at each stage, beginning with prototyping and progressing to market testing. By prioritising early knowledge acquisition through stakeholder feedback and iterative improvements, BP will build a robust, user-centred platform.

Acknowledging that innovation inherently involves uncertainty, BP embraces failure as a stepping stone to success. As noted by Dodgson and Gann (2010), early failures during testing present valuable opportunities to iterate and improve. Furthermore, perseverance and collaboration, essential attributes of successful innovation (Smith, 2015), will guide BP through the adjustments required to achieve its full potential.

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