Empowering AI-Powered Product Companies: Enhancing Design with Knowledge Management, Open Innovation, and Foresight

by

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Abstract

This paper proposes that Artificial Intelligence (AI) vendors should prioritise developing knowledge services for designers to improve the product innovation design process in the rapidly changing AI landscape. Emphasising a Knowledge-Based View (KBV), it argues for knowledge and its management as a key competency in design, crucial for product innovation. It explores the interaction of Open Innovation, Knowledge Management, and Foresight in enhancing knowledge delivery for designers, focusing on the importance of speed and accuracy of ideation in product innovation. The paper highlights the role of internal and external knowledge in improving design process outcomes and provides strategy and frameworks for integrating knowledge utilising a knowledge service, aiming to enhance innovation efficiency.

Introduction

In the AI-influenced business landscape, this paper proposes a refined design methodology for B2B AI vendors, merging open innovation, knowledge management, and foresight. It aims to augment designers' capabilities, ensuring design agility and market alignment. Addressing the rapid technological flux, it underscores the necessity for a cohesive framework to fortify vendors' innovation speed and accuracy, securing a competitive stance. The primary research question investigates the extent to which integrating these elements into the design process can expedite innovation and enhance market competitiveness—key components of resilience in the contemporary VUCA (Volatile, Uncertain, Complex, Ambiguous) environment.

This paper explores the melding of Open Innovation (OI), Knowledge Management (KM), and Foresight (FS) in AI innovation design, through a Knowledge-Based View (KBV). It begins by detailing the AI landscape and vendor needs, then employs KBV to highlight knowledge’s role in innovation. It then assesses how OI and KM capture and organise customer insights, and how FS anticipates AI evolution, promoting adaptable design thinking. The culmination is a knowledge service framework that integrates these disciplines into the design process, aiming to enhance AI vendors' design agility and market competitiveness.

The integration of open innovation, knowledge management, and foresight markedly bolsters the resilience and market competitiveness of B2B AI vendors. Findings indicate enhanced adaptability and decision-making in ideation, which accelerates innovation and helps align product development closely with market dynamics. Although, further empirical studies are anticipated to substantiate these findings.

Research Methodology

Premise

This research suggests that the amalgamation of open innovation, knowledge management, and foresight methodologies may significantly bolster the robustness of AI-powered product innovation design, thereby accelerating innovation and fortifying market competitiveness—crucial elements for resilience within the contemporary VUCA (Volatile, Uncertain, Complex, Ambiguous) landscape. It investigates this through literature review, and primary data from AI-powered product's designers, providing valuable qualitative insights and bridging theoretical analysis with practical industry-specific knowledge.

Secondary Research

The research began with a literature review to grasp the intricacies of AI, Open Innovation (OI), Knowledge Management (KM), Foresight (FS), innovation and design processes, the pivotal role of knowledge in innovation, and other works that intersect these domains. A targeted review followed, focusing on industry challenges, AI market growth, and the imperative for outsourcing and open innovation facilitation for AI vendors. It delved into the Knowledge-Based View (KBV) and Knowledge-Intensive Business Services (KIBS) to highlight knowledge as AI vendors' core competency.

The study also scrutinised the design process's critical role in innovation and the application of knowledge therein, including the use of internal and external knowledge. The study then delved into Knowledge Management (KM) strategies and organizational memory, aiming to strategically

leverage knowledge as a core competency. A STEEPV analysis was employed to understand AI's evolving context and thus relevant technological foresight methods were explored to address these evolutions. Literature on the product design process, designers' knowledge needs, and knowledge services was explored to help visualise a tailored knowledge service for product innovation.

Primary Research

Participants:

AI-powered product's designers

Purpose:

Engaging with designers from AI vendor firms, this study seeks to identify their knowledge needs in product innovation design and assess strengths and weaknesses therein, exploring the potential of a knowledge service to elevate the product innovation design process's efficiency and precision. It also examines visions for this service and ways to improve knowledge delivery and representation in the design process.

Online Recruitment Survey:

This recruitment survey asked for AI product designers' basic information, experience in AI product design, involvement in design processes, product's AI centrality, industry served, English fluency, interest to participate, contact details, and referrals to similar professionals.

70 designers were contacted and 4 of them responded and 1 participated in the study.

Interview: (Appendix 1 - Interview Questions)

This questionnaire was structured around themes of Design Process Steps and Knowledge Needs, Organisational Memory Representations, and the Need for Open Innovation, Foresight, and Knowledge Service. It probed into the current methodologies and practices employed in the design process, the organizational support structures in place for knowledge acquisition, and the potential impact of enhanced collaboration and technological insights on innovation. By eliciting detailed insights into each stage of the design process, it guided participants towards conceptualising a knowledge service that not only augmented the design process but also proposed strategies for its incremental improvement, fostering a continuous evolution in support of innovation.

Chapter 1: Harnessing Customer and Technological Knowledge for AI Product Innovation

Introduction:

This chapter delves into the strategic role of knowledge management for AI vendors, focusing on its application in providing specialised knowledge services for their designers. It underscores the importance of effective customer and technological knowledge utilisation, which directly impacts the speed and precision of innovation. This chapter highlights how managing and leveraging this knowledge is not just an operational necessity, but a strategic imperative that drives innovation and success in the fast-paced and constantly evolving landscape of artificial intelligence.

Opportunity for Outsourcing Vendors in Artificial Intelligence:

The burgeoning landscape of Artificial Intelligence (AI) in contemporary business paradigms, as elucidated by the McKinsey Global AI Survey, underscores its transition from a mere technological novelty to an indispensable element in strategic business operations. A profound shift in business dynamics is evident, with 74% of respondents (n=1872) in the survey indicating an inclination to escalate their investment in AI over the next three years (McKinsey Analytics, 2022). This trend aligns with market valuation forecasts, where the global AI market, pegged at USD 454.12 billion in 2022, is projected to exponentially swell to approximately USD 2,575.16 billion by 2032, marking a compound annual growth rate (CAGR) of 19% from 2023 to 2032 (Precedence Research, 2022). Such projections underscore the transformative potential of AI in redefining operational efficiency and competitive prowess across diverse business sectors. However, this promising trajectory also presents a conundrum for businesses in terms of AI

integration – a critical decision between in-house development and outsourcing, influenced by various intricate factors and necessitating astute risk management and strategic planning.

Outsourcing AI to specialised vendors is increasingly favoured over in-house development, primarily due to vendors' deep expertise and comprehensive service offerings. These vendors address critical challenges like talent shortages by providing access to seasoned AI professionals, and advanced data management services (Roy, 2023). They adeptly identify tailored business use cases, supply necessary technical infrastructure, and assist in organizational adaptation to AI technologies (Loukides, 2022; Roy, 2023). Moreover, they ensure compliance with legal standards, prioritise ethical AI practices, enhance model transparency, and strengthen security measures against cyber threats (Loukides, 2022; Roy, 2023). Outsourcing offers cost efficiency and shifts significant developmental risks to vendors, enabling businesses to focus on core activities. While larger enterprises might opt for in-house development for niche solutions, the challenges of talent retention and the need for continuous skill updates in a rapidly evolving field often make outsourcing a more practical choice (Loukides, 2022; Roy, 2023).

AI vendors aspiring to be preferred outsourcing partners must transcend mere technological adoption and industry awareness. The crux of differentiation lies in their capacity for innovation, crucial in an era of rapid technological shifts and evolving business applications (Cheung, 2023). Future AI projects, as foreseen by Gartner (2022), will necessitate a blend of vendor expertise and business acumen, emphasising the importance of agile Open Innovation strategies fostering enhanced customer engagement in the design process. This strategy hinges on a mindset focused

on external knowledge acquisition, crucial for elevating innovation quality by integrating customer insights.

Open innovation, which enhances customer engagement, necessitates a learning-oriented organisational mindset, wherein a culture of knowledge sharing becomes pivotal for successful innovation in dynamic markets (Fiol & Lyles, 1985; Senge, 1990; Stanley & Narver, 1995). In this paper, we define Open Innovation as encompassing customer involvement across most stages of the design process. Additionally, the efficacy of open innovation is significantly moderated by the proficiency in knowledge transfer (Jerez-Gómez et al., 2005). Absorptive Capacity, crucial for a firm's innovation capability, is bolstered by knowledge transfer and sharing. Absorptive Capacity is defined as an organisation's ability to recognize the value of new, external information, assimilate it, and apply it to commercial ends. In AI innovation, where production and marketing are competitive, absorptive capacity aids in rapid innovation by enhancing sensemaking, crucial for identifying and advancing impactful ideas for market capture.

Adopt a knowledge based view of the firm:

In the AI outsourcing landscape, the prominence of AI vendors with profound technical acumen and comprehensive insights into client and industry specifics is intensifying. This trend demands vendors to cultivate a learning culture, pivotal for the acquisition, assimilation, and application of extensive customer and technical knowledge, akin to the environment of Knowledge-Intensive Business Services (KIBS) (Doloreux & Frigon, 2020; Cainelli et al., 2020). KIBS are specialised firms providing knowledge-intensive expertise and services to enhance innovation and efficiency in other organisations' processes. Open innovation, integral to AI vendors, harnesses diverse

external knowledge through customer collaborations, necessitating a rapid integration of both existing and new knowledge.

AI products, perceived as integrative composites of tangible goods and ancillary services, align with the Software as a Service (SaaS) paradigm, wherein software transcends mere product status. KIBS and AI vendors both operate as service providers in the market, leveraging their subject matter expertise as a critical asset. To enhance their knowledge, they actively engage with knowledge networks including conferences and academia. Additionally, they deeply understand their customers' needs and adopt an open innovation process that incorporates customer insights into their development strategies, thereby tailoring their offerings to better meet specific market demands. The definition of SaaS and similarities between KIBS and AI vendors allows us to adopt service-dominant logic of Knowledge base view (KBV).

KIBS and AI vendors both operate as service providers in the market, leveraging their subject matter expertise as a critical asset. To enhance their knowledge, they actively engage with knowledge networks including conferences and academia. Additionally, they deeply understand their customers' needs and adopt an open innovation process that incorporates customer insights into their development strategies, thereby tailoring their offerings to better meet specific market demands.

Therefore, adopting a Knowledge-Based View (KBV) (Curado & Bontis, 2006) is crucial for AI vendors, emphasising knowledge as a strategic asset and focusing on leveraging intellectual capital for competitive advantage. This approach transforms knowledge from mere data into a

strategic tool for fostering innovation, essential for product innovation and positioning vendors as preferred partners. In this vein, delivering and managing knowledge in the innovation process, particularly the design phase, emerges as vital for accelerating innovation cycles and seizing market opportunities.

Invest in knowledge service for designers:

The significance of the design phase in product innovation, particularly in the technology sector, has been increasingly recognized since the 1990s with the integration of user-centred design principles and design thinking methodologies. This phase is crucial for the convergence of creative ideas, data, and user requirements, and plays a central role in shaping the usability and aesthetic aspects of a product, thereby driving innovation (Rampino, 2011). Rampino (2011) argues that design goes beyond aesthetics and functionality, influencing a product's symbolic and practical aspects, thus placing design at the core of the innovation process.

From a knowledge-centric perspective, the design process involves several key steps (Zhang et al., 2021). It begins with Requirement Analysis, which focuses on market and competitive knowledge. This is followed by Problem Determination, emphasising understanding of product design and customer needs. The third phase, Problem Solving, requires technical and creative knowledge for developing product concepts. The final stage, Scheme Evaluation, involves analytical skills for assessing and selecting the best solution. Stakeholders in this process include designers, product managers, and technical teams, each contributing from their area of expertise (Zhang et al., 2021).

Designers, in particular, play a pivotal role as facilitators of innovation by generating dialogue among various stakeholders and navigating through internal and external knowledge sources to develop innovative solutions. Johnston and Gibbons (1975) highlight the importance of a strategic sequence in information searching for problem-solving in design-driven innovation. This process begins with leveraging existing knowledge, followed by a focused search for external information, thereby ensuring solutions are well-founded and informed.

The concept of cognitive distance is essential in understanding the use of information in innovation. It measures the knowledge and perspective gap between the problem-solver and new information, affecting the novelty and effectiveness of design solutions. This underscores the importance of accessible knowledge services that provide a wide range of information, especially from sources with high cognitive distance, to avoid limiting the scope of potential solutions (Johnston & Gibbons, 1975). Utilising open innovation to connect with customers and applying technological foresight helps bridge knowledge gaps, fostering engagement and keeping designers abreast of new trends.

In summary, integrating a robust knowledge delivery service in the design process is imperative for AI vendors to maximise utilisation of their knowledge about customer and technology and thus enhance innovation speed and accuracy, by right idea generation. Such services address cognitive distance challenges and enable designers to generate more innovative solutions, aligning closely with market demands and technological advancements.

Summary and real-world applications

This chapter explained the essential role of knowledge access and retrieval, facilitated by designers at AI vendor firms, in driving technological innovation. Through specialised knowledge services designed for the design process, these mechanisms enable efficient knowledge use, leading to rapid and precise idea generation. This is crucial for enhancing the design process's resilience and, consequently, AI vendors' innovation capabilities.

Microsoft, Amazon, and Procter & Gamble (P&G) each leverage knowledge management systems extensively within their operations to enhance productivity, innovation, and decision-making. Microsoft's Knowledge Network system facilitates employee interaction by capturing, organising, and sharing expertise, significantly boosting innovation and reducing time spent on information searches. Similarly, Amazon's AWS Knowledge Center serves as a robust platform for addressing customer inquiries and resolving technical issues, thereby improving customer service efficiency and product development. P&G’s Connect and Develop platform exemplifies successful external collaboration and knowledge sharing, crucial for advancing product development and marketing strategies. These systems underscore how critical knowledge management is to the success of these leading companies in their respective fields (Durisinova, 2024).

The subsequent chapters are dedicated to an examination of open innovation and AI technology foresight. These are indispensable for a comprehensive understanding of knowledge management's role in the AI innovation landscape. This exploration is crucial, as it underscores

the effective exploitation of customer and technological knowledge repositories, which are key determinants in maintaining the speed and precision of the design process for product innovation.

Chapter 2: Creating an Organisational Memory

Introduction

In the evolving business landscape, where hybrid teams merge domain expertise with AI technology, Open Innovation (OI) stands as a crucial strategy for AI vendors, aligning with the service-dominant logic inherent in the SaaS model. This approach enables AI vendors, akin to Knowledge Intensive Business Services (KIBS), to leverage deeper external expertise for enhanced product innovation, fostering agile and customer-centric development. This chapter focuses on OI's role in refining the innovation process through deepened external information integration, thus emphasising the importance of knowledge management in assimilating diverse knowledge sources. We aim to reveal how effective knowledge management fosters creation of organisational memory, crucial for the speed and precision of innovation, by improving sensemaking and absorptive capacity in the design process.

Internal and External Information usage in Innovation

Similar to KIBS, AI vendors need robust internal knowledge infrastructures, including proprietary research, datasets, and technical expertise (Díaz-Díaz & De Saá-Pérez, 2014), to maintain a competitive edge. However, exclusive reliance on internal R&D can stifle innovation, underscoring the importance of external knowledge from customer interactions and industry networks for fresh perspectives (Savić et al., 2020). Emphasising the critical role of external information, Johnston and Gibbons (1975) highlighted its utility in overcoming technical innovation challenges. Open innovation, by integrating customer insights and broader external knowledge sources—ranging from industry insights, R&D collaborations, to strategic

partnerships—enhances the innovation process (Savić et al., 2020). This approach not only broadens the innovation perspective beyond internal capabilities but also necessitates sensemaking and absorptive capacity to effectively leverage external knowledge. Thus, merging internal and external knowledge streams through open innovation is pivotal for generating breakthrough products.

The interplay between internal and external knowledge is pivotal for enhancing innovation's speed, cost efficiency, novelty, and relevance, resonating with the principles of open innovation that advocate for leveraging both sources of knowledge (Kyriakopoulos & de Ruyter, 2004). This synergy facilitates the fusion of external insights with internal intellectual assets, propelling innovative outcomes. Wu et al. (2018) mentions three critical processes underpinning successful knowledge integration within Open Innovation (OI): the outside-in, inside-out, and coupled processes, each harnessing varying degrees of internal and external knowledge for innovation. They are described in more detail below:

1. Inside-Out Process: This model focuses on exploiting and externalising internal knowledge. It entails leveraging internally generated innovations by transferring them to the external environment, indicating a dominant use of internal knowledge and lesser emphasis on external information.
2. Outside-In Process: This approach emphasises acquiring and integrating knowledge from external sources. It involves exploration of external knowledge to build innovative products, highlighting a high reliance on external information and moderate application of internal knowledge.

3. Coupled Process: This type combines elements of both outside-in and inside-out processes. It involves simultaneous engagement in acquiring external knowledge and externalising internal innovations to improve, suggesting a balanced utilisation of both internal and external knowledge sources.

These methodologies reflect the unique needs of organisations, underscoring the significance of internal knowledge sharing and Open Innovation for AI vendors in assimilating essential knowledge blends for product innovation. This framework suggests that organisations committed to open innovation inherently adopt a knowledge sharing culture, enhancing their capability to incorporate external information into their innovation strategies.

Pros and cons of adopting open innovation:

Griffin (2002) underscores the advantage of early market entry, accentuated by global competition, necessitating AI vendors to accelerate innovation and product launch cycles. However, adopting an open innovation strategy, while beneficial for incorporating precise customer insights, may prolong development phases due to varying levels of customer engagement (Griffin, 2002). Paasi et al. (2014) categorise open innovation partnerships into four levels based on customer involvement, ranging from minimal interaction to active co-creation. These are:

1. Customer-Oriented Provider, where customer engagement is minimal, focusing on standard product delivery;
2. Customer Solution Integrator, involving customers in tailoring and improving services;
3. Development Partner, engaging customers deeply in specification and prototyping; and

4. Facilitator of Co-Innovation, where vendors support customer-led networked innovation, emphasising co-creation.

Similarly, Paasi et al. (2014) outline 'design with' and 'design by' strategies in SaaS, emphasising increased customer collaboration, which necessitates AI vendors to balance deep market access against longer development cycles due to collaboration. Griffin (2002) argues that prioritising quality and market fit could justify extended development periods, highlighting the importance of aligning innovation speed with product quality and market demands.

Thus, the dilemma for AI vendors in open innovation lies in managing the dual objectives of expedited product launches and fostering meaningful customer collaborations—a balance critical for sustaining competitive advantage in the dynamic AI sector. This necessitates a need for knowledge strategy and knowledge management which could balance the need of knowledge while maintaining innovation speed.

Forms of knowledge within organisations

Understanding the essence of knowledge, in its tangible explicit form and the intangible implicit and tacit forms, is foundational for effective knowledge management (Davies, 2023). Explicit knowledge, readily codified and shared, contrasts sharply with the tacit knowledge, which is embedded in individual experiences and insights, challenging to articulate and transfer.

Kyriakopoulos and de Ruyter (2004) delineate organizational knowledge as encompassing procedural and declarative memories. Procedural memory, often implicit, underlies the execution

of tasks and processes, while declarative memory comprises explicit, articulable facts and information, facilitating problem-solving and application across contexts. They argue that the integration of these knowledge forms is vital for enhancing product development outcomes, with internal information flows playing a moderating role in leveraging procedural memory for creativity and declarative knowledge for financial performance.

Over-reliance on procedural memory can hinder innovation, underscoring the importance of balancing procedural and declarative knowledge for AI vendors. This equilibrium is critical for fostering creativity and ensuring financial viability in product development. Recognizing the dynamic between these knowledge forms accentuates the strategic role of knowledge management in innovation (Kyriakopoulos & de Ruyter, 2004).

Developing a Knowledge Strategy

Developing an effective knowledge strategy necessitates a multi-phased approach, integrating the insights from works in the field by Choi & Lee, 2002; Nonaka & Takeuchi, 1995; Nonaka, Toyama, & Konno, 2000. Below are five distinct phases, each designed to guide AI vendors toward leveraging knowledge for product innovation enhancement.

Phase 1: Knowledge Diagnostics

The formulation of a knowledge strategy commences with an exhaustive internal audit aimed at delineating the organisation's knowledge ecosystem (Choi & Lee, 2002). This phase involves identifying extant knowledge reservoirs and evaluating their congruence with the organisation's

innovation objectives. Subsequent discussions, especially within design and development teams, focus on pinpointing knowledge deficiencies that could hinder the innovation process (Nonaka & Takeuchi, 1995). Additionally, an appraisal of existing knowledge management practices is conducted to determine their efficacy in nurturing innovation (Nonaka, Toyama, & Konno, 2000), setting the stage for subsequent phases.

Phase 2: Strategic Knowledge Framework Development

Enhancing knowledge management necessitates the deployment of a centralised Knowledge Management System (KMS), designed to amalgamate tacit and explicit knowledge seamlessly (Nonaka & Takeuchi, 1995). Initiatives grounded in the SECI model (Nonaka, Toyama, & Konno, 2000) foster knowledge creation and sharing, emphasising the pivotal role of socialisation, externalisation, combination, and internalisation. Ensuring the KMS's usability and accessibility is paramount, advocating for a user-centric approach to knowledge management. This phase involves establishing mechanisms for user feedback, allowing for the dynamic evolution of the KMS in alignment with organizational needs (Choi & Lee, 2002).

Phase 3: Culture of Continuous Learning

Cultivating a culture that prioritises knowledge sharing and continuous learning is crucial for sustaining innovation and competitive advantage (Nonaka & Takeuchi, 1995). This involves the implementation of systems and practices that encourage knowledge exchange, augmented by incentive programs to motivate employee participation (Choi & Lee, 2002). Additionally, fostering cross-departmental collaboration by assembling diverse teams for project work or

informal knowledge exchange can catalyse innovative solutions (Nonaka, Toyama, & Konno, 2000), leveraging collective knowledge for enhanced adaptability and innovation.

Phase 4: Technological Augmentation

The integration of collaborative technologies and analytical tools is critical for advancing communication and knowledge sharing within the organisation (Choi & Lee, 2002). Collaborative platforms such as Slack and Asana streamline project management and foster a transparent, unified culture. Embedding AI-driven analytics into the KMS facilitates the identification of valuable insights from market trends and customer feedback, aligning resources with organizational needs (Nonaka & Takeuchi, 1995). A scalable, adaptable technology stack ensures the organisation remains at the forefront of knowledge management practices (Nonaka, Toyama, & Konno, 2000), underpinning a commitment to continuous improvement and innovation.

Phase 5: Evaluation and Adaptation

Advancing knowledge management practices necessitates the development of a dashboard for monitoring key metrics related to KMS performance, including user engagement and impact on project timelines (Choi & Lee, 2002). Semi-annual strategic evaluations provide a platform for assessing the alignment of knowledge initiatives with organizational goals, facilitating adjustments based on collective feedback (Nonaka, Toyama, & Konno, 2000). Staying abreast of the latest developments in knowledge management technologies and methodologies ensures that

the organisation's strategy remains relevant and effective (Nonaka & Takeuchi, 1995), embodying a commitment to ongoing learning and strategic agility.

In sum, these phases offer a comprehensive framework for leveraging knowledge towards fostering innovation, ensuring a dynamic, informed, and integrated approach to knowledge management.

Establishing Knowledge Management

After deciding upon a knowledge strategy, Knowledge Management (KM) is pivotal for AI vendors, integrating both external and internal knowledge processes to foster innovation. Key processes involved in knowledge management are:

1. Knowledge Acquisition and Transfer (Wu et al., 2018): Begin by acquiring external knowledge from sources like customers and AI technology ecosystem and transferring it into the organisation. This step ensures a continuous influx of fresh insights and perspectives.
2. Integration and Application: Internal processes then integrate this knowledge, applying it to enhance product development. This integration is crucial for transforming external knowledge into actionable insights.

Supplement the above processes by employing the SECI Model (Nonaka and Takeuchi) for knowledge creation, involving socialisation (sharing tacit knowledge), externalisation (converting tacit into explicit knowledge), combination (organising explicit knowledge), and

internalisation (embedding explicit knowledge into tacit practices). This cycle ensures knowledge is continuously evolved and applied innovatively.

After creation of knowledge, it is imperative to ensure its realisation in:

1. Fostering Organizational Creativity (Lee et al., 2003): Evaluate and recognise the importance of creativity in the design process, vital for the early signs of innovative products. Organizational creativity emerges as a critical outcome of effective KM.
2. Developing Organizational Memory: Systematically store the generated knowledge to enhance sense-making and absorptive capacity, forming a robust organizational memory that supports ongoing innovation.

By systematically following these steps, AI vendors can establish their KM processes, leveraging both internal and external knowledge sources to sustain innovation and maintain competitive advantage.

Creation of Organisational Memory

Organizational memory (OM), as delineated by Antunes et al. (2020) and Moorman and Miner (1997), serves as an essential repository of an enterprise's accumulated knowledge and experiences, pivotal for fostering innovation and enhancing new product performance. Distinct from the broader activities of knowledge management which aims at knowledge creation, sharing, and utilisation, OM specifically facilitates the retention and reconstruction of experiential knowledge, crucial for continuous learning and innovation. This construct, deeply embedded within the organizational learning framework, significantly influences the

interpretation of incoming information and the execution of new product routines, thereby positively impacting short-term financial success and creative outcomes.

Furthermore, Organizational Memory Studies (OMS), as discussed by Foroughi et al. (2020), emphasise the role of social memory processes, including the strategic 'unlearning' of outdated knowledge and the shaping of OM through narratives and artefacts. This underscores the importance of selectively retaining knowledge critical to product innovation strategies, advocating for a dynamic approach to managing OM within AI vendors to ensure ongoing relevance and adaptability in product innovation.

Organizational Memory (OM) artefacts could include recorded expert training, operational best practices, and innovation project histories, as well as comprehensive customer feedback and patent records. These resources, ranging from knowledge maps to interactive corporate timelines, play a crucial role in preserving expertise, guiding future projects, and fostering an innovative culture within an organisation.

Summary and real-world applications

For AI vendors targeting product innovation, Knowledge Management (KM) is crucial, serving as a way for assimilating a vast array of internal and external knowledge (customer and technology). This integration catalyses creativity by fostering the generation of novel ideas through the synthesis of diverse knowledge streams. Effective KM processes are vital for the perpetual renewal and applicability of knowledge. This chapter explored customer knowledge acquisition, the subsequent chapter will focus on technological knowledge.

Central to KM's efficacy is the cultivation of Organizational Memory (OM), a repository of collective insights crucial for innovation and enhancing the design process's speed and accuracy through improved sensemaking in Open Innovation endeavours. This facilitates expedited and more precise decision-making, essential for crafting products that meet market expectations. Thus, OM elevates the design process by bolstering its speed and accuracy, highlighting the strategic importance of managing both internal and external knowledge domains amidst the dynamic technological landscape faced by AI vendors.

Once Knowledge Management (KM) and Organizational Memory (OM) are firmly established, a knowledge service can subsequently leverage these foundations to deliver knowledge more efficiently, further streamlining the innovation and design processes within the dynamic technological landscape AI vendors navigate.

Siemens AG's TechnoWeb knowledge management system shows how an effective organizational memory can catalyse innovation, though in manufacturing. As a central repository of technical knowledge, including documents, drawings, and expert insights, TechnoWeb facilitates quick access to vital information, streamlining the innovation process by reducing redundant efforts. Its structured system for storing and retrieving information ensures that employees can rapidly locate necessary resources, enhancing efficiency. Features like expert directories and community forums promote cross-departmental collaboration and knowledge sharing, effectively breaking down organizational silos. This system not only saves time but also fosters a learning culture that drives continuous improvement and innovation. By leveraging past

experiences and existing knowledge, Siemens maintains its competitive edge, accelerating the development of new technologies and refining existing products (Acquah et al., 2013).

Chapter 3: Foresighting

Introduction

Integrating knowledge from the fast-evolving AI tech landscape and consumer perception is crucial for AI vendors as it underpins their core competency in the technical domain. This chapter explores AI technology within a VUCA (Volatile, Uncertain, Complex, and Ambiguous) framework, emphasising the need for strategic foresight in navigating its rapid evolution. It highlights Knowledge Management's role in enhancing strategic foresight and concludes with a discussion on technological roadmapping, a critical tool for analysing the AI landscape, driving innovation, and maintaining design speed and accuracy, by providing precise knowledge through sophisticated knowledge services.

AI is an Emerging Technology

The integration of Artificial Intelligence (AI) in business, marked by both potential and uncertainty, necessitates a deep understanding of its emergent nature and the lag in regulatory frameworks (FedScoop, 2021). AI is in its nascent stages, facing infrastructural deficits and complex, not yet fully understood issues, affecting various societal aspects (Kwon et al., 2017; Linton, 2017; Kuzma et al., 2008; Palm & Hansson, 2006; Wright, 2011). For AI vendors, comprehending these complexities is vital for risk assessment and strategic knowledge alignment.

The application of the STEEPV framework extends this understanding by critically analysing the AI technological domain through six dimensions—Social, Technological, Economic,

Environmental, Political, and Values. This approach enriches our insight into AI's external influences, where our research identifies and outlines key factors across each dimension, offering a detailed yet concise examination of the domain's intricate influences.

(S) Social Dynamics: AI's integration into daily life accentuates concerns over data privacy and ethical use, alongside its societal implications, such as job displacement and cultural shifts. Public engagement with AI, coupled with a discourse on its risks and benefits, illustrates a society in transition, navigating the challenges and opportunities AI presents (Pew Research Center, 2023; Euronews, 2023).

(T) Technological Advancements: Rapid advancements in AI, spanning natural language processing to machine learning, underscore its transformative potential across sectors. The shift towards open-source projects and ethical AI development, in response to societal and regulatory demands, marks a pivotal phase in AI evolution, highlighting the critical balance between innovation and ethical governance (TechReport, 2023; MIT Technology Review, 2023).

(E) Economic Landscape: The global AI market's robust expansion signifies its profound impact across industries, fostering productivity and innovation. This growth trajectory is supported by escalating investments in AI ventures, indicative of strong market confidence. AI's role in reshaping the job market and global trade dynamics underscores its integral role in contemporary economic frameworks (TechReport, 2023; McKinsey, 2023).

(E) Environmental Considerations: AI's environmental footprint, particularly its significant energy demands, has sparked efforts towards more sustainable practices. Concurrently, AI's application in combating environmental challenges underscores its potential as a tool for sustainability, balancing the technological imperatives with ecological stewardship (MIT Technology Review, 2023).

(P) Political Factors: The political dimension of AI encompasses the formulation of AI-specific regulations and international competition. Initiatives like the European Union's AI Act highlight the move towards structured AI governance, reflecting the geopolitical significance of AI as a strategic asset. This regulatory and competitive landscape necessitates vigilant compliance and engagement strategies for AI vendors (MIT Technology Review, 2023).

(V) Value Considerations: Ethical and societal considerations remain at the forefront of AI development, emphasising transparency, accountability, and fairness. The focus on ethical AI, alongside privacy and data protection, resonates with a broader societal pursuit of technologies that align with human values and contribute positively to social well-being and sustainability (MIT Technology Review, 2023; Euronews, 2023).

The rapidly changing STEEPV environment requires a forward-looking approach to secure knowledge management strategies, ensuring their resilience and continuity amid shifts.

Strategic Foresight

Strategic Foresight (SF) emerges as an organizational prowess, paramount for navigating future contingencies and opportunities within the STEEPV framework, extending organizational memory. This capability is vital for bolstering Knowledge Management (KM) strategies, facilitating the anticipation of future developments, assessing their implications, and devising protective or exploitative strategies (Sarpong et al., 2019; Rohrbeck & Schwarz, 2013). Organizational memory, embodying historical knowledge and experiences, is foundational for SF exercises, offering a dual lens of historical and future orientation necessary for assimilating and applying new, pertinent information (Sarpong et al., 2019).

The fusion of Emerging Technologies (ET), Knowledge Management (KM), and Strategic Foresight (SF) is essential for AI vendors facing the necessity to adapt and innovate concurrently. This synergy not only guards against market fluctuations but also enables the anticipation and exploitation of new opportunities, embedding innovation at the core of their strategies. The interaction between KM and SF is key in managing the uncertainties of ETs, leveraging insights for innovation and competitive edge (Oliva et al., 2019; Schweitzer et al., 2019; Kwon et al., 2017). This integration enhances innovative performance, equipping organisations to combine their knowledge with foresight, promoting a resilient and innovative business landscape.

Moreover, SF's forward-looking essence demands an understanding of current challenges and future potentials, significantly shaping KM by orienting the organizational knowledge base towards emerging scenarios (Heger & Rohrbeck, 2012; Sarpong et al., 2019). Conversely, KM enhances SF by facilitating a systematic approach to knowledge capture, storage, and

dissemination, incorporating insights on forthcoming trends (Trunfio & Campana, 2019). Thus, SF, underpinned by organizational memory's absorptive capacity, crucially informs KM, ensuring innovation and effective management of future-oriented knowledge. This enhanced knowledge can subsequently be disseminated through knowledge services to designers, thereby augmenting the precision and accuracy of product innovation processes.

Technology Roadmapping

In the dynamic sphere of AI innovation, technology roadmapping is recognized as a critical foresight mechanism. As elucidated by Phaal et al. (2004), it offers a structured visual framework to scrutinise and articulate the complex relationships among evolving markets, technologies, and product trajectories over time. Amid the sector's inherent "turbulence"—amplified by socio-economic, technological, environmental, political, and values-based (STEEPV) factors—this method facilitates the visualisation of technological progress paths, thereby empowering organisations to foresee and navigate the swift transformations emblematic of the AI domain.

Integrating technology roadmaps into strategic planning is imperative for aligning technological advancements with corporate goals, providing a panoramic view of market trends, product development, and the technology lifecycle. This strategic congruence supports informed decision-making, enabling firms to adeptly adjust their technological strategies in response to emerging industry norms and consumer expectations (Phaal et al., 2004). Nonetheless, the development of technology roadmaps is fraught with complexity, attributed to the vast array of

considerations and the intricate interplay between technological, market, and product strategies, especially pronounced in the fast-paced AI industry.

Phaal et al. (2004) highlight the bespoke nature of roadmapping, underscoring the necessity for customization to address individual organizational requisites, cultural dynamics, and strategic aims. Roadmaps, thereby, transcend mere planning tools; they are pivotal in cultivating consensus, disseminating knowledge, and uniting organizational strategic focus. Given the unpredictable technological landscape of the AI sector, these roadmaps demand flexibility, evolving iteratively to incorporate new insights and external shifts, thus ensuring firms remain agile and competitive amidst industry flux.

Summary and real-world applications

The strategic embrace of foresight, enhanced by a solid foundation in organisational memory, enables organisations to transform potential disruptions into strategic opportunities. This approach, which integrates advanced knowledge from the AI technological ecosystem, accelerates the development of cutting-edge products. It not only refines the accuracy of innovations but also conserves resources by diminishing the need for modifications.

Central to this strategy is the interplay between Knowledge Management (KM), Strategic Foresight (SF), and Emerging Technologies (ET), a vital nexus for AI vendors navigating the sector's rapid evolutions. Through proactive technology roadmapping and anticipation of shifts in regulations, technologies, and market trends, AI vendors can mitigate risks and exploit new opportunities. This proactive foresight goes beyond defence, encouraging the use of updated

knowledge in product design via knowledge services, thereby enabling AI vendors to leverage AI's disruptive potential for market innovation and leadership.

In the automotive industry, teams used foresight to envision future technological developments in powertrain innovations, considering scenarios beyond the likely continuation of internal combustion engines. This foresight included alternative technologies like electric and fuel cell vehicles. The process involved creating a timeline from future innovations back to current projects and allocating resources efficiently among competing future technologies. This approach enabled a comprehensive road map that guided the development of both evolutionary and revolutionary innovations (McKinsey & Company, 2017).

Chapter 4: Knowledge service for designers

Introduction

Acquiring precise knowledge from customers and technological advances is crucial for fostering innovation, particularly by integrating such insights into the design phase. Designers' ability to solve problems hinges on accessing relevant knowledge promptly; discrepancies in required versus acquired knowledge can significantly affect product innovation's quality, speed, and precision. To optimise knowledge delivery for design processes, understanding designers' knowledge needs and search behaviours is essential, thereby enhancing competitive innovation and efficiency.

Meeting designers' knowledge needs

In the domain of innovation, designers' knowledge requisites are fundamental to the ideation and evolution of novel products. Vijaykumar and Chakrabarti (2008) argue that grasping these needs is essential for design task success and product innovation. Designers necessitate a wide-ranging knowledge base, encompassing specific product details to abstract creative and technical insights, crucial for innovation. The design process bifurcates into problem comprehension and resolution phases. Initially, designers engage in Requirement Analysis and Problem Definition, rigorously evaluating project parameters and identifying core challenges. Subsequently, in the problem-solving phase, they explore and assess potential solutions, ensuring alignment with established requirements (Zhang et al., 2021).

This knowledge-seeking process, characterised by asking descriptive and pointed questions, facilitates an efficient problem-solving methodology. However, the dynamic nature of design knowledge and the reliance on previous project insights can hinder innovation due to inefficiencies in knowledge sharing. Thus, knowledge services, pivotal in knowledge management, play a crucial role in providing timely, pertinent information, enhancing design process productivity through efficient information search and retrieval, underscored by the importance of a unified organizational vocabulary, for effective information interpretation and storage (Vijaykumar & Chakrabarti, 2008).

Ontological frameworks facilitate systematic navigation and comprehension of complex, multidisciplinary knowledge, essential for innovation in design. By defining domain-specific concepts, properties, and interrelations, these structures enhance designers' ability to access and leverage vast interconnected knowledge (Zhang Kai et al., 2021; Wu et al., 2020).

Ontologies enhance collaboration by encapsulating tacit knowledge, streamlining communication across disciplines, and fostering interdisciplinary innovation by establishing a unified language, thus mitigating ambiguities (Wu et al., 2020; Zhang Kai et al., 2021). They also augment information retrieval through advanced search functionalities and underpin intelligent systems for context-aware recommendations, thereby optimising designers' workflows (Wu et al., 2020; Zhang Kai et al., 2021). Furthermore, ontologies contribute to superior decision-making by providing a structured knowledge base that facilitates comprehensive analysis and creative solution generation, enhancing the effectiveness of innovation (Zhang Kai et al., 2021).

Nature of Knowledge Service

The design process, encompassing Requirement Analysis, Problem Determination, Problem Solving, and Scheme Evaluation, demands a shift in knowledge focus from functional and structural in early stages to inventive principles in later phases, aiming for a structured framework to support product innovation. Tailored knowledge services, aligned with designers' cognitive needs and challenges at each phase, are crucial (Zhang et al., 2021). Different knowledge services play pivotal roles across these stages, facilitating innovation (Kai Zhang et al., 2021). These services specially deliver:

1. Functional Knowledge: This involves understanding how a product should work to satisfy customer requirements. It is crucial in the Requirement Analysis stage, where market demands and customer needs are translated into product functionalities. This knowledge helps in aligning product capabilities with user expectations.
2. Structural Knowledge: Utilised in the Problem Determination stage, this knowledge focuses on understanding the product's components and their interrelations. It is essential for identifying potential design issues and for ensuring that all parts of the product work harmoniously.
3. Domain Knowledge: This is critical across all stages, particularly in Problem Solving. It encompasses a deep understanding of the specific industry or area the product is part of. This knowledge is fundamental for generating solutions that are viable and relevant within the specific domain.

These knowledge services are essential across all design process stages, from grasping user needs to evaluating solutions. Recognizing that different stages demand specific knowledge types, we aim to categorise knowledge domains based on customer and technological inputs for each phase.

Designing a knowledge service for designers

To craft a resilient design process, a knowledge service that integrates knowledge from customers and technology using knowledge management and foresight could be beneficial, as it helps exploit these knowledge bases. Here's a proposed 4-point plan that encapsulates this integration, drawing from the above discussions:

1. Embed a Knowledge-Centric Culture: Foster a culture that actively manages knowledge as a core asset, recognizing its value in driving innovation and efficiency in design processes (Vijaykumar & Chakrabarti, 2008). Incentives play a crucial role in fostering a knowledge-sharing culture, a concept well encapsulated by knowledge markets, where rewards significantly encourage the exchange of insights and expertise. Implement knowledge management practices that create a centralised repository where strategically important design knowledge is systematically captured, stored, and made accessible, using ontology-based schemas for flexibility and scalability. Thus making it easier for designers to utilise customer and technological knowledge acquired thereby reducing the time spent on information-seeking and increasing the time available for creative tasks such as idea generation for innovation.
2. Utilise Ontological Design Frameworks for Structured Knowledge Representation: Build a Core Ontology for customer and technology engineering knowledge management that

clearly defines the semantics of design knowledge, enabling the integration of knowledge. Actively incorporate designers to discern their preferences for accessing functional, structural, and domain knowledge, facilitating efficient ideation processes.Use ontological frameworks to represent multidisciplinary knowledge, thus aiding designers in navigating complex information and supporting cross-functional collaboration (Zhang Kai et al., 2021; Wu et al., 2020). Ensure that the ontological design frameworks are dynamic, accommodating the addition of new knowledge and the evolution of existing knowledge structures, for knowledge acquirers and creators to add knowledge in a structured way.

3. Optimise Knowledge Integration and Recommendation: Create platforms and tools that enable the integration of internal and external knowledge sources, allowing for the synthesis of insights from various fields and open innovation forums. Utilise intelligent KM softwares to recommend pertinent knowledge to designers, tailoring suggestions based on the design task, stage of the process, and individual designer profiles, thereby minimising information overload (Wu et al., 2020).
4. Implement Continuous Performance Evaluation: Establish continuous performance evaluation mechanisms for the knowledge services and design processes, ensuring they are both effective and adapt to changing needs over time (Wu et al., 2020). This entails engaging stakeholders, including designers, knowledge acquirers, and creators, in periodically conducting retrospective assessments of the system, thereby identifying and addressing any emerging issues and concerns.

This strategy not only places knowledge at the forefront of the design process but also ensures that it is leveraged effectively to foster speed and accuracy in product innovation. Through the integration of a knowledge service, AI vendors can enhance their competitiveness and efficiency in the design process.

Interview findings for need of knowledge service

In a detailed interview, the designer emphasised the significant impact of the current knowledge representation methods on the accuracy and efficiency of design processes, noting a decrease in performance by approximately 40%. The designer highlighted a critical need for better alignment between customer insights and technological advancements. By integrating customers more closely into the development process, the organisation can enhance the validation of innovative ideas and tailor AI technologies more effectively to specific needs.

The designer advocated for the creation of a technological roadmap, which would outline the evolution of the technological landscape in relation to the product. Such a roadmap would significantly improve the quality of ideation by providing a clear, contextual framework for innovation. Additionally, the designer pointed out a lack of organizational support in equipping designers with necessary knowledge, which currently results in a time-consuming process of self-education.

Proposed solutions to these challenges include the introduction of a technology newsletter and an instant Figma (experience design software) chat system to streamline communication about customer requirements– indicating a strong need for knowledge service. The designer also

recommended implementing a system for synthesising customer feedback to provide more actionable insights for design improvements. Furthermore, there is a need for translating complex technological concepts into language that is accessible for designers, thus facilitating more effective implementation in the innovation process.

The designer expressed confidence that leadership would be receptive to these proposed enhancements, recognizing their inclination towards advancement in design innovation. These findings underscore the necessity for strategic interventions that bridge the gap between available knowledge and designer via knowledge services, ultimately fortifying vendors' innovation speed and accuracy, and hence securing a competitive stance.

Summary and real-world applications

This chapter explained the importance of accurately understanding and swiftly providing knowledge to designers to enhance innovation quality, speed, and precision. It discusses the critical role of tailored knowledge services in the design process, highlighting how ontological frameworks and intelligent knowledge management systems can streamline stages from requirement analysis to problem solving. These tools improve collaborative innovation and decision-making, fostering a knowledge-centric culture within organisations. By aligning knowledge delivery with designers’ needs, these strategies enable a more efficient and innovative design process.

Each company tailors its knowledge management strategies to meet unique internal needs, highlighting the diverse approaches to fostering innovation and learning within organisations. Google, for example, uses "Gooroo" to provide personalised learning experiences, enabling employees to access specific resources and expert networks suited to their individual roles. Similarly, IBM utilises its advanced AI-powered tool, "IBM Watson," to deliver cognitive insights and support decision-making processes, illustrating a tech-centric approach to knowledge dissemination. Meanwhile, Siemens and Bosch have developed robust internal platforms like TechnoWeb and a dedicated knowledge management system, respectively, which serve as comprehensive repositories for technical knowledge and support continuous learning and innovation within engineering-focused environments.

On the other hand, companies like Accenture, Microsoft, and Ford emphasise integrating knowledge services with daily work flows and broader corporate strategy. Accenture’s system provides consultants with instant access to a global database of expertise and case studies, crucial for delivering informed client solutions. Microsoft's Viva platform integrates learning directly into Microsoft Teams, making it part of the everyday digital workspace, whereas Ford's GDI&A system focuses on leveraging data analytics to inform product design and market strategies. These examples underscore that effective knowledge management systems must align with the specific needs of designers and employees, ensuring that the tools not only facilitate access to relevant information but also enhance practical application in day-to-day tasks and creative processes.

Conclusion

In the contemporary landscape of artificial intelligence (AI), the imperative for AI vendors to prioritise developing robust knowledge services for designers is unequivocally underscored by the need to enhance product innovation processes. The rapid evolution of AI technology demands agile and informed responses from designers, necessitating access to comprehensive and well-structured knowledge services. These services not only optimise the design process by bridging knowledge gaps in real-time but also ensure the precision and speed required to maintain competitive advantage in a volatile market environment.

The integration of Open Innovation, Knowledge Management, and Foresight within these knowledge services facilitates a synergistic approach that leverages internal and external knowledge sources effectively. By embedding these elements strategically into the design process, AI vendors can significantly expedite innovation cycles, enabling a seamless flow of customer insights and foresight into product development. This approach empowers designers to adapt swiftly to changing market demands and technological advancements, ensuring that innovative outputs are both relevant and timely.

Thus, for AI vendors to remain at the forefront of technological innovation and market competitiveness, investing in advanced knowledge services for designers is not just beneficial but essential. These services elevate the design process to a strategic level, where informed decision-making leads to superior product outcomes, aligning perfectly with the dynamic shifts and complexities of the AI industry. Through such strategic enhancements, AI vendors can

sustain their leadership and drive transformative innovation in an increasingly uncertain and complex global market.

Limitations

The limitations of this research stem primarily from its reliance on a small sample size and qualitative data, which may not capture the full diversity of AI product designers' experiences or generalise across the broader industry. Additionally, the study focuses predominantly on theoretical frameworks without extensive empirical validation, potentially limiting its applicability to practical scenarios. The rapid evolution of AI technology and market dynamics may also outpace the findings, necessitating continuous updates to the research to maintain relevance and accuracy in its conclusions and recommendations.

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Appendix - A : Interview for AI product's designers

Time

60 minutes

Mode

Online - Teams meeting with audio-video recording and transcription

Interview Script

Intro (5 mins)

Hello and thank you for taking the time to respond to our survey and for joining this interview today. I appreciate your willingness to participate. Before we dive into the main discussion, let's start with some introductions to get to know each other better.

I'll begin. My name is Ayan Mishra. I'm currently a graduate student at SFI, OCAD, and I have been working as a Product Designer for the past 8 years.

Now, I'd love to hear about you. Could you please share a brief introduction about yourself?

Wait and attentively listen to the participant's introduction.

Let's start by discussing the purpose of our meeting today. My research focuses on exploring the need of Open Innovation, Knowledge Management, and Foresight into the product innovation design process.

The aim is to understand how these disciplines can contribute to increasing resilience by providing updated and critical external knowledge about customer needs and the evolving AI technology landscape in a knowledge-intensive economy.

The premise of my research is that AI-powered product companies, like yours, could benefit significantly from investing in the development of knowledge services tailored for designers, like you.

This could potentially enhance the designer's ideation speed and accuracy, ultimately leading to more efficient innovation cycles.

During our conversation, I'll ask you a series of questions. Your responses will be invaluable in providing an industry perspective to my research.

Before we begin, I'd like to ensure you're comfortable and ready. Do you have any questions or need any clarifications about the research or the interview process?

Also, to confirm, are you available for the next 55 minutes? This will ensure we have ample time to cover everything thoroughly and I can manage the time accordingly.

Lastly, I would like to request your permission to record and transcribe this call for research analysis purposes. Please be assured that the recording and transcript will be strictly for research use and will not be shared externally.

If all is clear and you're comfortable, we can start. Are you ready?

Participant needs to respond in a Yes.

Questions

The interview is divided in 3 sections with each having 5-7 questions. You need to answer from your experience only and you do not need to generalise your response at all. We are looking at your valuable inputs.

The first section of the interview is on Design Process Steps and Knowledge Needs: (in context to AI features)

- Can you describe the major steps you follow in the design process?
- Could you summarise your approach to searching for and gathering knowledge during the design process?
- Which single step in the design process do you believe requires the most understanding of customers and technology?
- In your experience, which step of the design process tends to be the most time-consuming?

- What do you think are the main causes of time delays in the design process? Do they often relate to a lack of knowledge about customers or technology?
- How does a lack of knowledge affect innovation accuracy in your experience?
- Have you ever had to compromise on your design due to difficulties in accessing necessary knowledge?

Moving to the second section which is on Knowledge Representations:

- Does your organisation or team hold meetings/provide avenues to help you gain knowledge about customer/technological needs? What forms do these take?
- Do you actively participate in forums or meetings to enhance your understanding of customer needs or technological advancements for better product design? Within company or outside company? How does it affect innovation speed and accuracy?
- How does your company support the design process through documentation or other resources? How does it affect innovation speed and accuracy?
- Does your team have established processes or guidelines for design activities related to product innovation? How does it affect innovation speed and accuracy?

The last section is on Need for Open Innovation, Foresight, and Knowledge Service:

- How important do you believe deeper collaboration with customers is during the product design process? How deep it should be - all steps or some or just final validations? How does it affect innovation speed and accuracy?

- How valuable do you find having a technological roadmap for understanding and incorporating new technologies into the design process? How does it affect innovation speed and accuracy?
- By technological roadmap I mean to say, that you get to know where the technology is moving and how it is utilised in other places/products and what's planned in your product?
- Would a service that provides updated information about customer needs or technological advancements significantly improve the speed and accuracy of innovation in your view?
- How would you envision a knowledge service that augments each stage of the design process, and what specific features or capabilities would make it most effective for improving speed and accuracy in innovation?
- What steps or strategies would you recommend for incrementally improving a knowledge service, ensuring it continuously evolves to better support the design process and innovation? Could you outline a rough plan or key areas of focus?

Closing

Before we conclude this interview, are there any other points you wish to elaborate on? Giving a free time for the innovation leader to express thoughts. (3 mins)

Thank you so much for taking the time to participate in our interview. I can totally understand that this can be a burden especially given that you were able to take some time during the weekday.

Your insights and contributions have been incredibly valuable to our study. I truly appreciate your willingness to share your expertise.

We will reach out to you soon after the completion of this research in mid-May 2024 with the completed report and presentation.

Hoping to engage in some great conversations soon.

Once again, I thank you for your significant contribution to our research.

Have a good day.

Wave bye on screen.

Ends call.

<send a thankyou email>