**DIANE E. BAILEY**

**Journal Publications**

*For a short list (no abstracts) of my journal publications, plus a list of my other publications, please see my CV.*

* **Leonardi, P.M., Bailey, D.E., Diniz, E.H., Sholler, D, and Nardi, B.A. (In Press.) Multiplex Appropriation in Complex Systems Implementation—The Case of Brazil's Correspondent Banking System. *MIS Quarterly*, Special Issue on ICT and Societal Challenges.**

When user needs do not align with system designers’ visions, new technology implementation becomes a complex process as users appropriate the new technology to meet their needs. Prior studies recognize this complexity, but focus on the complex implementation of simple systems in which user groups are well defined and the IT artifact is the primary change. We extend the research lens by examining the implementation of the Brazilian correspondent banking system, a complex system involving multiple actors, system elements, and settings intended to address the social problem of financial exclusion. Our case study comparison of two settings—retail stores and post offices—reveals that actors’ appropriations extended beyond the IT artifact to include technical, role, usage, social, and policy appropriations. The intended users (poor clients in remote and underserved areas) barely interacted with the IT artifact or other system elements; instead, they relied upon remote bankers (“correspondents”) to appropriate the system on their behalf. Because rewards, incentives, and constraints differed by setting, correspondents’ appropriations differed by setting. We call the resulting mix of appropriations across multiple elements by multiple actors in multiple settings multiplex appropriation. Complex societal challenges often involve multiple users in multiple settings with varied needs and few technology skills; thus, designing systems to meet user requirements may prove impossible. Instead, allowing multiplex appropriation might foster system success because, rather than forcing a global alignment among system elements or trying to ascertain multiple user needs, it allows for multiple local alignments of system elements that fit local settings.

* **Diniz, E.H., Bailey, D.E., and Sholler, D. 2014. Project success by altering context, not technology. *Information Technologies & International Development*, 10(4): 15-29.**

Abstract: When explaining the failure of information and communication technologies for development (ICT4D) projects, researchers often turn to differences between how designers perceive and users experience the context of technology use. According to these explanations, ICT4D projects fail because designers take an uninformed stance toward context. The ICT4D literature offers four approaches for how designers might better design technology for the context of use. In all four approaches, the target of action is typically the technology itself, not the context. Despite increasing use of these four approaches, projects still fail because of persistent differences between designers’ perceptions and users’ experience. These differences appear inevitable because ICT4D projects address problems nested in complex systems whose interaction is difªcult for designers to understand and predict. Yet, some projects do succeed. We show that success occurred in a Brazilian banking project because users took context-oriented, not technologyoriented, actions to better ªt the technology with the context. Based on our case study, we develop propositions that integrate and expand existing theories of ICT4D project success

* **Bailey, D.E., Leonardi, P.M., and Barley, S.R. 2012. The lure of the virtual. *Organization Science*, Special Issue on Digital Innovation, 23(5):1485-1504.**

Abstract: Although organizational scholars have begun to study virtual work, they have yet to fully grapple with its diversity. We draw on semiotics to distinguish among three types of virtual work (virtual teams, remote control, and simulations) based on what it is that a technology makes virtual and whether work is done with or on, through, or within representations. Of the three types, simulations have been least studied, yet they have the greatest potential to change work’s historically tight coupling to physical objects. Through a case study of an automobile manufacturer, we show how digital simulation technologies prompted a shift from symbolic to iconic representation of vehicle performance. The increasing verisimilitude of iconic simulation models altered workers’ dependence on each other and on physical objects, leading management to confound operating within representations with operating with or on representations. With this mistaken understanding, and lured by the virtual, managers organized simulation work in virtual teams, thereby distancing workers from the physical referents of their models and making it difficult to empirically validate models. From this case study, we draw implications for the study of virtual work by examining how changes to work organization vary by type of virtual work.

* **LeMaistre, T., Embry, R.L., Van Zandt, L.L., and Bailey, D.E. 2012. Role reinvention, structural defense, or resigned surrender: Institutional approaches to technological change in reference librarianship. *Library Quarterly*, 82(3): 241-275.**

Abstract: In a comparative field study of ten libraries, we show how technological advances in electronic and digital resources have led to an onslaught of technology questions at the reference desk, while prompting new and challenging work away from the desk. Libraries in our sample varied in their approaches to dealing with technological change, with institutional factors appearing to strongly shape their choice. Large, four-year academic libraries adopted a role reinvention approach that reduced reference librarians’ desk hours and permitted librarians to follow creative, often technical, pursuits. Small, four-year academic libraries took a structural defense approach that maintained the sanctity of the reference desk as the locus for substantive reference questions. Two-year academic and public libraries followed a resigned surrender approach under which reference librarians staffed busy desks, inundated with patron requests to aid with computer equipment. We discuss the implications of each approach for the work of reference librarians.

**Barley, W.C., Leonardi, P.M., and Bailey, D.E. 2012. Engineering objects for collaboration: Strategies of ambiguity and clarity at knowledge boundaries. *Human Communication Research*, 38(3): 280-308.**

Abstract: Prior research suggests that boundary objects gain meaning through group interaction. Drawing from the literature on strategic ambiguity, we explore the possibility that individuals strategically create potential boundary objects in an attempt to shape the meanings that groups develop. From ethnographic observations of automotive engineers, we identify 2 creation strategies: ambiguity (to create objects that support multiple meanings) and clarity (to creat objects that permit a particular meaning). We detail design activities that engineers undertook to create objects under each strategy. We find that, when creating objects, engineers favored a strategy of ambiguity, which they believed would foster healthy long-term group interactions, over a strategy of clarity, which they tended to employ only when they expected resistance to their ideas.

* **Bailey, D.E. & Barley, S.R. 2011. Teaching-learning ecologies: Patterned flows of explicit knowledge at work. *Organization Science*, 22(1): 262-285.**

Abstract: Although organizational theorists have long argued that environments shape organizational structures, they have paid little attention to the processes by which the shaping occurs. This paper examines these processes by showing how environments shape teaching and learning activities which, in turn, shape structure. Observational field data from structural engineering groups in three firms and hardware engineering groups in three firms revealed that the two occupations exhibited different patterns of learning episodes and different distributions of actors across those episodes, or what, following the work of Roger Barker, we call two distinct teaching-learning ecologies. After detailing the differences in the two ecologies, we show how these differences emerged from patterns of behavior that were influenced by unique sets of environmental and technological constraints. By demonstrating how actions transform environmental constraints into organizational structure, this paper indicates how research on individual learning in organizations can speak to larger concerns in organizational theory. Moreover, by adopting a synthetic and pragmatic approach to individual learning as a social activity the paper highlights the role of teachers in workplace learning and casts doubts on the existence of a universal model of how individuals learn at work.

* **Bailey, D.E., Leonardi, P.M., & Chong, J. 2010. Minding the gaps: Understanding technology interdependence and coordination in knowledge work. *Organization Science*, 21(3): 713-730.**

Abstract: In this paper, we broaden the concept of interdependence beyond its focus on task to include technology, defining technology interdependence as the extent to which the organization’s tasks require its technologies to work with one another. With technologies increasingly aiding knowledge work, understanding technology interdependence may be as important as understanding task interdependence for theories of organizing, but to date most technology studies examine one technology at a time. We develop concepts and methods for investigating interdependence among multiple technologies. We define a technology gap as the space in a workflow between one technology and a second technology wherein the output of the first technology is meant to be the input to the second one. Using data from a study of two engineering occupations (hardware engineering and structural engineering), we analyzed engineers’ gap encounters (episodes in which a technology gap appeared in the course of action) and found striking differences across occupations. Hardware engineers crossed gaps via “bridges” that automated transfers between technologies. Structural engineers, by contrast, allowed gaps to persist even though traversing gaps consumed significant time and effort. Differences in the ways that engineers interpreted and managed technology interdependence across the two occupations helped explain differences in how interdependence was manifested. By minding the technology gaps that individuals traverse, we uncovered a different way of conceptualizing task-technology fit that considers the full host of workplace technologies. Our findings make clear that theories of interdependence should simultaneously account for interdependence among workers, among technologies, and between workers and technologies.

* **Gainsburg, J., Rodriguez-Lluesma, C. and Bailey, D. E. 2010. A "knowledge profile" of an engineering occupation: Temporal patterns in the use of engineering knowledge. *Engineering Studies,*2(3):197-219.**

Abstract: Each engineering occupation is distinguished by the body of specific knowledge it has built up over time. Some scholars argue that the instrumentality of this historically established knowledge in the solution of everyday design problems renders formal education more important than experience. Other scholars counter that engineering work primarily demands practice-generated knowledge that individuals construct in the course of everyday activities. We address this argument by documenting the frequency with which engineers apply different types of knowledge, with different derivations. Adopting a behavioral perspective, we isolated 1072 episodes of knowledge use in our field observations of structural engineers. From these episodes, we constructed a ‘knowledge profile’ that indicated that two-thirds of the knowledge engineers employed was practice generated. The profile also revealed temporal patterns in the frequency with which the engineers used each knowledge type. Knowledge profiles like the one we constructed should help differentiate among engineering occupations, thereby serving as the foundation for conceptualizing occupations in a world of ‘knowledge work’. In addition, knowledge profiles can help university engineering education programs better target and mirror the knowledge demands of the profession.

* **Leonardi, P. & Bailey, D.E. 2008. Transformational technologies and the creation of new work practices: Making implicit knowledge explicit in task-based offshoring.*MIS Quarterly*, 32(2): 411-436.**

Abstract: Studies have shown the knowledge transfer problems that arise when communication and storage technologies are employed to accomplish work across time and space. Much less is known about knowledge transfer problems associated with transformational technologies, which afford the creation, modification and manipulation of digital artifacts. Yet, these technologies play a critical role in offshoring by allowing the distribution of work at the task level, what we call task-based offshoring. For example, computer-aided engineering applications transform input like physical dimensions, location coordinates, and material properties into computational models that can be shared electronically among engineers around the world as they work together on analysis tasks. Digital artifacts created via transformational technologies often embody implicit knowledge that must be correctly interpreted to successfully act upon the artifacts. To explore what problems might arise in interpreting this implicit knowledge across time and space, and how individuals might remedy these problems, we studied a firm that sent engineering tasks from home sites in Mexico and the U.S. to an offshore site in India. Despite having proper formal education and ample tool skills, the Indian engineers had difficulty interpreting the implicit knowledge embodied in artifacts sent to them from Mexico and the U.S. To resolve and prevent the problems that subsequently arose, individuals from the home sites developed five new work practices to transfer occupational knowledge to the offshore site. The five practices were defining requirements, monitoring progress, fixing returns, routing tasks strategically, and filtering quality. The extent to which sending engineers in our study were free from having to enact these new work practices because on-site coordinators acted on their behalf predicted their perceptions of the effectiveness of the offshoring arrangement, but Indian engineers preferred learning from sending engineers, not on-site coordinators. Our study contributes to theories of knowledge transfer and has practical implications for managing task-based offshoring arrangements.

* **Bailey, D.E. and Barley, S.R. 2005. Return to work: Toward post-industrial engineering. *IIE Transactions,* 37(8): 737-752.**

Abstract: Industrial engineering was originally founded as a discipline that focused on the study and design of work. Yet, today the field has largely distanced itself from this early concern. This paper tracks the decline of work studies in industrial engineering and explores the question of why the discipline lost its concern for work and, ultimately, its ability to speak to the kinds of social and economic changes that it was created to address. Our reading of historical documents and our analysis of data collected from nine industrial engineering departments from their founding to the present day reveal that changes in industrial engineering were tied to trends in society, to shifts in sources of funding, and to the field’s concern with its own status. The decline of work studies in industrial engineering is especially problematic because the nature of work has dramatically changed over the past 50 years, as we outline in this paper. The upshot is that industrial engineering now finds itself unable to speak about the organization of work and the design of modern work systems. We explain why the time has come for the field to rekindle its interest in the nature of work and the particulars of the workplace and we suggest several paths for proceeding in this direction.

* **Hinds, P.J. and Bailey, D.E. 2003. Out of sight, out of sync: Understanding conflict in distributed teams. *Organization Science* 14(6): 615-632.**

Abstract: The bulk of our understanding of teams is based on traditional teams in which all members are collocated and communicate face to face. However, geographically distributed teams, whose members are not collocated and must often communicate via technology, are growing in prevalence. Studies from the field are beginning to suggest that geographically distributed teams operate differently and experience different outcomes than traditional teams. For example, empirical studies suggest that distributed teams experience high levels of conflict. These empirical studies offer rich and valuable descriptions of this conflict, but they do not systematically identify the mechanisms by which conflict is engendered in distributed teams. In this paper, we develop a theory-based explanation of how geographical distribution provokes team-level conflict. We do so by considering the two characteristics that distinguish distributed teams from traditional ones: Namely, we examine how being distant from one's team members and relying on technology to mediate communication and collaborative work impacts team members. Our analysis identifies antecedents to conflict that are unique to distributed teams. We predict that conflict of all types (task, affective, and process) will be detrimental to the performance of distributed teams, a result that is contrary to much research on traditional teams. We also investigate conflict as a dynamic process to determine how teams might mitigate these negative impacts over time.

* **Bailey, D.E. and Kurland, N.B. 2002. A review of telework research: Findings, new directions, and lessons for the study of modern work. *Journal of Organizational Behavior*, 23(4): 383-400.**

Abstract: Telework has inspired research in disciplines ranging from transportation and urban planning to ethics, law, sociology, and organizational studies. In our review of this literature, we seek answers to three questions: who participates in telework, why they do, and what happens when they do? Who teleworks remains elusive, but research suggests that male professionals and female clerical workers predominate. Notably, work-related factors like managers’ willingness are most predictive of which employees will telework. Employees’ motivations for teleworking are also unclear, as commonly perceived reasons such as commute reduction and family obligations do not appear instrumental. On the firms’ side, managers’ reluctance, forged by concerns about cost and control and bolstered by little perceived need, inhibits the creation of telework programmes. As for outcomes, little clear evidence exists that telework increases job satisfaction and productivity, as it is often asserted to do. We suggest three steps for future research may provide richer insights: consider group and organizational level impacts to understand who telework affects, reconsider why people telework, and emphasize theory-building and links to existing organizational theories. We conclude with lessons learned from the telework literature that may be relevant to research on new work forms and workplaces.

* **Dessouky, M.M., Verma, S., Bailey, D.E., and Rickel, J. 2001. A methodology for developing a web-based factory simulator for manufacturing education. *IIE Transactions*, 33(3): 167-180.**

Abstract: Historically, manufacturing engineering education has focused on teaching mathematical models using simplifying assumptions that can mask the realities of complex manufacturing systems. Recent pedagogical approaches to manufacturing education have focused on developing a more holistic view of the manufacturing enterprise. In this paper, we describe the contents and development methodology of a Virtual Factory Teaching System (VFTS) whose aim is to provide a workspace that illustrates the concepts of factory management and design for complex manufacturing systems. The VFTS is unique in its integration of four domains: web-based simulations, engineering education, the Internet, and virtual factories. Evolutionary development of the VFTS is accomplished by separating the simulation model from the graphical interface and user interaction.

* **Bailey, D.E. 2000. Modeling work group effectiveness in high-technology manufacturing environments. *IIE Transactions*, 32:361-368.**

Abstract: Existing models of work group effectiveness have been tested in low-technology manufacturing settings, but not in a high- technology one. Typical features of high-technology environments - substantial automation, computerized scheduling systems, complex production processes, capital-intensive production, high-cost equipment, and high product value - render them significantly different from their low-technology counterparts. The increased use of work groups and teams among high-technology manufacturers raises the question of whether existing models can be generalized to these settings. In this paper, data from 89 groups in the semiconductor manufacturing industry are used to create predictive models of group productivity, job satisfaction, and perceived performance. External variables (such as conflict with supervisors and engineers) are found to be more predictive of productivity, while internal variables (such as conflict among group members) are more predictive of satisfaction. These results highlight the importance of fostering the work group's interaction with external technical support personnel when designing and managing successful work groups in high-technology workplaces.

**Bailey, D.E. 1999. Challenges of integration in semiconductor manufacturing firms. *IEEE Transactions on Engineering Management*, 46(4): 417-428.**

Abstract: Manufacturing efforts to reduce time to market often adopt a concurrent engineering approach that focuses on coordination and integration among engineering, production, and marketing functions. Technological complexity in the semiconductor industry requires an extension of this paradigm to include multiple engineering groups and a strong production maintenance department. Through interviews with employees drawn from engineering, production, maintenance, marketing, and other departments at three semiconductor plants, organizational problems are uncovered that inhibit successful integration within firms in this industry. Ideas for overcoming these problems are given with suggestions for future research.

* **Bailey, D.E. 1998. Comparison of manufacturing performance of three team structures in semiconductor plants. *IEEE Transactions on Engineering Management*, 45(1): 1-13.**

Abstract: Manufacturing programs aimed at improving performance often feature employee teams that address production problems at the shop-floor level. According to cognitive models of participation, performance under such programs is improved via the better utilization of skills and knowledge that occurs as employees are allowed greater decision making in their tasks. We examine the cognitive-model premise in a high-technology industry where improvement-team programs are on the rise. We study three types of improvement-team programs among a sample of eight manufacturing sites. The programs feature continuous improvement teams (CIT’s), quality circles (QC’s), or self-directed work teams (SDWT’s) and vary in the amount of decision-making power, skill attainment via training, and skill use granted to employees. A quantitative analysis of performance reveals that CIT programs were associated with the highest direct and indirect productivity, two metrics that were available for each firm. QC and SDWT programs should not be dismissed, however, as they may lead to improvements in quality metrics, as we note in suggestions for future research. Qualitative data gathered in site visits suggest that poor implementation and failure to integrate production programs with engineering departments are two factors that inhibit program success.

* **Kurland, N.B. and Bailey, D.E. 1999. Telework: The advantages and challenges of working here, there, anywhere, and anytime. *Organizational Dynamics*, 28(2): 53-68.**

Abstract: None.

**Bailey, D.E., Settles, F.S., and Sanrow, D. 1999. Applying continuous quality techniques to a research environment. *Quality Management Journal*, 6(2): 62-77.**

Abstract: Quality management is now a common theme in manufacturing and service environments. But quality management in the realm of industry and academic research has received far less attention. In this article, continuous quality improvement techniques are applied to the research process for an industrial consortium, whose member companies sponsor academic research in semiconductors. First, research quality is defined, based on input from industry representatives and academic researchers affiliated with teh consortium. Interviews revealed that the two constituencies have somewhat differing views regarding the nature of research quality. Second, concerns of both parties were combined to arrive at a five-part definition that covers: (1) applicability to industry; (2) significance and originality of the work; (3) pedagogical value; (4) goal achievement and thorough documentation; and (5) publications. Third, a plan is presented for controlling and improving research quality over time. Key to the plan is the incorporation of a systems view of quality that leads to controla and improvement procedures for each project phase, and that includes in its coverage all personnel involved in the research process. Although the results are specific to the environment studied, the methodology has potential for use in university research and industrial R&D settings, and thus facilitates the extension of quality concepts to the research domain.

* **Dessouky, M., Bailey, D., Verma, S., Adiga, S., Bekey,G., and Kazlauskas, E. 1998. A virtual factory teaching system in support of manufacturing education. *Journal of Engineering Education*, 87(4): 459-467.**

Abstract: To accommodate increasing product specialization, modern factories are increasingly becoming more flexible. A large measure of this flexibility is achieved via the integration of the various components of the manufacturing system (e.g., design, production, purchasing, etc). To be successful in this new manufacturing environment, an engineering college graduate must understand the total business process from design to production to delivery in order to develop a holistic view of manufacturing systems. Yet, traditional pedagogical tools are ill-equipped to develop this holistic view in students. In this paper, we describe a Virtual Factory Teaching System, VFTS, that is under development. The intent of the VFTS is to provide a tool for university instructors to illustrate the concepts of factory management and design as applied in a realistic setting. The focus of this paper is to present our pedagogical approach of the VFTS, the development of the prototype and its use in a senior-level industrial engineering class.

* **Cohen, S. G. and Bailey, D.E. 1997. What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management*, 23(3): 239-290.**

Abstract: In this article, we summarize and review the research on teams and groups in organization settings published from January 1990 to April 1996. The article focuses on studies in which the dependent variables are concerned with various dimensions of effectiveness. A heuristic framework illustrating recent trends in the literature depicts team effectiveness as a function of task, group, and organization design factors, environmental factors, internal processes, external processes, and group psychosocial traits. The review discusses four types of teams: work, parallel, project, and management. We review research findings for each type of team organized by the categories in our heuristic framework. The article concludes by comparing the variables studied for the different types of teams, highlighting the progress that has been made, suggesting what still needs to be done, summarizing key learnings from the last six years, and suggesting areas for further research.

* **Bailey, D.E. 1997. Manufacturing improvement team programs in the semiconductor industry. *IEEE Transactions on Semiconductor Manufacturing*, 10(1): 1-10.**

Abstract: Increasing numbers of semiconductor manufacturers are implementing improvement programs at their manufacturing sites (fabs). Yet despite their rising popularity, little attention has focused on the impact of a program’s design on its overall effectiveness. This research examines the improvement programs established at ten fabs. A categorization scheme classifies programs according to their use of one of three types of teams: continuous improvement teams (CIT’s), quality circles (QC’s), and self-directed work teams (SDWT’s). Results from 188 operator surveys and over 150 interviews with fab employees (including managers, engineers, technicians, supervisors, operators, and representatives from human resources and quality departments) indicate that a number of programs suffer from weak implementation and disorganized management. The failure to carefully design and implement a program is reflected in employee perceptions of the program’s effectiveness. Perceptions of CIT programs are found to be significantly lower than those of QC or SDWT programs, both of which feature higher degrees of autonomy and training. Results also highlight a nearly universal failure to integrate production team programs with engineering and maintenance functions. To help improve future programs, design implications and aspects of effective team programs are noted. Special attention is paid to program selection, goal design, organizational support, engineering integration, information systems, and empowerment semantics.

* **Bailey, D.E. and Adiga, S. 1997. Measuring manufacturing work group autonomy. *IEEE Transactions on Engineering Management*, 44(2):158-174.**

Abstract: The increasing use of autonomous work groups in manufacturing industries has been accompanied by a growing confusion over exactly what group autonomy connotes. Our intent in this paper is to provide clarity to the quantitative measurement of work group autonomy. An examination of classic case studies from the group literature reveals how group autonomy has been conceptualized over time, while highlighting the absence of more modern-day concerns in areas such as equipment maintenance and quality improvement. In attempting to objectively assess the degree of autonomy held by work groups both in the classic studies and in a modern high-technology industry, we find that the existing measurement instrument fails at the latter. A new more finely grained measuring instrument is introduced that covers decisions in the areas of methods, scheduling, task allocation, resource allocation and management, goals, and boundary management. Items on the instrument address topics in performance evaluation, training, equipment maintenance, group membership, and production, among others.