Productive Interrelationships Between Collaborative Groups Ease the Challenges of Dynamic and Multi-Teaming

Tara Matthews
IBM Research – Almaden
650 Harry Road, San Jose, CA 95120
(408) 927-1318
tlmatthe@us.ibm.com

Steve Whittaker
UC Santa Cruz
High Street, Santa Cruz, CA 95064
(831) 529 2390
swhittak@ucsc.edu

Thomas Moran
IBM Research – Almaden
650 Harry Road, San Jose, CA 95120
(408) 927-3844
tpmoran@us.ibm.com

Sandra Yuen
IBM Research – Almaden
650 Harry Road, San Jose, CA 95120
sandra.yuen@alumni.ubc.ca

Tejinder Judge
Virginia Tech
Computer Science, 2202 Kraft Drive,
Blacksburg, VA 24060
tkjudge@vt.edu

1

ABSTRACT

Work organization and team membership is highly complex for modern workers. Teams are often *dynamic* as personnel change during a project. Dynamic team members have to be actively recruited and personnel changes make it harder for participants to retain group focus. Workers are often members of *multiple teams*. Though prior work has identified the prevalence of multi-teaming and dynamic teams, it has been unable to explain how workers cope with the challenges the new style of work should cause. This paper systematically characterizes the modern organizational landscape from an individual perspective, by studying how people typically organize work across their multiple projects. A unique contribution of our work is to examine the *interrelationships* between the collaborative groups individuals typically participate in. We introduce the notion of a *collaboration profile* to characterize these interrelations. We expected workers to be overburdened by contributing to multiple teams often with shifting personnel. However, we found that multi-teaming involves *productive interrelationships* between collaborative groups that ease some of the documented challenges of dynamic teams, such as goal setting, recruiting, and group maintenance. We define a typology that describes the various types of collaborative groups workers participate in, and provide examples of productive interrelations between collaborations. In characterizing interrelations between collaborations, we provide detailed examples of how people exploit resources across their different collaborations to address do problems of working in multiple dynamic teams.

Author Keywords

Collaboration types, Collaborative work, Multi-teaming, Interrelations, Office, Teams, Workplace.

2

1. Introduction

The last two decades have witnessed major transformations in workplace organization and collaboration. Developments in technology and changes in management practice have promoted new forms of work organized around *communities* where participants share information and expertise around common interests or job roles (Lave and Wenger 1998; Kraut 2003; Preece and Maloney-Krichmar 2005). New social networking tools have elevated *professional social networks* to an increasingly important level in the workplace (McDonald and Ackerman 2000; Nardi et al. 2002; Zhang et al. 2007). More recently, we have seen the emergence of radically different types of *Collective Intelligence* where people voluntarily self-organize to develop significant intellectual products such as Wikipedia (Kittur and Kraut 2008; Panicera et al. 2009; Shirky 2008) and Opensource (Moon and Sproull 2002).

In addition to these new types of collaboration, there have also been fundamental changes in the nature of project-based teams. Traditional stable teams (Gersick 1988; Hackman 1990; McGrath 1984) have been transformed with the emergence of *dynamic*, self-configuring teams whose membership changes in response to organizational demands (Marks et al. 2005; O'Leary et al. 2011). Many organizations now exploit subject matter experts (SMEs) who contribute their expertise on an 'as needed' basis, rather than participating throughout the lifetime of a team (Chudoba et al. 2005; Mortensen and Hinds 2002; Nardi et al. 2002; O'Leary et al. 2011). Such dynamic teams are often formed to accomplish a specific task, and when it is completed they are disbanded (O'Leary et al. 2011). This matrixed form of organization means that workers are being asked to simultaneously participate in multiple workgroups (Chudoba et al. 2005; Mark and Poltrock 2004; O'Leary, et al. 2011; Zika-Viktorsson et al. 2006), a phenomenon referred to as *multi-teaming*.

Work organization that exploits dynamic teams and multi-teaming may improve organizational efficiency by directly meeting specific organizational demands, reducing 'organizational slack' and increasing 'utilization' (Kc and Terwiesch 2009). In the same way, voluntary contributions to Collective Intelligence projects or communities provide important organizational benefits (Lave and Wenger 1998; Moon and Sproull 2002). Less research has looked beyond organizational advantages and focused on the implications for individual group members, and especially how individuals cope with the potential challenges of this style of work, a topic we explore in this paper.

Participating in multiple dynamic teams may make life more complex for team members. Classic small teams research demonstrates the importance of *group maintenance processes* such as affiliation and social support, motivating members to contribute, facilitating advice giving and expertise sharing (Kraut 2003; Marks et al. 2005; McGrath 1984). But the effectiveness of such group maintenance processes may be attenuated when a person contributes to multiple dynamic teams in which team membership is constantly shifting and affiliation is diluted. Teams also need *clear goals*, in order to allocate tasks appropriately based on different members' expertise (DeChurch and Marks 2006), and to retain overall team focus (Hackman 1990). Again dynamic teams may create difficulties in goal setting, time management and organizing work within a project. It may be difficult for workers to coordinate interdependent tasks within a dynamic project because responsibilities are less clear, or because people work part time on the project (O' Leary et al., 2011, Zika-Viktorsson et al. 2006). Finally the very existence of dynamic teams generates new demands for workers: new members with appropriate expertise have to be *recruited* by the team (McDonald and Ackerman 2000; Zhang et al. 2007), and they have to be onboarded and oriented to team goals.

4

Newer forms of work that fall outside an individual's main job responsibilities also make life more complex for individual workers. While there are clear benefits to contributing to communities of practice (Lave and Wenger 1998; Preece and Maloney-Krichmar 2005), how do workers balance such voluntary contributions against the need to contribute to their core work projects with clear deliverables? If workers volunteer time or expertise to Collective Intelligence projects, do they receive credit from management for such contributions, when these may not be critical workplace deliverables? These newer forms of collaboration place demands on workers' time that have to be balanced against their other commitments.

This paper systematically characterizes the modern organizational landscape from an individual perspective, by studying how people typically organize work across their multiple collaborative groups. Though prior work has identified the prevalence of multi-teaming and dynamic teams and pointed to potential challenges for individuals, it has been unable to *explain* how workers cope with the challenges this style of work should cause. Prior work has documented *that* individuals multi-team, but it has not explored *how* they do it, specifically with respect to managing the additional complexity engendered by multi-teaming. Nor has it explained how fundamental team processes of goal setting (Hackman, 1990) and group maintenance (Marks et al., 2005) are achieved in dynamic teams, or how teams recruit members (McDonald and Ackerman, 2000) with appropriate skills. To do this, we introduce the notion of a *collaboration profile*. This profile characterizes the different *types* of collaborations that an individual works on, as well as the *interrelations* between those different collaborations. We present a field study of collaboration in a large, global, software and services company where multi-teaming is prevalent. We explore forms of collaboration, focusing on identifying collaboration types and their productive interrelationships. We ask:

5

- What are the prevalent forms of collaboration that people typically engage in?

- What is the extent of multi-teaming? How many collaborative groups do people typically contribute to at a given time?

- What are the interrelations between the different collaborative groups an individual participates in?

- How do people handle the overheads of multi-teaming?

- How do participants in dynamic teams satisfy critical team processes that have been described in prior literature? How do they recruit effectively, set appropriate goals and support group maintenance functions?

Our results confirm prior work showing that multi-teaming is prevalent, with dynamic project teams being among the most common collaboration types. We expected the overheads of dynamic teaming and prevalent multi-teaming to significantly burden workers. Contrary to our expectations, however, multi-teaming served to partially address some of the problems of participating in dynamic teams. Specifically, we found *productive relationships* between many of participants' collaborations: secondary collaborations (such as communities of practice) often directly supported mission critical collaborations (such as dynamic project teams) by helping with recruiting and group maintenance, and groups with stable personnel often initiated and set goals for groups with dynamic personnel. Rather than being exclusively an additional workload, multi-teaming involved productive interrelationships between collaborative groups that eased some of the challenges of working in dynamic teams.

2. Data Collection

Our primary data was derived from in-depth interviews. To generalize, we also surveyed a broader range of participants about their collaboration structures and practices.

2.1 Participants and Organizational Context

Interviews. We interviewed 21 employees drawn from multiple parts of a large technology company: hardware, software, services, human resources (HR), marketing, and communications. They were recruited using a combination of theoretical and snowball sampling and included: 5 client-focused, technical sales specialists (1 brand presales, 1 brand IT specialist, 1 brand IT specialist manager, 1 cross-brand, 1 regional manager); 3 technology, strategy, & sales focused (1 water management, 1 user collaboration, 1 optimization); 1 client-focused, cross-brand sales; 3 software (1 development lab head, 1 software engineer, 1 information architect); 2 services (1 IT consultant, 1 VP), 2 hardware / manufacturing (1 engineer, 1 supply/scheduling professional), 2 communications (1 intranet editor, 1 HR program manager), 2 marketing, 1 health services (a registered nurse).
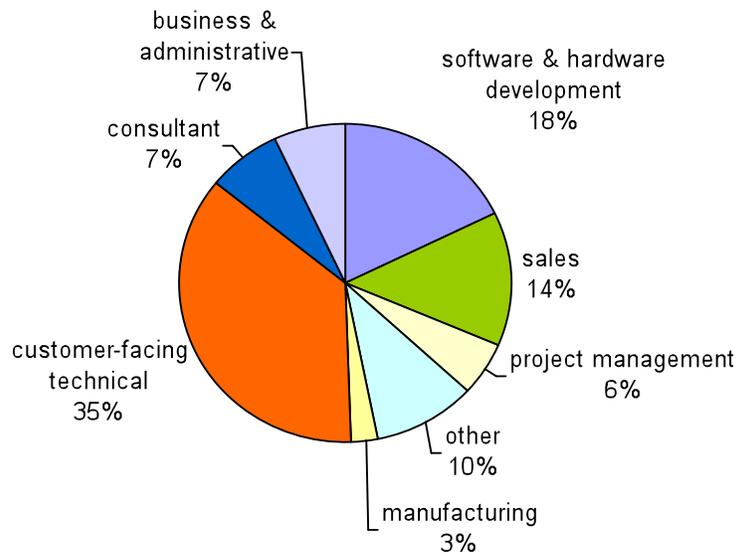
Figure 1. Job roles of 198 survey respondents.

Survey. We also surveyed 198 employees across all business units of the same company. Figure 1 shows that we collected responses from a range of job roles. Our online survey was able to collect answers for some questions without requiring respondents to complete the survey, so wherever we report survey results, we include the number of respondents, N.

Because the company developed technology, most of our participants were extremely confident in adopting and using new technologies, such as social software. The company was also quite progressive in management methods and working styles. In particular, management encouraged the use of social software in supporting communities and social networking, via blogs, wikis, forums, and personal profiles, and these were widely used. Because interviewees were drawn from this one company, our results can only generalize to companies with similar policies and cultures.

2.2 Method

Interview participants were contacted by phone and asked to characterize their collaborations using a semi-structured procedure. We defined collaborations as activities in which people worked or interacted with others around a work objective. Collaborations could also include activities that had more indirect effects on work, such as participation in communities of interest relevant to work related goals. We began by asking for a complete list of the participant's collaborative groups and then discussed as many of these in-depth as we could in one hour (usually 3 to 4). Participants used real time screen sharing software to interactively fill in a visual representation, called their *collaboration profile,* and this was used to focus the interview discussion (see Figure 2 for an example from our results).

For each of their collaborations, participants described:

- Collaboration *type* (see below for a description).

- Main *goals* and deliverables of the collaboration, and whether these are a main job-focus for the participant.

- Number of *people*, including their roles.

- Whether personnel are *dynamic* or *stable*.

- Time course, including the overall *duration* and whether the collaboration is *bounded* or *ongoing*.

- *Tools* used.

We asked participants to discuss each of these items in depth, e.g., what each role contributes to the collaboration, how they use tools, what relations exist between groups, etc. We also asked them to discuss the *work style* of each group i.e., the ways in which group members interwork. We categorized work style into three categories based on prior literature (Katz and Tushman, 1979, Kraut 2003). The first two were based on a core work deliverable, the third on communication:

- *Deliverable pooling*: members work independently until it is time to combine their work toward the group goal.

- *Deliverable co-creating*: members work closely together to collectively create work deliverables.

- *Communication-focused*: the focus is on interaction; members work independently and do not rely on other members to complete their work deliverables. This interaction may be focused on maintaining a relationship or on sharing information.

The participant's assessment of collaboration type was influenced by a list we provided them. The list was based on a taxonomy derived from prior literature. We included distinct group types identified in prior studies including stable project teams (Gersick 1988; Hackman 1990; McGrath 1984), dynamic project teams (Chudoba et al. 2005; Mortensen and Hinds 2002; Nardi et al. 2002; O'Leary et al. 2011), functional or organization-based groups (Hackman 1990), communities (Lave and Wenger 1998; Kraut 2003; Preece and Maloney-Krichmar 2005), and task teams (Yarosh et al. 2009). In the interview introduction, we made it clear to participants that modifying, adding to, and clarifying the list of types was a major goal of our research and they were encouraged to do so as they brainstormed their list of collaborations. These discussions led to the final list of collaboration types presented in our results.

Surveys: Survey questions supplemented the interview by gathering similar data on a wider-scale. We asked people how many of each collaboration type they participated in, as well as other questions that we do not present here. The survey was developed after the interviews were completed and analyzed, so we were able to ask about the collaboration types identified in the interviews.

2.3   Interview Data Analysis

Two analysts individually conducted open coding on interview transcripts and also categorized the collaborations into overall types, according to the initial dimensions we had probed and incorporating the initial categories indicated by participants. The coders tended to keep the initial collaboration categories indicated by participants unless the ensuing interview strongly supported changing the category. For example, if a participant categorized a group as a stable project team and then discussed how the team was primarily comprised of members who came and went from the team, coders would recategorize the group as a dynamic project team. A third coder went through the final coding to check for consistency across and between codes. All coders then analyzed the data for recurrent themes. Disagreements between coders were discussed and resolved.

3. Collaboration Typology

Our analysis revealed six distinct *types* of collaborations: stable project team, dynamic project team, committee, client-supplier relationship group, community, and professional relationship (see Table 1). The table shows the key underlying dimensions that differed between types namely their goals, personnel, work style, and whether they were a core or secondary work focus for most members.

Table 1. Collaboration types and their distinguishing dimensions.

	Work Focus (most members)	Goal and Duration	Personnel	Work Style
stable project team	Core	Deliverable; until complete	Stable	Pooling and Co-creating
dynamic project team	Core	Deliverable; until complete	Dynamic	Pooling and Co-creating
client-supplier relationship group	Core	Relationship; ongoing	Stable	Communication-focused
committee	Secondary	Deliverable; until complete	Stable	Pooling and Co-creating
community	Secondary	Exchange expertise and best practice; ongoing	Stable &/or Dynamic	Communication-focused
professional relationships	Secondary	Status updates, informational exchanges; ongoing	Dynamic	Communication-focused

Identifying new forms of collaboration is not the unique value of this work, since each of the collaboration types in our typology has been discussed in prior literature. Instead our main contribution is to analyze how each person's collaborations *related* to each other. Our typology is empirically derived and emphasizes the group types that participants defined as important parts of their work. The value of this collaboration typology is that it describes the classes of groups that make up an important set of interrelated collaborations that individual workers manage. Before discussing these interrelations, we first characterize and contrast the types of collaboration we observed.

3.1 Stable Project Team

Definition. A stable project team is a group where most members stay the same, working closely together toward a common deliverable that is a core work focus for its members. A deliverable is an artifact, recommendation, or information the group is supposed to produce. The duration of the project extends until a particular set of goals related to its major deliverable are accomplished. Stable project teams are a common feature of the small groups and business literatures (Hackman, 1990,

Kraut 2003; Marks et al., 2005, McGrath 1984). They arise from an organizational requirement for sustained contribution from a very specific combination of people to meet a single deliverable. For technology, they heavily used email, meetings, and shared archives, combined with occasional instant messaging and social software (wikis, forums, blogs).

We distinguish stable and dynamic teams based on the *people* involved: if most members stay the same for the duration of their project objective, even if other aspects of the collaboration change, we consider this a stable team. However, even dynamic teams have a stable core set of members; the difference being that the majority of members are changing. A dynamic team tends to tackle one project objective and then dismantle. Stable teams vary: some tackle one project objective and dismantle, some tackle many projects in an ongoing basis. Over the duration of a very long-lived stable team, personnel may change completely—people change jobs, companies shift people, etc.— but during each project objective, a stable team will have personnel that are primarily unchanging.

Subtypes: We saw different subtypes of stable project teams depending on whether there is a need to support: (a) recurring organizational processes, (b) a particular combination of expertise invoked across multiple contexts, or (c) a single deliverable. Each of these demand sustained contribution from a specific group of people, so dynamic recruitment of subject matter experts (SMEs) is not a viable organizational solution.

Examples. M.H., a Manufacturing Supply Management/Scheduling Professional, provided an example of a stable team handling a recurring organizational process: "Quad2 Review" is in charge of creating and reviewing the plan for each week's manufacturing load and verifying that it will meet all customer needs. This process repeats weekly in an ongoing basis. C., a Registered Nurse,

13

provided an example of a team with specific expertise being invoked across multiple contexts: "Health Services Team" was a group of doctors and nurses who handled projects related to employee health services. Their current project was redesigning employee health services case management to meet budget requirements and delivery needs in growth markets. Finally, M.C., an Information Architect, provided an example of a single deliverable: "Biztech Redesign Work / Life Zone" was a group of software developers who were formed to redesign an intranet site focused on work-life balance issues. The project would last for six months and then the team would be disbanded.

3.2 Dynamic Project Team

Definition. A dynamic project team is a group of people, where a minority of members are unchanged but most members come and go during the lifetime of the project. Members work closely together toward a common deliverable that is a core work focus for those members. Dynamic teams are similar to stable project teams in their focus on *deliverables*. However, there are key differences relating to changes in personnel. Although dynamic teams usually have a stable core sub-team, there is a need to recruit people with specific expertise to fulfill certain, often short-term, functions. Unlike stable teams, dynamic teams have to (a) recruit subject matter experts (SMEs) 'as needed'; (b) set goals and retain focus and resources as personnel change; and (c) support group maintenance and affiliation as team members change. Dynamic teams are increasingly prevalent in recent organizational analyses (O'Leary et al. 2011; Zika-Viktorsson et al. 2006). For technology, they heavily use email, meetings, and shared archives, combined with occasional use of social software (wikis, blogs, forums).

Sub-types. There are two types of dynamic teams. The main difference between subtypes arise in how team members are *recruited*, in particular how straightforward it is to identify SMEs. In most cases, SMEs are recruited informally via personal and professional connections, sometimes using online communities. In other cases, recruitment follows more official channels, as SMEs are identified through organizational connections. For example, a functional area may provide specific skills across projects, such as legal, PR, or HR.

Examples. D., a Cross-Brand Software IT Architect, provides a dynamic project team example where experts are informally recruited. To win a customer sale, he regularly collaborates with others to put together a set of documents and presentations called a request for proposal (RFP) response. When the opportunity arises, D. gathers together a team of people with the appropriate expertise to generate that response. Since it is not always clear who is needed from the start, new SMEs are called upon throughout the life of the RFP project. He describes how dynamic SMEs are recruited on the "[Customer] [Technology] Tools RFP Demo" team:

> *For that [client's] Request for Proposal (RFP)… I started with the local sales team and then we pulled the resources together to start answering the RFP, and then we decided we needed expertise from a broader range. We needed some industry-sector subject matter expertise, and then we went and pulled… those resources. Then we decided that we didn't really have we needed internally, we needed a business partner. So we engaged somebody to prime the contract from a services perspective as well as one of the guys, the subject matter experts had a relationship with this other company that specialized in [a specific] technology, so we pulled them in… The technical specialists are very dynamic because they come and go as they're needed. Sometimes... we'll need a specific skill and we'll bring somebody in for a couple of days or a couple of weeks and then they'll go away again and they won't come back for, sometimes ever.*

15

P., a Test and Characterization Engineer, provides an example of a dynamic team that recruits members via organizational channels: the "Engineering Efficiency Pilot" project involves developing a method to identify and eliminate waste in the daily engineering workload at a manufacturing plant. Various engineers are brought onto the team to identify the sources of waste and later to evaluate the elimination method.

3.3   Client-Supplier Relationship Groups

Definition: A client-supplier relationship group consists of a stable group of people from both the client and supplier organizations who communicate on an ongoing basis to ensure the supplier meets the needs of the client. The primary goal is the maintenance of a relationship. However, this may generate work objectives that follow from addressing the client's needs. In such cases, it was common for this type of group to initiate a dynamic project team to meet a client need (a property we discuss in depth later). Client-supplier relationship groups also differ from other collaboration types by usually involving people across organizations (Moon and Armstrong 1994). There is typically a group on both the client and supplier sides, so these are not just one-on-one relationships. For technology, they heavily used email and meetings, with some instant messaging and shared archive use. They seldom used social software (wikis, blogs, forums).

Client-supplier relationship groups are similar to stable project teams, being staffed by a specific set of people in well-defined roles. It is vital to support steady, responsive interactions to make customers feel comfortable, and to have clearly defined roles so clients know who to go to. Unlike project teams, these collaborations are not strictly deliverable-oriented, because the main objective is to satisfy the customer. This collaboration type is generic across companies, since all companies

have customers. Note that we interviewed only suppliers, so we know little about the client's perspective on the collaboration.

Examples. R., a Cross-brand Sales Representative, provides a typical example of a client-supplier relationship group: "[Customer name] Client Relationship" involves working with various brand specialists to maintain and ongoing relationship with a specific customer. Not all client-supplier groups directly involve sales, as P. illustrates with an example from a manufacturing plant: "NV RAM Customer Facing" involves the manufacturing engineering team interfacing with customers to ensure that the hardware product meets their needs before fabrication.

3.4   Committee
Definition. A committee is a group of people working closely together toward a common deliverable that is secondary to most members' main job focus. Committees are also well documented in the management literature (McGrath 1984). They often exist to satisfy internal organizational processes, such as promotions, recruiting permanent staff, or determining policy (McGrath 1984). They may also be associated with reflecting on processes or quality across organizations. Committees tend to have a stable membership. People are typically chosen to participate because they are representative of a particular job role, perspective, or area of expertise. Participants may serve for a bounded, short- or long-term period.

Though there is often a "lead cat herder," they tend to be discussion-oriented and consensus-run. Also, committees are typically a secondary work focus for members. These two factors—their democratic management and secondary work focus—often cause committees to move slowly.

For technology, committees relied mainly on meetings and shared repositories. There was less use of email and little use of social software.

Example. S., a VP of Application Services, provides an example of a committee: "World-Wide [Department name] Distinguished Engineer Board" forms yearly to select candidates for promotion in their department. Half the members return and half are new each year. The group works together by splitting up the candidates for independent review and then coming together to make a group decision.

3.5 Community
Definition. Following Lave and Wenger (1998), we define a community as a group of people with similar job functions or a shared interest, who come together to exchange knowledge, information, best practices, and possibly to spark new collaborations. Communities are very different from deliverable focused collaborations because their main function is to share information, rather than deliver specific products. They use a rich mix of technologies, including shared repositories, meetings, email, and social software (blogs, wikis, forums).

Subtypes. Consistent with the literature (Lave and Wenger 1998), we found evidence for the classic distinction between *communities of interest* (COI) and *practice* (COP). The final subtype was *bounded communities*, relatively small groups of people with shared job functions and management, whose main work was done on dynamic project teams. They were similar to COP except that they had fewer participants who were all known to each other. Bounded communities provided a focused forum for exchange of expertise, as well as providing group maintenance.

Examples. H., a Technical Sales Manager, provides an example of a COP: "[Brand] Change & Release Management Community" is a group of people who specialize in a particular type of software within one of the company's major brands. H. uses the community to gather knowledge about this technology, in service of customer needs. "Coverage Software Architects in [Customer] Sales" is a bounded community example provided by D. It involves direct reports of a single manager who are all Coverage Software Architects participating mainly in dynamic teams and client-supplier groups. They do not work closely together, but they do meet regularly and provide each other with peer group support.

3.6   Professional Relationships

Definition. Professional relationships are dyadic relationships between individuals focused around shared professional contexts, which can include both weak and strong ties (Granovetter 1973). They are primarily focused on informal social interaction rather than explicit work goals, but these interactions can sometimes initiate new collaborations. Common purposes for professional relationships include mentoring, finding collaborators, building one's reputation, and/or getting answers and feedback. Professional relationships relied on social software and communication tools such as email or IM.

According to classical definitions, professional relationships would not be classified as a type of collaboration, since they involve dyads rather than groups (McGrath, 1984). Although we had not included professional relationships as an initial collaboration type, they were spontaneously mentioned by many of our participants as being an important class of collaboration, and we felt it important to respect an informant-driven typology. This focus on professional relations occurred in part because most participants had adopted social software tools, such as LinkedIn or Twitter, and

were making active use of these. In our analysis, we considered only those cases where participants explicitly mentioned their professional relationships as a form of collaboration. The decision to include professional relationships proved fruitful, since we discovered that professional relationships play a critical role supporting other collaboration types, a finding we present in the next section on the collaboration interrelationships.

4. Collaboration interrelationships: Explaining how individuals cope with the overheads of multi-teaming and dynamic teams

So far our analysis has focused on a general taxonomy of collaborations and, like most prior work, has considered each type of collaboration in isolation. We now move to characterizing the *interrelationships* among the collaboration types. We first confirm that dynamic teams are where most of an individual's key work is done. As noted in prior work, these provide numerous challenges for teams including goal setting, group maintenance and recruitment. Our main result is showing that a worker's set of collaborations usually include predictable combinations of stable, dynamic, and relationship-oriented groups that individuals combine, to at least partially compensate for the challenges of working in dynamic groups. Workers multi-team partly because this helps them execute their core job functions. Viewed another way, people's core job functions demand that workers participate in more diverse collaborations. Rather than each collaboration being its own completely independent cognitive and logistical burden, an individual's multiple collaborations stand in a productive relationship to each other.
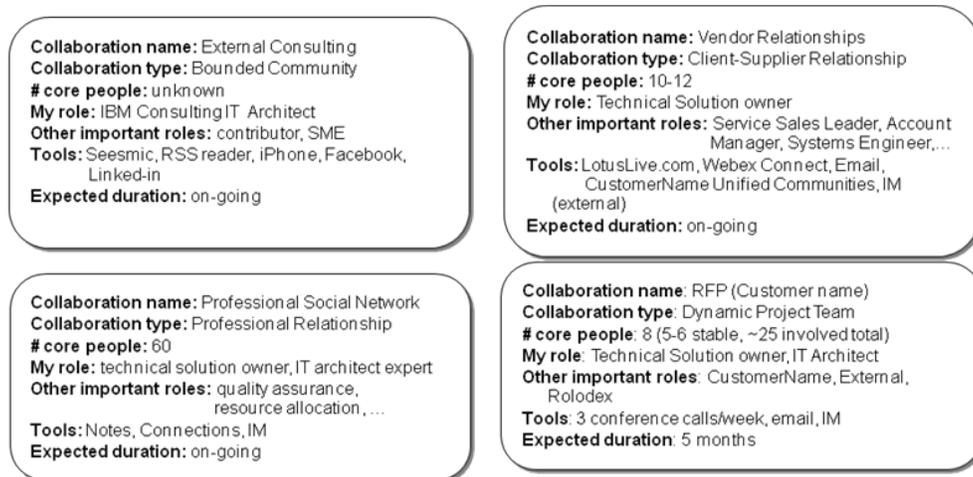
Figure 2. Part of a Collaboration Profile for a Software IT Architect showing four different collaboration types and their properties

4.1 Productive Interrelationships: Multiple Collaborations and Dynamic Teams

To illustrate common relationships between collaborations, we present a typical *collaboration profile*, shown in Figure 2. This belongs to A., a Software IT Architect. His job was to work within teams to bid for new contracts and maintain software solutions for existing clients. His profile shows that A. participates in *multiple collaborations of different types*. These types include a dynamic project team, a client-supplier relationship group, a community, and a professional relationship. Also note that none of A's collaborations take place through a stable project team. According to him, most of his core work is done through *dynamic project teams* like the one shown, where he helps plan and prototype bids for software solutions for large organizations. Although not shown in Figure 2 for space reasons, A. simultaneously works with several other dynamic teams in the same way. These dynamic project teams are often initiated by his stable client-supplier relationship group, which identifies both problems with software installed at a customer site as well as new sales leads for dynamic teams to address.

21

Table 2. Survey results showing the average number of each collaboration type per participant.

Types per participant	Mean	Std. Dev	Number of respondents (N)
communities	5.62	3.661	118
stable project teams	2.99	2.488	164
dynamic project teams	2.87	2.810	139
committees	2.13	2.724	108
client-supplier relationship groups	1.46	2.545	107
professional relationship	.91	.290	109

A. was not unique in his participation in multiple teams. In our study, multi-teaming was the dominant way of working. Interview participants identified and discussed an average of 6.33 collaborations each. (These participants likely underestimated their actual number of collaborations, because some did not have time to completely describe all of their collaborations.) Survey participants reported an average of 15.50 collaborations (median = 15, standard deviation = 9.00, N = 107). (Note that we counted professional relationships as 1 for each participant who reported them, even though this type may represent many individual relationships.) These findings are consistent with recent work, which has argued that people's work is shifting away from a focus on one or two main teams to multiple collaborations (Chudoba et al. 2005; O'Leary et al. 2011; Zika-Viktorsson et al. 2006). Nor was A. unique in participating in multiple types of collaborations. On average, interview participants were involved in 3.38 different types of collaborations; survey participants were involved in 5.17 types.

Overall dynamic teams seemed to be the focus of participants' critical work activities. A.'s membership in dynamic teams reflects the rest of our data. Despite a diversity of job roles among

our interview participants, 78% had collaborations with dynamic personnel. Survey participants had an average of 2.87 dynamic project teams each (see Table 2), on a par with the number of stable project teams they had, which was 2.99. As one IT Consultant in the company's Global Technology Services business unit observed: *"I used to do more of the stable project team things. Everything would be the same team. Now it's more dynamic."* The prevalence of dynamic teams also confirms other recent work (Chudoba et al. 2005; O'Leary et al. 2011). Another striking aspect of dynamic teams is that such teams served multiple organizational functions. HR and communications were formerly specialties that would have been handled by intact stable teams, requiring specific expertise. We saw instances of dynamic teams being used in both these domains.

We next explored how participants addressed the challenges of working in multiple dynamic teams, which have been identified in prior work (Chudoba et al. 2005; DeChurch and Marks 2006; Marks et al. 2005; Mortensen and Hinds 2002; O'Leary et al. 2011; Zika-Viktorsson et al. 2006). More specifically, how did members of dynamic teams *recruit appropriate members, set consistent goals* and engage in *group maintenance* as personnel shift? Multi-teaming adds a distinct set of demands: participants have to multi-task and juggle priorities across multiple collaborations (Chudoba et al. 2005; Mark and Poltrock 2004; O'Leary, et al. 2011; Zika-Viktorsson et al. 2006). When we combine multi-teaming and dynamic teams, it seems that our participants should have been extremely overloaded. Despite this apparent complexity, our participants were able to manage an average of 15 collaborations, including several dynamic teams. How are workers able to contribute to multiple teams while managing the extra workload introduced by dynamic teams? We address this paradox in the next section.

4.2 Productive Relationships Between Collaborations

Among a person's multiple collaborations, there were *predictable, productive patterns of interrelationships*. These are illustrated in the Collaboration Profile for A., the Software IT Architect we introduced above (see Figure 2). As A. explained, there were important *relationships* between his collaborations. The two collaborations on the left hand side of Figure 2 (the community and professional relationships) were secondary to his primary job responsibilities and acted to *support* the two core work collaborations on the right hand side (the client-supplier relationship group and dynamic project team). Specifically, his external consulting community activities and his professional relationships helped with *recruiting* for his dynamic team. The client-supplier relationship group *set goals* for the dynamic team.

Figure 3 depicts general relationships between different collaboration types, serving as a proposed model for how participants' different types of collaborations acted productively together. Other collaborations acted in support of dynamic groups where most work got done. The figure shows how
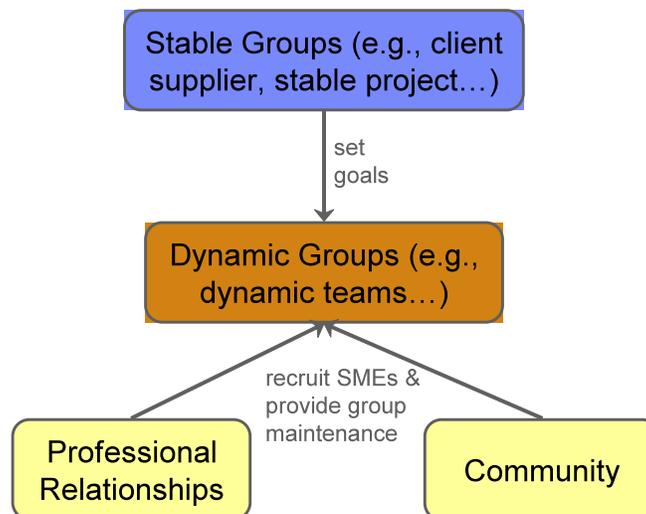
Figure 3. Interrelations between collaborations: dynamic groups are at the center, with stable groups setting their goals and relationship-oriented collaborations providing group maintenance and member recruitment.

stable groups—like client-supplier relationships or stable projects—initiated and set goals for dynamic groups. Communities and professional relationships provided relationship-oriented functions, such as group maintenance and recruiting. Note that committees are not shown on the diagram: this is because they were not well-linked to other collaboration types. We will argue that the absence of links between committees and collaborations involving concrete work deliverables can sometimes lead to problems of execution for committees.

We now characterize the relations depicted in Figure 3 in more detail. We describe how the interrelations between an individual's collaborations address core team functions such as *goal setting* and *group maintenance*, when people are working across multiple teams and much of their core work is focused on dynamic teams. We then discuss how these interrelations help people *recruit* members with appropriate skills to staff those dynamic teams on an 'as needed' basis.

4.3 Stable Groups Initiate and Help Set Goals for Dynamic Groups

Productive teams need to have shared goals allowing participants to co-ordinate interdependent work (Hackman 1990; McGrath, 1984). A problem for dynamic groups is to set goals and retain focus as personnel shift. The address this challenge, we saw people exploit their other *stable* collaborations to provide direction for their dynamic groups. Stable groups tended to be focused on longer-term goals, making goal setting less dynamic and more straightforward. We saw various examples of stable client-supplier relationship groups setting goals for dynamic teams (see Figure 3). For example, H. a Senior IT Specialist, described how a "toolkit of piece parts" was built by various dynamic project teams, initiated by the stable "Technical Affinity Group."

25

The responsibility of the Technical Affinity Group is… to extract discrete data points from our sales and customer facing staff so we can figure out strategically where our architecture work and solution design stuff should be headed… We can't deal with having sales folks come to us and say they need some brand new solution tomorrow. So we start to extract the kinds of conversations they're having such that by the time they do finally come back and say, 'Oh hey, I'm headed to [this company] in two weeks and I want to show them mashups.'… Our goal is to always be strategic in building out the toolkit of piece parts that solve patterns and generic customer needs.

Add another example of goal setting here

4.4 Communities and Professional Relationships Provide Group Maintenance

Well-managed stable project teams provide both collective resources and social support, i.e., group maintenance (Kraut 2003; McGrath 1984). However these functions are much harder to support in dynamic groups. People who are working together over short periods may not want to offer social support, because rapport is fragile. Also, processes such as mentoring may be less prevalent in dynamic groups, as stable social relations may be hard to establish. Furthermore, educational, process, and other archival resources may be more difficult to maintain without a stable group of people.

Again we saw that when these group maintenance functions were not supplied within the local dynamic group, people reached out to their other collaborations to compensate. Many people who were primarily members of dynamic groups talked about exploiting communities for work-related interaction. L.S., a community leader within Marketing, described the various social and educational events he organized for his community of practice:

We do a monthly community call [for the whole community] where we tell stuff about what is happening with the community. Then we have the education sessions in the community. They are typically every two months where we provide education and various different community building techniques. And then we have the watercooler call every two weeks to provide like a virtual gathering for them to share.

H. a Senior IT Specialist describes how participating in professional networks and communities, provides on-the-job learning by interacting with experts and peers:

...it's important that I stay involved with our communities in terms of, you know, we're constantly coming out with new versions of our products and I have to stay up to speed on those. And there's all kinds of experts all across [our company] that can help and I try to contribute with things that I learn and I learn about other things people are learning, or maybe they're doing the same kinds of things I'm doing."

H., also talked explicitly about how he provided mentoring to community members. Note too that his mentoring activities have management support. H. talks about how these "voluntary" mentoring activities are seen as an important aspect of his job even when those extend beyond the work focus of his main teams. Here he discusses how he is evaluated:

It's kind of interesting how we're rated. The big number is revenue, but there's other things that are involved, like are we participating in the communities internally, are we mentoring our fellow teammates, there's other sales IT guys, am I helping them out. Those are harder to measure, but they try to. One way with... [our community's online forum], I post certain tidbits to [the forum] that I think can be helpful as something that my manager can see.

H. points out that contribution to the community's online forum is something that he explicitly draws to his manager's attention. For his manager, community membership is seen as having strategic organizational value in contributing to workers' career development, as well as providing expertise and recruitment opportunities.

However, workers still had to find time in their busy days to participate in communities and professional relationships, which tended to be secondary to their core job responsibilities. Challenges arose when these secondary collaborations demanded time-consuming tasks. For example, H. described how certain critical resources that used to be the responsibility of a dedicated stable team were now maintained by a community:

> *There used to be a team and it was their whole job to create these proof of technology materials, keep them updated, add new scenarios to them, make them better... Due to [our company's] organizational reasons, that group is no longer and the responsibility of keeping up those materials—think of them like training materials... fell to the community of practice, which is voluntary (laughs). But it is so important that we keep maintaining those artifacts, but it became voluntary. But it is a challenge. There is a person that runs that community and needs us to be active... or else it won't be a good thing.*

Others echoed problems in relying on communities and professional relationships rather than intact stable teams. Because communities are volunteer-driven, it can be difficult to keep them active, because people do not see them as part of their core work activities. We talked to several people who managed communities using software tools such as forums, feeds, wikis, blogs, and shared tagging. They complained about the difficulties of ensuring sustained interaction and guaranteeing that people received answers to critical work questions. However, we found that successful communities tended to be focused around an intact stable team of organizers. This core team developed proactive management strategies – for example, they posted frequent new content and organized events (such as expert speakers and 'open mic' sessions) – to ensure that communities remained active, and therefore supported group maintenance.

So far we have presented data that demonstrates productive links between a person's collaborations, including that secondary collaborations often support core work. In other cases, such as committees, however, the link to core work deliverables was less direct. As several participants pointed out, the absence of a link between committees and a core work goal led to committees that were "too democratic" and "too slow". Like communities, the voluntary nature of committees may have contributed to their inefficiencies. Unlike communities, the lack of a tie to core work objectives meant that individuals working on committees needed other motivations to participate. This lack of a productive interrelationship between committees and a worker's core collaborations may also help explain why committees sometimes had problems in achieving their objectives in a timely manner.

4.5 Communities and Professional Relationships Aid in Recruiting Dynamic Group Members

A defining feature of dynamic groups is that they have shifting personnel that are recruited 'as needed'. But how do teams identify and onboard subject matter experts (SMEs) with the appropriate expertise? How do they ensure new personnel will fit into the team with minimal disruption?

Our interviews revealed that dynamic groups did much of their recruiting by exploiting their other collaborations, especially communities and professional relationships (see Figure 3). SMEs were recruited because they were a part of the recruiter's work-related network (e.g., recruitees and recruiters had collaborated together on projects in the past) or recruitees had demonstrated relevant expertise through community participation. Thus, professional relationships and communities played a key role in the recruitment process. This is supported by our data: of the 16 people who participated in dynamic teams, 15 were members of at least one community or were actively managing professional relationships (likewise with 73% of our survey respondents, N=118). In most

cases people relied on professional relationships for recruitment purposes, because recruiters had richer information about those people.

A. talked about how he used his professional network to staff dynamic teams in response to emerging customer requirements:

My linkedin is 500, plus [company] internal, there's 60 people I can approach right there... So if I need to get a number of people on board, I need to know if are they available, and when can they start? If I need project management, I think who's best suited to manage the project as it goes into delivery, then if I need contract management, and technical advisors, people who are really good at doing dial plans for instance, or people who are good at creating scripts... If I need a resource, then I identify a resource and then bill it to the account, they can bill hours. I get pinged all the time with the same requests.

Note in this example, that using professional relationships was a reciprocal process. Not only did A. serve as a recruiter, but another person's professional network served to recruit him to other teams (e.g., "I get pinged all the time with the same requests"). The same recruiting processes took place in communities, as shown by L., a Technical Presales Specialist who was recruited from a community to a chief information office (CIO) team:

[Participating in communities] helps me discover new projects. I have been able to volunteer for several projects, and participated in stuff that otherwise I wouldn't have known about... An example was that I was actually able to meet the person who was responsible for putting [a specific product] in production as part of the CIO office and so he had some process to open up the system for developers and he was asking comments so I gave him my 2 cents and started collaborating with him. He's the kind of person I've never met in my life. So after some back and forth he asked me to be one of the stakeholders for the project going forward. I see this as a volunteer activity, above and beyond. It has nothing to do with my day job, its career enhancement.

The importance of communities and professional social networks as recruiting tools was reinforced by another example. J., a Distinguished Engineer, had recently changed jobs within the company and did not report participating in communities. He therefore lacked access to relevant social connections. He observed that until he established new professional relationships, his ability to be recruited to emerging project opportunities was compromised.

At the beginning of last year I changed from process development to business optimization, it's a completely different set of people and it's amazing the lack of knowledge that we in [this company] have between different divisions. At the beginning nobody knows me, and so no-one is aware that I am there. And then it started very slowly, and then after a while it's like an avalanche of opportunities that come down because people start to know me and they recommend me to other folks. It's the problem that we have in [this company] to find the right person.

This example also indicates that successful recruiting is not always straightforward, and that the absence of communities and professional relationships can compromise participation in dynamic groups. Recruiting may be more difficult for people and organizations that do not use social software tools.

4.6 The Individual's Active Role in Enabling Productive Interrelationships Among Collaborations

Although interrelations between collaborations were productive, individuals still had to actively create and maintain their multiple collaborations to foster those connections. As described above, the company studied was organized with a high level of matrixing, which led to significant dynamic teaming. The stable teams that initiated and set goals for dynamic teams were primarily a fixture of organizational planning. However, individuals had to engage their relationship-oriented

collaborations to enable the other productive interrelationships described above, i.e., recruiting and group maintenance for dynamic teams.

Building rich professional networks and supportive communities required effort from individual workers. A typical way to build a professional network was to read people's blogs or follow people on tools like Twitter or internal corporate microblogging. However, this resulted in large amounts of information to read and potentially follow up on, as L. a Technical Presales Specialist, noted: "Right now in my network I have around 500 people. It's kind of challenging." Actively participating in online communities also required significant time, as H. an IT Architect in Sales, reported: "The trick is finding time, because you're being measured by everything else, to find time to give back to that community."

Management was often supportive of workers' efforts to build relationship-focused collaboration to some degree, but this support was not uniform for all employees. For example, H. said his manager "tried" to evaluate him positively for community participation and group maintenance, but this was difficult to track:

> *It's kind of interested how we're rated. The big number is revenue, but there's other things that are involved, like are we participating in the communities internally, are we mentoring our fellow teammates, there's other sales IT guys, am I helping them out. Those are harder to measure, but they try to. One way with... [our online community tool], I post certain tidbits to [our online community tool], that I think can be helpful as something that my manager can see. If I'm on the phone or emailing a lot with my fellow [company] employees helping them with their jobs, the phone you're not going to be able to see…"*

In contrast, L. noted that his activities of building a professional network by sharing information via social networking tools was "something above and beyond, my manager doesn't really care."

Despite their support of mission-critical work, such networking activities were still considered "voluntary" or outside the primary job functions for which that employee was evaluated. By and large, however, individuals were personally motivated to make efforts to build rich relationship-focused collaborations because they saw how these could support mission-critical collaborations.

One such motivation participants noted for working on such voluntary collaborations was reciprocity where participants strived to perpetuate a culture of friendly collaboration, as noted by A. a Software IT Architect:

> *I think its important to give back in collaborations, so I get a piece of information I like to say thanks, or if I see someone that has information that I know then I like to give back to keep the collaboration spirit rolling.*

Another motivation was to build one's reputation and exposure within the company. L., a Technical Presales Specialist describes using social networking tools to build his professional network:

> *Sometimes I am just following people just trying to work out what people are doing and what new projects are out there. Perhaps I could volunteer on those projects by participating in any way that I can so that I can grow my exposure within the company. So a career enhancement kind of move."*

Workers like L., A., and a number of our other participants saw benefits in contributing to communities and professional relationships. Individuals like them helped to partially counteract the problem of ensuring contributions to communities noted in a previous section. These motivated volunteers helped drive various communities and professional relationships.

5. Discussion and Implications

There are theoretical, technical and management implications to these findings.

Our work provides a novel perspective on modern organizations by describing the interrelations between workers' different collaborations. The organizational order identified in prior work—characterized by high levels of multi-teaming and dynamic teaming—at first appears extraordinarily complex for individuals to manage. Nevertheless, our results indicate that some of this complexity is managed by productive interrelations between workers' multiple collaborations. Individuals *combine their collaborations* in productive ways to compensate for some of the added demands of working in multiple dynamic groups, for example, by using communities to recruit SMEs and provide group maintenance. These results are consistent with findings from work exploring context switching at a cognitive level, which shows how complex multitasking is partially simplified by interrelations between tasks (Gonzalez and Mark 2004).

Further support for the importance of interrelationships among collaborations is provided by cases where particular collaborations were isolated and *lacked* connections. Collaborations such as committees that had weak relations to other types of collaboration were often inefficient. The absence of connections to other collaborations seemed to make committee work an isolated task requiring additional effort for participants.

==Tara I removed this new para as it seems to contradict our main argument==

Although our main focus here concerned interrelationships between collaborations centered around dynamic groups, we also observed other types of interrelationships. For example, there were important interrelations between stable groups and communities. Echoing recent work on collective intelligence, specifically Opensource and Wikipedia (Kittur and Kraut 2008; Moon and Sproull

2002; Panciera et al. 2009), we found that successful communities were usually dependent on a core stable team who set direction and managed contributions for a larger volunteer community.

Future theoretical work needs to further characterize different types of interrelationship, moving beyond the empirical descriptions of relationships we presented here, to making theoretical predictions about what types of relationships can occur between collaborations and what combinations are likely to be productive. Developing such theory may be helped by using our new descriptive concept of a *collaboration profile* to characterize the relations between collaborations. Another potential new theoretical direction might be to exploit other disciplines such as biology that explicitly model functional interrelations between organisms and their environment using the concept of an *ecology*. In future theoretical work we intend to explore how ecological concepts can be applied to the organizational context.

Our observations also have important technical implications. We have emphasized the conceptual connections between people's multiple collaborations. However at the software level, there is often no connection. Without closer integration between applications supporting different, interrelated collaborations, workers must switch applications and hence contexts to connect their collaborations. For example, members of a dynamic team cannot post information requests to relevant online communities without leaving their dedicated team tools. Or they must leave their team tools to use social software to identify people with relevant expertise. However, direct integration at the software level is both technically complex and requires participants to agree on what tools they will collectively use (Yarosh et al. 2009). An alternative might be to use email to share information across collaborations in a way that is lighter-weight and consistent with current collaborative practices. Our participants were all highly reliant on email as their main communication tool, using it

to share information about core work directly, as well as to publish pointers to information in social tools such as forums, blogs and wikis. We have therefore developed an application, Topika (Mahmud et al. 2011), which allows email interactions to be posted to relevant blogs, wikis or forums without participants leaving email to access those tools. Participants can thus continue to use email for core dynamic team activities, but have relevant interactions posted to their other group tools (e.g., in online community spaces), achieving better linkage between information related to their different collaborations.

Another area that could benefit from improved technical support is *recruiting* SMEs to execute core work tasks on dynamic teams. SME recruitment shares partial similarity with expertise location—a phenomenon that has been well documented (Ackerman and McDonald 1998). However, our data points to important differences between the two. Expertise location has typically been seen as the task of finding experts to provide *specific information*, e.g., to answer factual questions. In contrast SME recruitment is altogether more stringent, as recruiters are seeking experts to *make substantial collaborative contributions* to their team. So, detailed information about recruitees' past performance, their ability to collaborate and even personality, can be critical in deciding whether to recruit someone to a team.

 Given the central role that dynamic teams play in modern organizations, new technology is needed to support such informed recruitment. Currently, individuals put significant work into building and maintaining professional networks to serve as SME recruitment resources. Tools that make it easier to maintain and interrogate such relationships would be a great help. When looking outside one's network, very detailed information about a potential team member is needed. New recruitment tools might therefore allow SMEs to create and maintain detailed, linked, searchable profiles of their work

36

along with evaluations of that work by others. These tools might also maintain links to the worker's social network to facilitate posting status updates about current projects or recent achievements. They might also allow recruiters to search a history of the SME's contributions to social media tools, such as their forum or wiki postings.

Our observations also point to the need for new design methods for collaborative applications. Elsewhere, we have argued that current design techniques such as *personas* are focused on individual user applications and consequently fail to incorporate important aspects of collaboration (Matthews et al. 2011). We have developed a new design method, *collaborative personas*, that addresses aspects of team functioning and uses the *collaboration profile* to characterize distinctions and interrelations between participants' collaborations.

Finally there are important management implications of our findings. Managers need to be aware of the interrelations between different aspects of their employees' working lives. They need to understand, for example, how collective intelligence groups, such as communities or professional relationships, can have direct impact on core project work. People who are deeply embedded in communities or with extensive social networks, can make better recruitment decisions and access relevant expertise. Management therefore needs to provide direct encouragement for participation in these 'voluntary' collaboration types as they can have strong implications for the success of core projects. Performance evaluations might also incorporate these more voluntary contributions.

In conclusion, our research shows adaptive interrelations between people's collaborations, explaining how these help people deal with the complexities of participating in multiple and dynamic groups. In future work we will enrich our descriptions of these interrelations beyond a

focus on dynamic groups, and develop a systematic framework for different types of collaborative relationships.

Acknowledgements

References

1. Ackerman, M. and McDonald, D. (1998). Just talk to me: A field study of expertise location. *Proceedings of CSCW*, pp. 315-324.

2. Balakrishnan, A., Matthews, T., and Moran, T.P. (2010). Fitting an activity-centric system into an ecology of workplace tools. *Proceedings of CHI*, pp. 787-790

3. Butler, B., Sproull, L., Kiesler, S., & Kraut, R. (2007). Community effort in online groups: Who does the work and why? In S. Weisband. (ed): *Leadership at a Distance*. Hillsdale, NJ: Erlbaum, pp. 171-194.

4. Chudoba, K.M., Wynn, E., Lu, M., and Watson-Manheim, B. (2005) How virtual are we? Measuring virtuality and understanding its impact in a global organization. *Information Systems Journal*, vol. 15, pp. 279-306.

5. DeChurch, L. A., and Marks, M. A. 2006. Leadership in multi-team systems. *Journal of Applied Psychology*, vol. 91, pp. 311– 329.

6. Gersick, C. J. G. (1988). Time and transition in work teams: Toward a new model of group development. *The Academy of Management Journal,* vol. 31, no. 1, pp. 9-41.

7. González, V. M. and Mark, G. (2004). "Constant, constant, multi-tasking craziness": managing multiple working spheres. *Proceedings of CHI*. New York: ACM Press, pp. 113-120.

8. Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology*, vol. 78, no. 6, pp. 1360-1380.

9. Hackman, J. R. (1990). *Groups that work (and those that don't): Creating conditions for effective teamwork*. San Francisco: Jossey-Bass.

10. Holtzblatt, L., Damianos, L., and Weiss, D. (2010). Factors impeding wiki use in the enterprise: A case study. *Collective Intelligence Workshop at CSCW*.

11. Katz, R., & Tushman, M. (1979). Communication patterns, project performance, and task characteristics: An empirical evaluation and integration in an R&D setting. Organizational Behavior and Human Decision Processes, 23, 139-162.

12. Kc, D. and Terwiesch, C. (2009). Impact of workload on service time and patient safety: An econometric analysis of hospital operations. *Management Science*, vol. 55, pp. 1486–1498.

13. Kittur, A. and Kraut, R. E. (2008). Harnessing the wisdom of crowds in wikipedia: Quality through coordination. *Proceedings of the ACM Conference on Computer-Supported Cooperative Work*. New York: ACM Press, pp. 37-46.

14. Kraut, R. E. (2003). Applying social psychological theory to the problems of group work. In J. Carroll (ed): *HCI Models, Theories and Frameworks*. New York: Morgan Kaufman, pp. 325-356.

15. Lave, J. and Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge, UK: Cambridge University Press.

16. Mahmud, J. Matthews, T., Whittaker, S., Moran, T., and Lau, T. (2011). Topika: Integrating collaborative sharing with email. *Proceedings of CHI 2011*, pp. 3161-3164.

17. Matthews, T., Whittaker, S., Moran, T., and Yuen, S. (2011). Collaboration Personas: A new approach to designing workplace collaboration tools. *Proceedings of CHI 2011*, pp. 2247-2256.

18. Mark, G. and Poltrock, S. (2004). Groupware adoption in a distributed organization: Transporting and transforming technology through social worlds. *Information and Organization,* vol. 14, pp. 297–327.

19. Marks, M. A., DeChurch, L. A., Mathieu, J. E., Panzer, F. J., and Alonso, A. (2005). Teamwork in multiteam systems. *Journal of Applied Psychology*, vol. 90, pp. 964–971.

20. McDonald, D., and Ackerman, M. (2000). Expertise recommender: A flexible recommendation system and architecture. Proceedings of the ACM Conference on Computer-Supported Cooperative Work (CSCW 2000), Philadelphia, PA. New York: ACM Press, pp. 231-240.

21. McGrath, J.E. (1984). Groups: Interaction and performance. Englewood Cliffs, NJ: Prentice-Hall.

22. Moon, J. and Sproull, L. (2002). Essence of distributed work: The case of the Linux kernel. In Pamela J. Hinds and Sara Kiesler (eds): *Distributed Work*. Cambridge: MIT Press, pp. 381-404.

23. Moon, M. A. & Armstrong, G. M. (1994). Selling teams: A conceptual framework and research agenda. *Journal of Personal Selling & Sales Management*, vol. 14, no. 1, pp. 17-41.

24. Mortensen, M. and Hinds, P. (2002). Fuzzy teams: Boundary disagreement in distributed and collocated teams. In P. Hinds and S. Kiesler (eds): *Distributed Work*. Cambridge: MIT Press, pp. 283-308.

25. Nardi, B. A., Whittaker, S., and Schwarz, H. 2002. Networkers and their Activity in Intensional Networks. *Computer Supported Cooperative Work*, vol. 11, nos. 1-2, pp. 205-242.

26. O'Leary, M., Mortensen, M., and Woolley, A. (2011). Multiple team membership: A theoretical model of its effects on productivity and learning for individuals, teams, and organizations, *Academy of Management Review*. To appear.

27. Panciera, K., Halfaker, A., and Terveen, L. (2009). Wikipedians are born, not made: a study of power editors on Wikipedia. *Proceedings of the ACM 2009 international conference on supporting group work (GROUP '09)*. New York: ACM Press, pp. 51-60.

28. Preece, J., and Maloney-Krichmar, D. (2005). Online communities: Design, theory, and practice. *Journal of Computer-Mediated Communication,* vol. 10, no. 4, article 1.

29. Shirky, C. (2008). *Here Comes Everybody*, London: Penguin.

30. Whittaker, S. (2005). Supporting Collaborative Task Management in Email. *HCI,* vol. 20, pp. 49-88

31. Yarosh, S., Matthews, T., Moran, T., and Smith, B. (2009) What is an activity? Appropriating an activity-centric system. *Proceedings of INTERACT*, pp. 582-595.

32. Zhang, J., Ackerman, M. and Adamic, L. (2007). Expertise networks in online communities: structure and algorithms. *Proceedings of the 16th international conference on World Wide Web* (WWW '07). New York: ACM Press, pp. 221-230.

33. Zika-Viktorsson, A., Sundström, P., and Engwall, M. (2006): Project overload: an exploratory study of work and management in multi-project settings. International Journal of Project Management, vol. 24, no. 5, pp. 385-394.