

Research Statement

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Two interrelated goals guide my research activities: (1) to help improve the efficacy of information systems in enabling innovation and business strategies, and (2) to help people involved in information systems development to produce high quality products, solutions, and services in an efficient manner. I take a socio-technical and design science approach to investigate system design and development activity by focusing on team-level processes and their interrelationships with the technical design attributes of artifacts produced by the team. In doing so, I develop process and product design guidelines for product development teams, contribute to design science theory development, and help practitioners manage complex tradeoffs in product, service, and organization design.

1. Research Evolution

1.1. Process Design

I started my investigation of globally distributed product development by seeking to establish the impact of global work dispersion on performance of innovation-focused and knowledge-intensive projects. I undertook a series of field studies to gather data on distributed software development, both in the custom software services and product development settings, to document the different impacts of the various modes of distributing software work across global development centers and the ways in which firms managed the process.

The primary insights from these field studies relate to the tradeoffs involved in adopting structured quality management processes, configurations of team structures and processes, and the interventions necessary to manage these tradeoffs. This research showed that conscious investments to build easy-to-implement learning routines were the key to manage the detrimental effects of work dispersion. This line of work has been well recognized by the software product development research community as evidenced by the following publications:

- Ramasubbu, N., Mithas, S., Krishnan, M.S., and Kemerer, C. "Work Dispersion, Process-Based Learning and Offshore Software Development Performance," *MIS Quarterly*, June 2008.
- Ramasubbu, N., Balan, R. "Empirical Analysis of globally distributed software development", Proceedings of the 16th *ACM SIGSOFT FSE Conference* (distinguished paper award).
- Ramasubbu, N., Balan, R. "Impact of process choice in distributed software development: an empirical analysis", Proceedings of the 2009 *ICSE conference*.
- Ramasubbu, N, "An empiricist view of managing globally distributed software development", Keynote speech at the 2009 *Software Engineering for Offshore and Outsourced Software Development Conference*, ETH, Zurich.

- Ramasubbu, N., Cataldo, M., Balan, R., and Herbsleb, J. “Configuring Globally Distributed Software Teams: A Multi-company Analysis of Productivity, Quality, and Profits,” 2011 *ICSE Conference* (distinguished paper award).

The practitioner-oriented guidelines that stemmed out of the field research have also been well acknowledged:

- Ramasubbu, N., Krishnan, M.S., and Kompalli, P. "Leveraging global resources: A process maturity framework for managing distributed development," *IEEE Software* (22:3), 2005.
- Ramasubbu, N., “Managing globally distributed software development”, Invited Talk at the first *Indian Software Engineering Conference*, 2007.

1.2. Product Design

A related, second line of research I have been pursuing investigates the role of product design in improving distributed project performance. The focus of this research is to help product developers mitigate the ill effects of complexity arising out of both organizational changes (business needs) and technical design changes (code growth, programming language change, etc).

I have conducted field studies in six leading product development and technology services firms and investigated the product design process employed by the teams. Specifically, the research analyzed the model-driven product design and development methodology adopted by the firms and its impact on the ability to achieve improved project performance. A key insight from these studies pertains to the tradeoffs involved in product design – flexibility vs. efficiency, and customization vs. standardization – and the organizational factors that shape these tradeoffs. Two of my papers in this research stream have been accepted for publication and several others are currently in the review pipeline:

- Ramanath. S, Ramasubbu. N., Krishnan, M.S. “In Search of Efficient Flexibility: An Empirical Study of Model-driven Component-based Software Development,” accepted for publication at *Information Systems Research*.
- Ethiraj. S, Ramasubbu. N, Krishnan, M.S. “Calculus of Being Customer Focused: Does complexity affect incentives to innovate?,” accepted for publication at *Strategic Management Journal*.
- Ramasubbu, N., Woodard, J., Tschang, T., Sambamurthy, V. “Where Do Digital Business Strategies Come From? The Interrelated Roles of Digital Options and Design Moves,” under 2nd round review, *MIS Quarterly*.
- Ramasubbu, N., Woodard, J., Mithas, S. “Orchestrating Service Innovation: The Dynamics of Fit between Service Architecture and Enterprise IT Architecture,” under review, *MIS Quarterly*.

2. Future Research

In the next four-to-five years, I will continue to investigate the process and product design mechanisms that enable business strategies and innovation. Specifically, my research aims to contribute to the further development of design science theory in two

ways. First, I am working towards the development of a robust empirical method centered on “design moves” to rigorously study design evolution. The design moves lens aims to untangle the empirical difficulties in examining the interrelated effects of business context and design complexity in influencing the evolution of product and service designs. Second, using the design moves lens, I plan to empirically investigate the various patterns in which firms and product designers manage tradeoffs in product development and gather empirical evidence for a theory of design evolution.

My planned empirical studies on design evolution also naturally lend themselves to examine other related issues in software engineering and product management such as platform competition, user-led innovation, take-off of products, and managing enterprise information systems.

As I started applying the design moves methodology to study the evolution of mobile applications on various mobile platforms such as the Apple iOS, Google Android, Windows Mobile, and the RIM Blackberry, I discovered three distinct application takeoff patterns (i.e., reaching widespread adoption) that were different from the traditional product takeoff patterns reported in the marketing literature. Using a rich data set drawn from the various mobile platform marketplaces (App store, Android Market, etc), I am now examining the various factors that cause application takeoffs and sustained growth. This research aims to shed light on sustainability of platform ecosystems and develop design-related best practices for individual application developers participating in the platform ecosystems.

Through a focused partnership with enterprise systems vendors in the business analytics domain, I am investigating how cloud computing and social media are shaping the requirements for next generation business intelligence enterprise systems. With an aim to equip firms with tools that help improve their sense-respond capabilities, I am developing a business analytics framework for integrating social media analytics and traditional structured data analysis. With partnership with Origami Inc, I am currently empirically validating the framework in the context of sales force effectiveness improvement programs. In a related research project, I am working on building a business analytics framework and corresponding business models to deliver small business-focused business analytics through cloud computing. In partnership with Elixir technologies, I am building a market-based business analytics platform to achieve cost-effectiveness and leverage the niche, small-scale suppliers in the research community.

I have also developed a research plan to investigate the role of boundary spanning end-users in facilitating technology-induced changes in enterprises. Both user-led innovation and end-user product engineering research streams emphasize the increased participation of end-users in system development processes. However, the knowledge and skills gap between end-users and designers/developers has been difficult to bridge and presents itself as a major coordination hurdle. My research plan is to investigate the role of boundary spanning processes and emerging design mechanisms, such as model-driven development in minimizing the gap between end-users and designers.

I have summarized my research plan for the next four-five years in the table presented below, outlining the key projects that I am working on. As for the publication strategy, I aim to publish in the Information Systems outlets (MISQ, ISR, JMIS, etc), strategy and organization studies outlets (Management Science, Strategic Management Journal, Organization Science, etc), and reputed computer science outlets (FSE, ICSE, IEEE and ACM Transactions, etc). Throughout, I strive to disseminate the research insights and learning through consulting and publications in managerially relevant outlets. My research themes focused on design science and the socio-technical approach I adopt for research enable such an interdisciplinary publication strategy.

Research Plan Summary

Topic	Project Goals and Description
Design Moves	<ul style="list-style-type: none"> • Develop an empirical method to untangle interrelated effects of business context and product complexity to study design evolution. • Demonstrate the use of “design moves” in various product development settings.
Design Evolution	<ul style="list-style-type: none"> • Establish the various patterns in which designs evolve • Investigate the role of managerial action in optimizing tradeoffs (such as technical debt vs. design options, flexibility vs. efficiency) in influencing design evolution. • Establish the strategic role of design in impacting organizational performance.
Open and User-driven innovation	<ul style="list-style-type: none"> • Enabling end-users to create their own systems by providing necessary platform tools. • Conditions under which end-users contribute to design decisions. • Beyond prototyping – how to engage users to help manage tradeoffs: standardization vs. customization? • Social knowledge and information management process for enabling large scaled end-user driven innovation.
Next generation Business Analytics design and tools	<ul style="list-style-type: none"> • Developing designs to integrate social media analytics with firm- level data; integrating structured and unstructured analytics. • Building and testing small business-focused, market-based business analytics solutions through cloud computing.
Platforms and Ecosystems	<ul style="list-style-type: none"> • What causes application take-offs in mobile platform ecosystems? • How does better design, newer disruptive technology affect the sustainability of an ecosystem? • Investigating how customization scenarios can be preserved while migrating IT platforms. • The interplay between packaged vendor, system integrator, and customer incentives in enterprise product ecosystems.
Process design for distributed experiential environments	<ul style="list-style-type: none"> • Work division mechanisms when social awareness is improved using experiential environments. • Impact of experiential environments on coordination, learning and knowledge creation/sharing in firms.