REIMAGINING CROSS-FUNCTIONAL DESIGN IN THE AGE OF AI: A PRELIMINARY INVESTIGATION

Kenneth B. Kahn, Ph.D.
Professor, Strome College of Business
Old Dominion University
2006 Constant Hall
Norfolk, Virginia 23529
kkahn@odu.edu

Marina Candi, Ph.D.
Professor and Director of the Center for Research on Innovation and Entrepreneurship
Reykjavik University
Department of Business and Economics
Menntavegur 1
Reykjavik, Iceland
marina@ru.is

ABSTRACT

Being cross-functional in design work can enable effective innovation, though the relevance of 'being cross-functional' and the related concept of 'T-shaped' individuals could potentially change in the age of artificial intelligence (AI). Reporting results of interviews with design managers, we explore what being cross-functional means for design, the benefits and challenges inherent in cross-functional design work, and AI's possible impact on the nature of being cross-functional during design activities. Manager responses emphasized the importance of being cross-functional in design work. Noted challenges of cross-functional work include conflicting priorities, differing opinions, unclear roles, loss of design influence, multitasking pressure, and personality differences. Noted benefits include broader viewpoint, creativity versus practicality balance, healthy tension, diverse perspectives, early issue identification, and well-rounded solutions. Regarding the effects of AI, the transformation of cross-functional work by automating routine tasks and enabling deeper data-driven insights is foreseen, but there is disagreement on the degree of change. Some see a shift in the cognitive burden on individuals, allowing them to focus more on creative and integrative tasks, others not so much. All agree that AI tools offer significant opportunities for synthesizing information and managing mundane project management tasks. Managerial and research implications are suggested.

KEYWORDS

Design, Cross-functional, T-Shaped, Artificial Intelligence

REIMAGINING CROSS-FUNCTIONAL DESIGN IN THE AGE OF AI: A PRELIMINARY INVESTIGATION

INTRODUCTION

Alongside other design tenets, such as being customer-centric and user-centric (cf. Wechsler and Schweitzer 2019), being cross-functional is relevant for good design (cf. Dahl 2011) and design success (Kim and Kang 2008). Yet, cross-functional design work may not come naturally. According to IDEO CEO Tim Brown, "What tends to happen is that each individual discipline represents its own point of view. It basically becomes a negotiation at the table as to whose point of view wins, and that's when you get gray compromises where the best you can achieve is the lowest common denominator between all points of view. The results are never spectacular but at best average (Hansen 2015)." This may explain, in part, why nearly 75% of cross-functional teams are considered dysfunctional in nature (Tabrizi 2015). If being cross-functional represents a tenet for good design, how can designers and design organizations embrace being cross-functional amidst the underlying challenges mentioned above?

A related topic is the concept of T-shaped individuals. Tim Brown, who is a strong advocate of the concept, attributes his company's ability to engage successfully in intense cross-functional project work to employing T-shaped people. According to Brown, T-shaped people have two kinds of characteristics that provide both depth and breadth skills for cross-functional work: depth of skills allows one to contribute to the creative process and breadth allows one to view things from other perspectives as well as make one enthusiastic about one or more other disciplines to the point that one may start to practice those disciplines (Hansen 2015). However, anecdotal evidence indicates that most people would not consider themselves T-shaped, and when serving on cross-functional teams, typically view themselves as liaisons and advocates for their respective discipline/functional area. Thus, how prominent is the T-shaped concept within design work?

A third topic concerns the impact of artificial intelligence (AI) on design work per Verganti et al. (2020). The limited research examining this topic suggests that the use of AI tools can streamline communication, enhance productivity, and improve decision-making within cross-functional teams by analyzing communication patterns, tracking project progress, providing insights into team dynamics, and helping leaders identify areas for improvement and team workflows optimization (Attah et al., 2024; Roberts and Candi, 2024). AI-powered project management tools also can assist in automating routine tasks, such as scheduling meetings and setting reminders, freeing up valuable time for more strategic work (Esan et al., 2024). Two unanswered questions are whether AI will influence that actual nature of cross-functional design work and whether AI will increase or decrease the need for T-shaped people.

We explore these two questions as part of an examination of the meaning and nature of cross-functional design. The results of interviews with six design managers are shared. We begin this manuscript by first examining what 'being cross-functional' means across the organization, the team, and the individual, with the latter serving as the context for examining the concept of T-shaped individuals. The manuscript concludes with thoughts on cross-functional design and T-shaped in the age of AI.

BACKGROUND

The Meaning of Cross-Functional

Dictionary definitions for cross-functional illustrate that 'cross-functional' pertains to different levels of analysis. For example, the Cambridge Dictionary defines cross-functional as "involving people or departments who do different types of work for the same company." In comparison, the Oxford Dictionary defines cross-functional as "denoting or relating to a system whereby people from different areas of an organization work together as a team." The first definition places emphasis on the organization, whereas the second definition places emphasis on the team. Both definitions portray 'cross-functional' as a group behavior characteristic and imply that 'cross-functional' only has two levels of analysis. The mention of people in these definitions points to a possible individual level of analysis as well. The reason why level is important is because there are varied theories resident at each of the three levels that can be used to explain 'cross-functional' phenomena. T-shaped is indicative of the individual level of analysis.

Cross-functional work has its challenges and thus is not a panacea. Challenges include that cross-functional can confuse lines of authority; create ambiguity over resources, technical issues, pay, and personal assignments; contribute to organizational conflict between functional and team project managers; lead to conflict among individuals who must work together but have very different backgrounds and perspectives; be more costly for organizations in terms of resource requirements; and be more costly for individuals in terms of role ambiguity, conflict, and stress (Lim and Reid 1992; Cespedes 1995; Jassawalla and Sashittal 1999; Krohmer et al. 2002). However, being cross-functional offers benefits. Cross-functional work can enable lateral communication channels; increase the amount of information the organization can handle; allow flexibility in the use of human and capital resources; increase individual motivation, job satisfaction, commitment, and personal development; achieve technical excellence more easily; and increase firm growth and strategic initiatives through functional heterogeneity (Cunningham and Chelladurai 2004). These challenges and benefits of 'being cross-functional' pertain to the organization, the team, and the individual, which highlight and distinguish three levels of analysis. We now discuss cross-functional at these three levels.

Cross-Functional at the Organization Level

Organization theory posits that organization structure and administration contribute to the differentiation and specialization of groups and individuals within these groups (e.g., Lawrence and Lorsch 1986, Hall 1991). Departments and functions are used to organize workflow (cf. Hall 1991), where departments are a higher order construct than functions and viewed as the level of organization structure that encompasses multiple functions, and functions represent distinct groups of personnel who serve as specialists in achieving a set of given objectives and corresponding activities. Departments are more permanent in nature, pending major shifts in organization structure due to management intervention. Functions are also lasting elements of the organization so long as the organization deems those objectives relevant and the respective skill set remains required. The importance attributed to each department and function is predicated on the capability to cope effectively with uncertainty and ambiguity caused by critical environmental factors, where coping enables the respective organization to plan, organize, manage, direct, and control its activities as it pursues multiple objectives simultaneously (Lawrence and Lorsch 1986; Hall 1991).

Effective companies are those companies achieving proper differentiation and integration of functions (Lawrence and Lorsch 1986). Differentiation is defined as the state of segmentation

of the organization into functions, with each developing particular attributes in relation to the requirements posed by its relevant external conditions (Lawrence and Lorsch 1967, pp. 3-4). Integration is defined as the process of achieving unity of effort among the various subsystems in the accomplishment of the company's task by the demands of the environment (Lawrence and Lorsch 1967, 1986). Together, differentiation and integration represent the company's responses to the levels of uncertainty inherent in the environment, with the objective to integrate across differentiated parts of the company to facilitate organizational information processing (Lawrence and Lorsch 1986; Sherman, Berkowitz, and Souder 2005). In other words, cross-functional initiatives serve to help the organization contend with uncertain and ambiguous situations, with situations with higher levels of uncertainty and ambiguity requiring greater information-processing requirements and more extensive modes of integration, while situations with low levels of uncertainty and ambiguity would not require as much integration (Daft and Lengel 1986; Keller 2001). Information processing leading to knowledge creation would be accomplished through the promotion of interactions and problem-solving among individuals with unique knowledge sets coupled with the combining of disparate resources (Tsourkas 1996; Hinsz 1997). This shows how cross-functional initiatives serve to create knowledge in the organization as interaction between individuals with similar knowledge sets would not create as much knowledge as individuals with different knowledge sets.

Driving the need for 'being cross-functional' at the organization level are company directives, which require integration across differentiated parts of the company for the purpose of tapping into various functional expertise and functional area resources in order to allow the organization to cope with varying situations (Lawrence and Lorsch 1986; Sherman et al. 2005). Organizational integration aims to strategically link functionally specialized functions to ensure cooperation in decision-making and tasks (Moenaert and Souder 1990, Parry et al. 2010) and structure the different ways in which functional areas might interact, share information, build relationships, and work together to solve problems and accomplish specific new product design task objectives (Parry et al. 2010). Those product design projects with greater uncertainty and greater ambiguity require the collection and sharing of information from numerous sources to conceive the best path forward and ensure product design tasks are on track (Keller 2001). Examples of organizational integration mechanisms include colocation; personnel movement through job rotation; formal product planning processes such as the Stage Gate® process; informal social systems pertaining to scheduling meetings and get-togethers; incentives, rewards, and recognitions relating to performance evaluations and compensation; and organizational structure (Griffin and Hauser 1996). Missing from this list of mechanisms is the team, which is discussed separately in the next section.

Indicative of the psychological and sociological factors that come into play when different areas of the organization interact with each other, Social Identity Theory (cf. Tajfel 1978; Tajfel and Turner 1985; Ashforth and Mael 1989) can be used to explain the behavior of individuals in functional areas working with individuals from other functional areas. Social Identity Theory purports that people tend to categorize themselves and others into various social categories as a way to organize their views. The tendency to categorize serves two purposes: one, it cognitively segments and orders the social environment, providing individuals with a systematic means of defining others; and two, it enables the individual to locate/define himself or herself in the social environment (Ashforth and Mael 1989). Categorization is enacted through prototypical characterizations based on members' biases and stereotypes, which are not

necessarily reliable and can be very hard to overcome (Ashforth and Mael 1989, Mackie and Goethals 1987, Sethi et al. 2001).

Building on Social Identity Theory, Fisher et al. (1997) introduced the concept of relative functional identity (RFI). Defined as the strength of an individual's psychological connection to their functional area compared to the firm as a whole (Fisher et al., 1997), RFI stems from people deriving strength and a sense of identity from their connections to organizational and functional memberships. People also may confer positive or negative attributes to a group based on the extent to which they are valued or undesired and experience vicariously a group's successes and failures. High RFI individuals will identify more strongly with their own function than with the organization, align themselves closely with what they perceive to be the interests of their own functional area and their colleagues, and place the interests of the function above what is best for the organization (Fisher et al., 1997). Empirical study by Fisher et al. (1997) found that high-RFI managers were willing to attempt coercion in order that other functional managers comply with their own functional perspective on organizational issues and more likely focus on their functional area's problems, issues, and solutions than those of the overall organization. This has the potential to impact competition, conflict, and cooperation across the organization's departments and functions.

Cross-Functional at the Team Level

Teams traditionally serve as temporary mechanisms for the integration of personnel and are a versatile, prevalent mechanism for achieving integration between functions, especially in the case of new product development, because they can readily span the organization structure (Sarin and Mahajan 2001). A team residing in a single functional area or department would characterize a functional team, whereas a cross-functional team overlays and establishes links across the existing functional organization with the aim of improving integration across the company. Cross-functional teams are shorter-term organizational structural arrangements that aim to coordinate functional areas and increase the level of cross-functional integration during the new product development (NPD) process (Griffin and Hauser 1996; Olson et al. 2001; Sethi 2000). Cutting across functions, they assemble employees to work on the same project as a group, with the aim to integrate all functional aspects at project inception (Donnellon 1993; Karlsson and Ahlström 1996). Ford and Randolph (1992) note three particular distinctions of cross-functional teams. One, cross-functional teams experience abundant pressure and conflict so the early development of stable and effective group processes is critical to their success. Two, cross-functional teams confront different sets of performance expectations that include the needs to reduce cycle time, create knowledge, and disseminate organizational learning. And three, cross-functional teams are usually representative groups in which each member has a competing social identity and obligation to another function of the organization.

Kahn (2009) reinforces that not all teams need to be cross-functional. Sometimes a functional team may be sufficient, where the team only concerns itself with function-specific activities that are narrow in scope, low in uncertainty, and pertain to function-specific goals. Functional team members come from the same functional area and have minimal to no contact with personnel from other functions. Contrasting functional teams are multifunctional and cross-functional teams (Kahn 2009). Multifunctional teams represent those initiatives where personnel serve a liaison role to represent their respective function's views, which corresponds to Tim Brown's observation noted earlier in this paper. Cross-functional teams are those initiatives where team members are more strongly tied to, have a vested interest in, and heavily engage with

the team. People forming cross-functional teams represent different functional areas (Karlsson and Ahlström 1996); are carefully selected specialists tasked with jointly and simultaneously making decisions (Henke et al. 1993); are given specified release time for the project (Cooper and Kleinshcmidt 1994); focus on different facets of a problem and interpret information differently (Souder, 1987); work concurrently with each other under a project manager (Cordero et al. 1998; Cooper 2001); have an equal stake in and commitment to the project (Cooper and Kleinshmidt 1994); and assume joint responsibility for the achievement of the team goal (Cordero et al. 1998).

Parry et al. (2009) explain that because separate learning curves may exist in different functional areas, the use of a cross-functional team for product development allows representatives from different functions to simultaneously progress along their respective learning curves and accelerate the NPD process. The inclusion of representatives from key functions at the onset of an NPD project further ensures that relevant information and knowledge reduce the likelihood that later stages of the NPD process will require the rethinking of earlier decisions (Park et al., 2009; Swink and Song, 2007). In the best scenarios, cross-functional team members share a common set of performance objectives and a common reward or merit scheme contingent on successful new product performance, which in turn, foster a sense of co-mingling among team members, remove feudal barriers that inhibit innovative solutions (Cooper 2001), secure commitment of functions (Parry et al. 2009), and reduce cross-functional conflict (Parry et al. 2009).

Social Identity Theory (cf. Tajfel 1978; Tajfel and Turner 1985; Ashforth and Mael 1989) has been used at the team level to explain cross-functional team behaviors. Predicated on Social Identity Theory, Sethi (2000) introduced the construct of Superordinate Team Identity (STI). STI corresponds to the extent to which members feel (or do not feel) a sense of connection with the team (Sethi 2000). A low STI would be characterized by the retention of functional identities, biases, and stereotypes, while a high STI would be able to override the adverse effects of functional identities of team members, enhance the perception of intra-team similarities, and promote psychological acceptance of members from other functional areas and their work methods. High STI thus has the potential to reduce the adverse effect of cross-functional biases and stereotypes (Sethi 2000). Empirical studies have shown a significant, positive relationship between STI and new product performance (Sethi 2000), and STI and new product innovativeness (Sethi et al., 2001), indicating that a strong STI within a cross-functional team can reduce the adverse effects that functional identities may pose.

Cross-Functional at the Individual Level

Emphasizing the important role played by individuals, Social Identity Theory also prescribes that an individual's cognition and emotional dimensions are important for their engagement in cross-functional work. "That part of an individual's self-concept which derives from his [or her] knowledge of his [or her] membership of a social group (or groups) together with the value and emotional significance attached to that membership" (Tajfel 1978, p. 63). Later work by Cameron (2004) and others has provided cogent theoretical support and empirical evidence for the relevance of multiple dimensions underlying the construct of social identity, particularly a cognition or understanding of the other group and an emotional feeling towards the other group (cf. Deaux, 1996; Ellemers et al., 1999; Hinkle et al., 1989; Jackson, 2002). The concept of a cross-functional mindset at the individual level is therefore introduced where the individual has an understanding of other functional areas and a willingness or emotional predisposition to work with other functional areas. Understanding other functional areas is a

cognitive component, and willingness to work with other functional areas is an affective/emotional component.

T-shaped individuals illustrate the concept of the cross-functional mindset. T-shaped individuals reflect understanding because their deep knowledge in one area is augmented with broad knowledge across other areas. Having a breadth of knowledge, these individuals understand other disciplines'/functional areas' terminology, methodologies, and techniques, for example. T-shaped individuals also reflect willingness because they are enthusiastic to work across disciplines and advocate for each area being successful. Besides T-shaped models, other similarly advocated concepts include the pi-shaped individual (Griffin et al. 2012), who has deep expertise in two areas and a broad base of knowledge of other areas, and the comb-shaped individual, who has many specific domains of expertise and breadth of knowledge covering the innovation process. T-shaped, pi-shaped, and comb-shaped individuals are described as having capabilities in both 'left brain' and 'right brain' disciplines, which allow them to embrace analytical and data-driven elements plus storytelling and experiential elements (Friedlein and Mortimer 2012). Described in this manner, all of these individuals reflect an understanding of different disciplines and a willingness to engage with other functional areas.

Individuals who are effective cross-functional team members may not be T-shaped or reflect another similar model but should reflect a cross-functional mindset comprising understanding and willingness will be important. Such understanding and willingness influence one's relative functional identity when working with other functional areas and superordinate team identity when working on a team. Someone with a high level of understanding and a high level of willingness would conceivably be more likely to reflect a lower relative functional identity and a higher superordinate team identity to support cross-functional activity, and in doing so, facilitate the effectiveness of cross-functional team and its cross-functional activities.

AI's Influence on Design

While attracting much attention in the popular press, research has only begun to explore the effect of artificial intelligence (AI) in the area of design. Verganti et al. (2020) found that AI can improve the scalability of the design process, broadening its scope across traditional boundaries, and enhancing its ability to learn and adapt on the fly. AI also appears to deeply enact several popular design principles, reinforcing the principles of being people-centered, abductive, and iterative and enabling the creation of solutions that are more highly user centered than human-based approaches. The conclusion of Verganti et al. (2020) was that while AI does not undermine the basic principles of design, it profoundly changes the practice of design, where problem-solving tasks traditionally carried out by designers are now automated into learning loops that operate without limitations of volume and speed. The algorithms embedded in these loops think in a radically different way than a designer who handles complex problems holistically with a systemic perspective.

Zhang et al. (2021) found that the use of deep learning AI in distributed human engineering design teams boosted the initial performance of low-performing teams before the problem changed but always hurt the performance of high-performing teams. The reduced performance of high-performing teams appeared to be due to cognitive overload by having to interpret vague directions, the flawed inference from AI suggestions, and a lack of motivation among participants to find better designs. The authors prescribed that when working with AI agents, AI agents need to provide suggestions that are straightforward for human designers to follow or at least easy to interpret, and not overwhelm users with too many options to consider at a time.

With evidence suggesting AI does impact design work and design teams, a specific area of questioning that has not been explored is the effect of AI on the cross-functional nature of design work and whether AI will encourage, impede, or have minimal effect on cross-functional design work. In addition, will AI require or diminish the need for T-shaped individuals?

METHODOLOGY

This study adopts an exploratory qualitative research approach using in-depth interviews, which is particularly suited for gaining rich insights into the complex and nuanced issues cross-functional and T-shaped in design practice. Semi-structured interviews were chosen because they provide flexibility, allowing researchers to probe deeply into participants' experiences, perceptions, and attitudes. This method is particularly useful for capturing detailed and nuanced understandings that quantitative methods might overlook.

We conducted in-depth, semi-structured interviews with six design managers from diverse firms, ranging from a small architectural firm to large multinational corporations operating in sectors such as consumer products, retail, and financial services. Participants were selected through purposive sampling to ensure the inclusion of perspectives from individuals knowledgeable about cross-functional design processes and the integration of AI technologies.

The interview protocol was designed to address the key research questions of the study, including managers' definitions and perceptions of cross-functional, their understanding and evaluation of the T-shaped individual concept, and their insights into how AI may influence these dynamics. Interview questions were open-ended to facilitate rich, spontaneous responses and allow participants to share insights beyond predefined topics.

Transcripts from interviews were analyzed using thematic analysis to identify common themes, patterns, and divergences among the responses. Coding was conducted iteratively to ensure reliability and consistency, with initial codes grouped into broader categories reflecting key research topics. This approach provided a structured yet flexible framework to synthesize findings and allowed for the emergence of unexpected insights.

FINDINGS

Understanding Cross-Functional Design

Design managers were first asked to articulate their understanding of cross-functional design, revealing nuanced insights aligned with organizational, team, and individual levels of analysis. At the organizational level, responses highlighted the necessity of integrating diverse disciplines, skills, and perspectives, breaking down departmental silos to enhance collaboration across functional boundaries such as design, business, engineering, and operations. At the team level, cross-functionality was depicted as the process of engaging multiple design roles throughout the lifecycle of problem-solving—from research and strategy to technical execution. Managers emphasized ensuring that design teams remain connected with other parts of the organization, noting that cross-functional work means "recognizing that design is inherently cross-functional, working alongside product and tech teams, and contributing to strategy, research, and design in product development."

Facilitating Cross-Functional Work

Managers described multiple strategies for facilitating cross-functional design, focusing heavily on culture and established organizational practices. These include creating structured collaborative practices such as critiques, feedback loops, workshops, and communities of

practice. Team-building forums and senior management buy-in were also emphasized as vital in fostering effective cross-functional interactions. Highlighting the cultural aspect, one manager noted that cross-functional engagement "echoes through the entire company," emphasizing widespread institutional support and regular collaboration practices as central to facilitating effective cross-functionality.

Challenges in Cross-Functional Design

Several challenges emerged in the interviews. One recurring issue was conflicting priorities, where managers pointed to situations in which product design, budgets, and schedules failed to align, complicating coordination efforts, especially in smaller teams. Ambiguous and unclear roles represented another significant hurdle, creating inefficiencies and friction: "Too many contributors without defined responsibilities can lead to conflicts, inefficiencies, and perceived role superiority." Managers also emphasized the pressure of multitasking, acknowledging the dilution of quality as team members juggle multiple roles simultaneously. The dynamics of personality differences and inclusion concerns were also highlighted as frequent sources of tension, influencing team cohesion and performance negatively.

Benefits of Cross-Functional Design

Despite these challenges, interviewees consistently acknowledged substantial benefits to cross-functional collaboration. Broader viewpoints emerged as a critical advantage, allowing teams to gain comprehensive understanding and appreciation for constraints and opportunities beyond their immediate roles. Managers emphasized how a cross-functional approach supports a balance between creativity and practicality, ensuring innovative solutions remain feasible within real-world constraints. Healthy debate and diverse perspectives were also valued, with one manager noting that "tension is necessary," suggesting it refines ideas, facilitates early issue identification, and ultimately contributes to developing robust solutions that integrate insights across multiple platforms and disciplines.

The Role of T-Shaped Individuals

While most managers recognized the T-shaped concept and its relevance, their perspectives varied. Some noted increasing prominence of T-shaped characteristics, particularly among mid-level and senior design personnel, while others expressed skepticism, stating, "It's a nice idea on paper, but people aren't always so neatly shaped." One manager questioned the practicality of developing broad skillsets, stating, "Not everyone has the time or the opportunity to build that broad base of knowledge," implying limitations in broadly applying the T-shaped model.

The Impact of AI on Cross-Functional Design

Respondents agreed that AI would influence cross-functional design, though there was variation in expectations of its extent and nature. A strong consensus emerged that AI will enhance rather than replace human collaboration, with one manager remarking that "AI will assist, not replace," suggesting that human creativity, judgment, and empathy remain indispensable. AI was seen as a valuable assistant in streamlining repetitive, administrative tasks and making internal knowledge more accessible, enhancing cross-functional collaboration and efficiency. Yet managers cautioned against viewing AI as a panacea, noting that human empathy and judgment remain irreplaceable components of high-quality design work.

AI's Influence on the Need for T-Shaped Individuals

Respondents expressed mixed perspectives about the role of AI in shaping the importance of T-shaped individuals. Some interviewees believed AI might slightly reduce the breadth component of the T-shaped skill set, suggesting that specialists could rely on AI to support tasks outside their primary expertise more effectively. One manager argued explicitly that "AI lacks human empathy and perspective," thus reinforcing the importance of broad knowledge and deep expertise. Another manager speculated that AI could reduce the breadth required from individuals, allowing specialists to focus more intently on their core competencies. However, all respondents generally agreed that, irrespective of AI's support, human judgment, empathy, and contextual interpretation provided by T-shaped or similarly skilled individuals would remain vital for effective cross-functional collaboration and innovative design outcomes.

DISCUSSION AND TENTATIVE CONCLUSIONS

The managers we interviewed emphasized the importance, some noting the critical importance – of being cross-functional in design work. Several key benefits afforded by cross-functional work are providing a well-rounded perspective, reducing rework, gathering diverse viewpoints, creating necessary tensions, and finding the best solution where functional viewpoints meet. As one interviewee noted, "tension is necessary – it is where the magic happens." These benefits contribute to fostering a novel and user-centered approach to design (Kim and Kang, 2008). Our findings shed light on challenges too. Issues mentioned include the phenomenon of "too many cooks," which can lead to friction and overlapping roles, role ambiguity, lack of role clarity, and overlapping skills – all of which can create friction and stress (Fisher et al., 1997). Interviewees tended to agree that AI has the potential to automate routine tasks and enable deeper data-driven insights, though there was disagreement on the degree of change. This shift is expected to reduce the cognitive burden on individuals, allowing them to focus more on creative and integrative tasks (Roberts and Candi, 2024) and also may reconfigure the need for certain cross-functional capabilities.

This points to a potential conundrum: AI tools become so adept at synthesizing information across different domains that the necessity for individuals to be skilled in multiple functional areas diminishes. Meanwhile, a prominent theme in the interviews is the role of T-shaped individuals in enabling cross-functional teams and cross-functional design work (cf. Hansen, 2015). AI holds promise to support cross-functional work by reducing functional silos and enhancing information flow, but it also may demand new forms of integration, especially at the intersection of human and machine creativity, which T-shaped individuals could facilitate. The managerial implications of the findings point to the possibility that whereas past realities called for hiring T-shaped individuals for design teams, the increased prevalence of AI use in design might call for hiring poly-shaped individuals (cf. Griffin et al., 2012). These individuals possess deep knowledge in a specialist field and boundary-crossing competencies that would include a comprehensive understanding of the capabilities of AI.

The need for cross-functional work will endure, not diminish in the age of AI. And while not all teams need to be cross-functional, it is becoming more likely that a team comprising multiple functional areas will be necessary for product design projects, where complexity is almost always present and one discipline/functional area working alone will not suffice. Design appears to be stronger when perspectives and knowledge from across multiple disciplines and functional areas come together to create knowledge in the course of the product design effort,

whether at the organization or team level. The role of AI and its relationship to enabling cross-functional design work deserves continued investigation, along with how T-shaped or poly-shaped individuals may be better at leading design efforts in an AI-enabled world. Exploring the moderating issues of uncertainty and scope is a pertinent research avenue here. For example, projects that are more uncertain and broader in scope might necessitate a stronger cross-functional mindset and greater AI support. More uncertain and broader in scope projects also might need people with training in multiple functional areas, i.e., T-shaped individuals or individuals predisposed to being T-shaped. This supports the notion that the interplay between cross-functional and AI may be contextual and not a one-size-fit-all approach. Given that working across functional areas is a mainstay of business and cross-functional teams represent a prevalent mechanism for design projects, continued study of how best to integrate and leverage AI tools to support cross-functional activities is warranted.

References

Ashforth, B.E. and Mael, F. 1989. Social Identity Theory and the Organization, *Academy of Management Review*, 14: 20-39.

Cespedes, F. V. 1995. *Concurrent Marketing: Integrating Product, Sales, and Service*, Boston, Massachusetts: Harvard Business School Press.

Cambridge Dictionary. 2024. http://dictionary.cambridge.org/us/dictionary/english/cross-functional.

Cooper, R. G. 2001. *Winning at new products*. Cambridge, MA: Perseus Publishing.

Cooper, R. G. and Kleinschmidt, E. J. 1994. Determinants of Timeliness in Product Development. *Journal of Product Innovation Management*, 11 (5): 381–396.

Cordero, R., Farris, G. F., and Di Tomaso, N. 1998. Technical Professionals in Cross-functional Teams: Their Quality of Work Life. *Journal of Product Innovation Management*, 15 (6): 550–563.

Cunningham, G. B. and Chelladurai, P. 2004. Affective Reactions to Cross-Functional Teams: The Impact of Size, Relative Performance, and Common In-Group Identity, *Group Dynamics: Theory, Research, and Practice*, 8 (2): 83-97.

Daft, R. L. and Lengel, R. H. 1986. Organizational Information Requirements, Media Richness and Structural Design. *Management Science*, 32 (5): 554-571.

Dahl, D. W. 2011. Clarity in Defining Product Design: Inspiring Research Opportunities for the Design Process. *Journal of Product Innovation Management*, 28(3): 425–427.

Deaux, K. 1996. *Social Identification*. in *Social Psychology: Handbook of Basic Principles* (edited by E. Tory Higgins and Arie W. Kruglanski). New York: Guilford. 777-798.

Donnellon, A. 1993. Crossfunctional Teams in Product Development: Accomodating the Structure to the Process. *Journal of Product Innovation Management*, 10 (5): 377-392.

Ellemers, N., Kortekaasand, P., and Ouwerkerk, J. W. 1999. Self-Categorisation, Commitment to the Group and Group Self-Esteem as Related But Distinct Aspects of Social Identity. *European Journal of Social Psychology*, 29: 371-389.

Fisher, R. J., Maltz, E., and Jaworski, B. J. 1997. Enhancing Communication between Marketing and Engineering: The Moderating Role of Relative Functional Identification. *Journal of Marketing*, 61 (3): 54-70.

Ford, R. C. and Randolph, W. A. 1992. Cross-Functional Structures: A Review and Integration of Matrix Organization and Project Management. *Journal of Management*, 18 (2): 267-294.

Friedlein, A. and Mortimer, R. 2012. Why Modern Marketers Need To Be Pi-People. *Marketing Week* November 7. http://www.marketingweek.com/2012/11/07/why-modern-marketers-need-to-be-pi-people/

Griffin, A. and Hauser, J. R. 1996. Integrating R&D and Marketing: A Review and Analysis of the Literature. *Journal of Product Innovation Management*, 13 (3): 191-215.

Griffin, A., Price, R. L., and Vojak, B. A. 2012. *Serial Innovators: How Individuals Create and Deliver Breakthrough Innovations in Mature Firms*. Stanford, CA: Stanford Business Books.

Hall, R. H. 1991. *Organizations: Structure, Processes, and Outcomes*. Englewood Cliffs, NJ: Prentice-Hall.

Hansen, M. T. 2015. IDEO CEO Tim Brown: T-Shaped Stars: The Backbone of IDEO's Collaborative Culture. *Chief Executive*, October 12.

Henke, J. W., Krachenberg, A. R., and Lyons, T. F. 1993. Cross-Functional Teams: Good Concept, Poor Implementation! *Journal of Product Innovation Management*, 10 (3): 216–229.

Hinkle, S., Taylor, L. A., Fox-Cardamone, D. L., and Crook, K. F. 1989. Intragroup Identification and Intergroup Differentiation: A Multicomponent Approach. *British Journal of Social Psychology*, 28: 305-317.

Hinsz, V. B. and Vollrath, D. A. 1997. The Emerging Conceptualization of Groups as Information Processors. *Psychological Bulletin*, 121 (1): 43-64.

Jackson, J. W. and Smith, E. R. 1999. Conceptualizing Social Identity: A New Framework and Evidence for the Impact of Different Dimensions. *Personality and Social Psychology Bulletin*, 25: 120-135.

Jassawalla, A. R. and Sashittal, H. C. 1999. Building Collaborative Cross-Functional New Product Teams. *Academy of Management Perspectives*, 13 (3): 50-63.

Kahn, K. B. 2009. Functional, Multifunctional, and Cross-Functional: Considerations for Marketing Management. *Journal of Marketing Theory and Practice*, 17 (1): 75-84.

Keller, R. T. 2001. Cross-Functional Project Groups in Research and New Product Development: Diversity, Communications, Job Stress, and Outcomes. *Academy of Management Journal*, 44 (3): 547-555.

Kim, B. Y. and Kang, B. K. (2008). Cross-Functional Cooperation with Design Teams in New Product Development. *International Journal of Design*, 2(3): 43-54.

Karlsson, C. and Ahlström, P. 1996. The Difficult Path to Lean Product Development. *Journal of Product Innovation Management*, 13 (4): 283-295.

Krohmer, H., Homburg, C., and Workman, J. P. 2002. Should Marketing Be Cross-Functional? Conceptual Development and International Empirical Evidence. *Journal of Business Research*, 55 (6): 451-465.

Lawrence, P. R. and Lorsch, J. W. 1967. Differentiation and Integration in Complex Organizations. *Administrative Science Quarterly*, 12 (1): 1-47.

Lawrence, P. R. and Lorsch, J. W. 1986. *Organization and Environment: Managing Differentiation and Integration*. Boston, MA: Harvard Business School Press.

Lim, J. and Reid, D. A. 1992. Vital Cross-Functional Linkages with Marketing. *Industrial Marketing Management*, 21 (2): 159-165.

Mackie, D. M. and Goethals, G. R.. 1987. Individual and Group Goals. In *Review of Personality and Social Psychology: Group Processes*. ed. Clyde Hendrick, Newbury Park, CA: Sage.

Moenaert, R. K. and Souder, W. E. 1990. An Information Transfer Model for Integrating Marketing and R&D Personnel in New Product Development. *Journal of Product Innovation Management*, 7 (2): 91–107.
Olson, E. M., Walker, O. C. Jr., Ruekert, R. W., and Bonner, J. M. 2001. Patterns of Cooperation During New Product Development Among Marketing, Operations and R&D: Implications for Project Performance. *Journal of Product Innovation Management*, 18 (4): 258–271.
Oxford Dictionary. 2024. http://www.oxforddictionaries.com/us/definition/american_english/cross-functional.
Park, M. H., Lim, J. W., and Birnbaum-More, P. H. 2009. The Effect of Multiknowledge Individuals on Performance in Cross-Functional New Product Development Teams. *Journal of Product Innovation Management*, 26 (1): 86–96.
Parry, M. E., Song, M., De Weerd-Nederhof, P. C., and Visscher, K. 2009. The Impact of NPD Strategy, Product Strategy, and NPD Processes on Perceived Cycle Time. *Journal of Product Innovation Management*, 26 (6): 627–639.
Parry, M. E., Ferrín, P. F, González, J. A. V., and Song, M. 2010. Cross-Functional Integration in Spanish Firms. *Journal of Product Innovation Management*, 27 (4): 606–615.
Roberts, D.L. and Candi, M. 2024. Artificial intelligence and innovation management: Charting the evolving landscape. *Technovation*, 136.
Sarin, S. and Mahajan, V. 2001. The Effect of Reward Structures on the Performance of Cross-Functional Product Development Teams. *Journal of Marketing*, 65 (2): 35-53.
Sethi, R. 2000. Superordinate Identity in Cross-Functional Product Development Teams: Its Antecedents and Effect on New Product Performance. *Journal of the Academy of Marketing Science* 28 (3): 330-344.
Sethi, R., Smith, D. C., and Park, C. W.. 2001. The Effect of Cross-Functional Product Development Teams on the Innovativeness of New Consumer Products. *Journal of Marketing Research*, 38 (February): 73-85.
Sherman, J. D., Berkowitz, D., and Souder, W. E. 2005. New Product Development Performance and the Interaction of Cross-Functional Integration and Knowledge Management. *Journal of Product Innovation Management*, 22 (5): 399-411.
Souder, W. E. 1987. *Managing New Product Innovations*. Lexington, MA: Lexington Books.
Swink, M. and Song, M. 2007. Effects of Marketing-Manufacturing Integration on New Product Development Time and Competitive Advantage. *Journal of Operations Management*, 25 (1): 203–217.
Tajfel, H. (1978). Differentiation between Social Groups. London: Academic Press.
Tajfel, H. and Turner, J. C. 1985. The Social Identity Theory of Intergroup Behavior. In *Psychology of Intergroup Relations* (2nd Edition). S. Worchel & W. G. Austin (Editors.). Chicago: Nelson-Hall, 7-24.
Tabrizi, B. 2015. 75% of Cross-Functional Teams Are Dysfunctional. *Harvard Business Review* Digital Article. June 23. https://hbr.org/2015/06/75-of-cross-functional-teams-are-dysfunctional.
Tsourkas, H. (1996), The Firm as a Distributed Knowledge System: A Constructionist Approach, *Strategic Management Journal*, 17 (Winter): 11-25.
Wechsler, J. and Schweitzer J. 2019. Creating Customer-Centric Organizations: The Value of Design Artefacts. *The Design Journal*, 22(4): 505-527.