

Advantage of Technical Knowledge in Making Business Decisions

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Abstract

A company's success in the modern business landscape is always tied to its ability to innovate on its processes, products, and services. Product innovation has always been a key driver in acquiring market share, establishing competitive advantage, and even demonstrating the strength of sustainability [1]. However, engineers constantly struggle to align innovation with management decisions, especially when attempting disruptive innovation. This paper explores the disconnect between business leaders and engineering teams and emphasizes the need for mutual understanding to bridge the gap, highlighting the importance of technical knowledge in management and a business mindset in engineers. It also outlines the complexities of the modern product innovation process and proposes methods for overcoming these challenges. Strategies such as technical upskilling for business leaders and cross-functional collaboration to foster an innovation-friendly environment are proposed to enhance product innovation and facilitate better decision-making processes.

Keywords: product innovation, technical challenges, technological uncertainty, engineering, business management, decision-making, cross-functional collaboration, technical literacy, system integration.

1. INTRODUCTION

In the current landscape of business evolution, companies are continuously innovating to remain in competition. Product innovation and disruption to the current market are at a higher scale than ever before. Product innovation, in particular, has been an essential driver of success across various industries, especially in consumer electronics and Technology service products. However, the Innovation process is constantly troubled with technical challenges, often impaired by the gap between the technical knowledge of engineering teams and the strategic decision-making abilities of business leaders.

Despite the critical role innovation plays in the organization's success, there is a persistent disconnect between engineering teams, which possess technical expertise, and business management, which drive the overall strategic direction of the companies. Business leaders often hire business-oriented product managers who are more inclined towards business and lack technical understanding to bridge the gap between business and engineering thought and help engineers connect with business thoughts. The challenge in this approach is that the business leaders expect engineering teams to align with business thoughts without putting an effort into fully understanding technical challenges in innovation or even being willing to invest their efforts in doing so. This misalignment often results in product delays, overrun budget, or even suboptimal solutions that fail to meet the market demand. Similarly, engineering leaders tend to struggle to communicate or articulate their challenges in terms of business objectives.

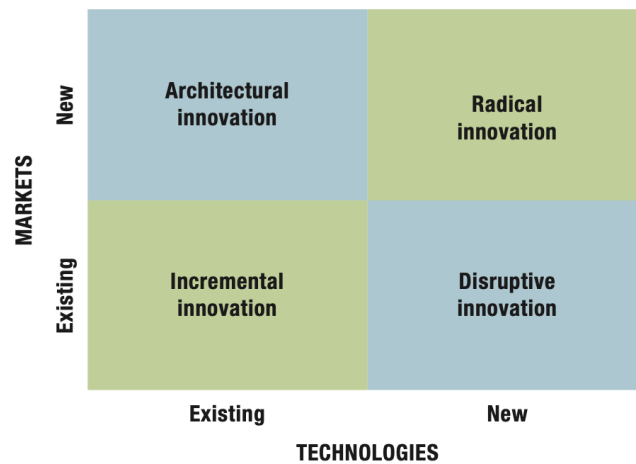
This paper is intended to address this gap and highlight the importance of understanding these challenges within the innovation space. Navigating the complexities of innovation and making informed decisions can be made more effective by fostering a mutual understanding between engineers and business leaders, thereby achieving overall successful outcomes.

2. LITERATURE REVIEW

A. Importance of Product Innovation

Product innovation can fall into any of the four categories: Disruptive, incremental, sustainable, and e. Irrespective of the type of innovation one focuses on, the need to meet customer needs and enhance functionality. The process of innovation is essential for companies that aim to sustain growth, capture market share, and respond to the ever-evolving technology landscape. According to studies, businesses that prioritize product innovation outperform competitors in critical areas such as customer satisfaction, profitability, and market relevance [2]. Using innovation as a strategy holds the potential for businesses to change competitive dynamics, capture emerging market opportunities, and build a sustainable business model [3].

B. Types of product innovation



Source: Strategic Management by Frank Rothaermel (2015)

Incremental Innovation[4][5]: This innovation refers to incremental improvements made to existing products or services to enhance performance and satisfy current customers. A typical example could be Coca-Cola's introduction of new flavors, packaging, and even product enhancement like Coke Zero.

Architectural innovation [4]: This refers to significant improvements made to existing products or services to maintain the competitive edge or to catch up with the competition on their performance and keep current customers satisfied. A typical example would be Apple's iPhone series, Microsoft Windows OS, where each new model offers better features that build on the existing design.

Disruptive Innovation[4][5]: This refers to introducing alternative solutions to solve the same customer problem or convenience or affordability, reshaping the market to the same customer segment. A classic example is Netflix disrupting the video rental industry with its streaming service.

Radical innovation [4]: This form of innovation is focused on exploring new markets that never existed before and often without immediate commercialization in mind, laying the groundwork for future innovations. Examples of such markets could be Amazon, Google, Facebook, etc. These markets were driven by the invention of the Internet. Blockchain, IoT, etc., fall into this classification.

C. Disconnect between Business Leaders and Engineers

Unfortunately, despite the importance of innovation, there exists a significant gap between business leaders and

engineering teams across organizations. Many business leaders often focus on the commercial aspects of innovation, such as market trends, revenue projections, and financial metrics, while overlooking the technical complexities involved in realizing the innovation [3]. In contrast, engineers tend to focus on the technical feasibility, efficiency, and risk associated with the innovation without fully considering the business implications. This disconnect often leads to misalignment, with business leaders pushing for aggressive timelines and cost targets that are not realistic from an engineering standpoint while engineers struggle to communicate the technical challenges effectively to the business side. However, the journey from market research to concept to market is rarely a straightforward process, with technical challenges being important to consider.

D. Understanding the disconnect

The innovation process is often a cross-functional collaboration process from customer insights that starts with sales or marketing to manufacturing or shipping to Customer service teams to provide post-sale support. However, the two main teams that make the product successful, especially the new market or disruptive innovation, are the engineering teams that innovate and the business team that invests. Business leaders are often excited by the possibility of opportunities explained by engineers, and engineers with enthusiasm for working on new technology overestimate the possibility of success with such technology. This often creates friction when the business leaders do not understand the dynamics of the engineering. It is also true that engineers need to understand the impact of their commitment on business viability. Business leaders often work with the concepts of predictability, driving customer perception and financial parameters that drive the sustainability of the organization. These parameters unconsciously build a behavior on commitment. However, engineers often have an experiment-oriented mindset, driving the possibility of failure and acceptance to delay deliverables to achieve perfection. This difference in mindsets and unconscious behavior creates challenges in communication and how they work with other teams, creating a disconnect between business leaders and engineers.

Template based on the scoring probability, resources, market, etc., to help communicate feasibility

3. TECHNICAL CHALLENGES IN PRODUCT INNOVATION

The process of product innovation is complex due to the combination of various technical and non-technical elements. Engineers are often responsible for designing and developing new products, facing a wide range of challenges that can hinder innovation or its output. These challenges are often caused by technological constraints, expert resource limitations, and the complexity of integrating new technologies into existing systems, especially when the technology is still in development.

a. Technological Complexity and Integration

In new markets, product innovation, especially in industries such as electronics, automotive, and aerospace, is a combination of multiple interdependent subsystems. Each subsystem must work harmoniously with the other subsystems, requiring precise integration to ensure the final product functions as intended. Engineers must manage all engineering aspects, such as hardware, firmware, mechanical, optical, and software integration challenges, ensuring compatibility while meeting performance, safety, regulatory, and reliability standards. For example, in the automotive industry, the integration of heads-up display systems requires engineers to combine sensors, machine learning algorithms, optical understanding, and control systems into a cohesive unit. Missteps in integration can lead to catastrophic product failures, which could cause heavy injury to the driver or even death.

b. Short-term vision vs Long term vision

Business leaders often prioritize growing revenue with their existing product base with incremental or sustainable innovation. This is mainly due to the lack of long-term product vision and focus on short-term vision. This often constrains resources like time, budget, and human capital for long-term product innovation. Engineers must

navigate these constraints while striving to meet ambitious disruptive or new market innovation goals. The pressure to reduce time-to-market often leads to compromises in product quality or technical rigor. There is a need for business leaders to understand the impact of these priorities on the product innovation process.

c. Technological Advancements vs expert resource

The pace at which the technology is evolving presents itself as a new challenge for engineers. While these new technologies present new opportunities, they also introduce uncertainty and risk. Engineers have to balance the latest developments in their fields while ensuring the current technologies produce products for the market. The shortage of skilled engineers in new technology, especially if it is a specialized field, such as artificial intelligence (AI) and data science, could pose a significant barrier to successful innovation. Business leaders, who are typically more risk-averse, may be hesitant to embrace these uncertain paths, leading to a clash with the engineering team's more exploratory approach[5]. It is the business and engineering leaders' responsibility to balance the need to deliver product innovation with the practicalities of resource limitations and how well a task can be executed. This dynamic, constantly evolving environment makes it difficult for both business and engineering to focus and gain confidence in the direction of product innovation. These changing business decisions can hinder the engineering team's confidence and morale if not communicated properly. The key for business leaders is to understand that an engineering mindset makes engineers invest in personal feelings while developing new technology products.

d. Regulatory and safety standards

Product innovation in regulated industries, such as aviation and automotive, is often regulated by rigorous safety and regulatory requirements. Engineers must ensure that new products comply with national and international standards, which can vary significantly across regions. Additionally, the new technologies may not have regulation standards. Navigating these regulatory challenges adds a layer of complexity to the innovation process, where engineers must balance innovation with compliance. Meeting these standards often requires extensive testing, certification, and documentation, which can delay product launches.

e. Intellectual Property and Patents

During the process of product innovation, especially in new market innovations, engineers have the ability to give a competitive edge to the business with intellectual properties (IP). It is also true that engineers might leap into other IPs, causing business challenges in the future stages of the products. Engineers must consider the legal implications of their designs, ensuring that their work does not infringe on existing patents. Additionally, they must work with legal teams to file patents for new innovations, a process that can be time-consuming and costly but necessary for commercial success. Failing to secure IP protection can result in lost revenue and diminished competitive advantage, as competitors may copy and market similar products. This understanding of business from engineers could help businesses achieve far greater results than they intended.

4. UNDERSTANDING THE GAP

While engineering is focused on solving the problems defined by the customer or by the business based on their research, business leaders are responsible for aligning these technical solutions with the value created for the success of the organization. The key role is to align the business objective in terms of technical needs and vice-versa. Communication is a key element that creates or destroys the gap between the two groups. Effective communication can help align priorities, constraints, and expectations, while a mis or undercommunication could create misalignment, thereby destroying the effectiveness of strategic initiatives and innovations. This disconnect is often rooted in differences in perspectives, language, and focus.

a. Divergent Priorities

Business leaders, by nature and responsibilities, prioritize aspects such as cost reduction, market share, and custo-

mer satisfaction, while the engineering teams prioritize functionality, performance, and technical compatibility. This differing priority could often lead to conflicting goals, which then lead to conflicting strategies contributing to different visions. While business leaders focus on short-term goals with long-term vision, engineering teams concentrate on long-term goals with long-term vision. For example, a business leader may push for a shorter time-to-market to capitalize on a trending opportunity, while engineers may argue for more time to refine the product and ensure technical superiority.

When conflicts and these priorities clash, often the priorities are redefined with a holistic organizational vision in mind. During this process, compromises are made that may not be fully brought in or agreed upon by either side. As a result, the product is rushed to the market, compromising quality and technical superiority or even leaving customer needs as a gap. Consequently, these innovative products often fail to highlight the technical decisions that may have led to missed business opportunities.

b. Differences in Language

One of the primary reasons for the disconnect between engineers and business leaders is the difference in language they use. Engineers often communicate using technical jargon, acronyms, and detailed specifications, which may be difficult for non-technical management teams to understand. Conversely, business leaders often speak in terms of market trends, return on investment (ROI), and competitive positioning, which may seem abstract or irrelevant to engineers focused on solving specific technical problems.

This language barrier exacerbates the difficulty in aligning technical and business priorities. Engineers may struggle to convey the importance of addressing specific technical challenges, while business leaders may find it difficult to articulate their strategic vision in a way that resonates with the technical team. Effective communication requires both parties to bridge this language gap, finding common ground that allows for a shared understanding of both technical challenges and business objectives.

c. Misaligned Incentives

Incentives are one of the primary motivators for all the teams in the organization to work towards creating superior value. Incentives can come in many forms, from financial incentives to higher vacations to opportunities to work on interesting projects or product innovations. In many organizations, engineers and business leaders are incentivized in different ways. Engineers are rewarded for the development of technically superior solutions that provide a competitive edge in the industry and how well the planned product launch execution was handled. At the same time, the business leaders are evaluated based on financial performance, sales volume, and market share growth. These misaligned incentives can create friction between two groups, each prioritizing and focusing on goals that prove their worth to the organization.

For instance, engineers may prioritize developing cutting-edge technology-oriented products, even if it is costly and have a limited impact on the company's portfolio. In contrast, business leaders may prioritize products that are currently performing on cost, volume, and profit measures that reduce the scope for technical experimentation. The result is a conflict between technical excellence and financial judgment, which can hinder product innovation and overall company performance.

5. STRATEGIES TO BRIDGE THE GAP

To bridge the gap between engineering and business leaders, business leaders need to develop a foundational understanding of the technical challenges their teams face. This technical literacy could enable them to make more informed decisions, set and align with engineering team goals, and create strategies that balance technical feasibility with business goals.

a. Enhancing Technical Literacy for Business Leaders

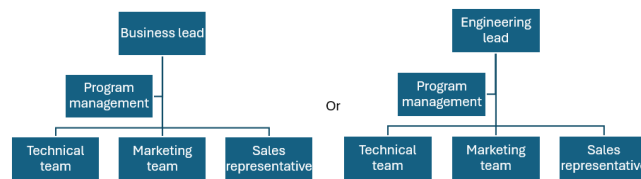
Technical literacy refers to the ability of business leaders to understand basic engineering concepts, technological trends, and the challenges that arise in the product innovation process. While business leaders do not need to be experts in engineering, a foundational understanding of technical issues can significantly improve communication and decision-making.

Company or industry-based training programs focused on increasing technical literacy for business executives can help bridge the communication gap. For example, short courses in relevant fields to understand the challenges such as software development, Autopilot, machine learning, AI, or manufacturing processes help business leaders with the knowledge they need to have meaningful conversations with engineering teams. Such programs can also cover topics like technology/product lifecycle management, the limitations of specific technologies, and the risks associated with cutting-edge innovations.

Additionally, creating opportunities for business leaders to work closely with technical teams through cross-functional projects or rotational assignments can provide hands-on experience and an opportunity to develop an understanding of a shared mindset. Exposure to the technical side of product development allows business leaders to appreciate the complexities engineers face and make effective decisions.

b. Forming Product teams

Based on the company's bandwidth, organizations can form product-based team structures that limit the matrix organization limitations and help teams work on aligned goals and incentives based on product success rather than individual capability goals. The concept here is to ask the business leader or an engineering lead with cross-functional experience to lead the product innovation process that aligns with the organization's goal. Each of the capabilities supporting the product innovation is incentivized based on the success of the product rather than misaligned incentives based on the capabilities. This approach is driven by the organization's capability to support and treat each of its product teams as non-competing internal entrepreneurship endeavors instead of aligned organization teams. These teams can often collaborate to offer high value to customers while creating value for the organization without hindering the ability to innovate by eliminating the barriers between business and engineering. Additionally, this creates opportunities for business leaders to work closely with technical teams through cross-functional innovation teams, allowing them to understand other teams' challenges and address their concerns, appreciating the complexities engineers face and making effective decisions.



c. Innovation manager and Innovation management process

Establishing a structured innovation management process involving business and engineering teams can help streamline the product innovation lifecycle.[2] A liaison often spearheads this process. Hiring a liaison is a very effective way to bridge the gap between the business leaders and engineering teams. These liaisons bring in the ability and skillset to understand both the business and engineering worlds and help establish an aligned understanding to achieve common goals. With the combination of innovation managers, often called product managers, and dedicated innovation processes, companies break down the walls that separate business and engineering and create higher value with the elimination of waste and focused vision.

Agile methodologies could be helpful in some industries as iterative innovation and business involvement in deci-

sion-making accelerate innovation.

d. Mutual mentorship

Creating and encouraging a mentorship program where business leaders and engineers can learn from each other's perspectives can help bridge the gap and foster mutual understanding. This program helps executives understand the challenges faced by the engineering teams and helps engineers understand the economic impact of their decisions. This program will also help to create future leaders in both business and engineering.

e. Fostering Cross-Functional Collaboration

Another effective strategy for bridging the gap between engineering and management is fostering cross-functional collaboration with the help of talent networks. In this approach, teams from cross-functional capabilities work together on temporary experimental or innovation projects, which are often proof of concepts. They can share knowledge, perspectives, and priorities, leading to more balanced decision-making. Cross-functional teams include both engineers and non-engineering teams across the organization, allowing for real-time challenges, communication, and problem-solving and reducing the risk of misunderstandings or misaligned objectives.

Companies can encourage cross-functional collaboration by breaking down departmental silos, promoting open communication, and ensuring that both technical and business perspectives are considered in decision-making processes. For example, some companies implement agile project management methods, where interdisciplinary teams work in short development cycles, continuously iterating and aligning their efforts with business goals.

6. CASE STUDIES OF SUCCESSFUL COLLABORATION

Innovation challenges are not new to the business world, and several companies have successfully bridged the gap between engineering and management, leading to breakthrough innovations and enhanced product performance. Tesla and Apple are two companies that illustrate how fostering collaboration between technical and business teams can drive product innovation.

a. Tesla Motors

Tesla Motors is renowned for its ability to innovate rapidly in the electric vehicle (EV) space. This success is possible due to the close integration between engineering and business teams. Elon Musk, Tesla's CEO, has a deep technical background, allowing him to make informed decisions about the company's engineering challenges while keeping business objectives in mind. Tesla emphasizes on cross-functional collaboration. Engineers work closely with business leaders to ensure that both technical performance and business goals are met.

b. Apple Inc

Apple Inc. provides another example of how successful collaboration between engineering and business leaders can deliver product innovation. Apple's innovation management process focuses strongly on both technical functionality and user experience design. Business leaders at Apple work closely with engineers and designers to ensure that products are not only technologically advanced but also meet market demands for usability and aesthetics. iPhone and Mac are classic examples of not only Apple's success but also examples of business leaders and engineering collaboration.

Apple's success lies in its ability to align the technical expertise of its engineering teams with the strategic vision of its business leaders. By fostering a collaborative culture where both groups work together to solve problems and make decisions, Apple has consistently been able to dominate the market.

7. CONCLUSION

The success of a company in the modern business landscape is directly linked to its ability to innovate on its pro-

cesses, products, and services. However, bridging the gap between business leaders and engineering teams remains a continuing challenge, as the two groups often struggle to align their priorities and understand each other's perspectives.

Understanding the technical challenges in product innovation is key to bridging the gap between engineering and business leaders. Engineers face numerous challenges. However, these challenges are often misunderstood or undervalued by business leaders, leading to misaligned priorities and suboptimal decision-making. To overcome these barriers, it is essential for business leaders to develop a foundational understanding of technical challenges and for engineers to align their priorities with broader business goals.

Enhancing technical literacy among business leaders, fostering cross-functional collaboration, and aligning incentives between engineering and management are critical steps toward achieving successful product innovation. This paper also suggests additional strategies like mutual mentorship and a dedicated innovation management process to achieve higher collaborations. By fostering a mutual understanding of both technical and business perspectives, companies can create an effective innovation process, ultimately leading to the development of products that meet both technical standards and market demands, positioning themselves for success in a competitive landscape.

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