Intranets and Organizational Change:
The Evolutionary Deployment of Corporate Information Infrastructure

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Introduction

Intranets --internal corporate networks based on Internet technologies-- have become the rage in corporate networking. A vibrant industry of hardware vendors, software providers, and consultants vie for the attention and dollars of organizations racing to deploy their own Intranets. Impressive claims fuel this frenzy: Intranets, we are told, will revolutionize the organization of work. They will enable sweeping corporate reorganization, boosting productivity and enhancing their owners' competitiveness. Connected to the public Internet, they will support seamless virtual companies, ushering

in the era of electronic commerce. On the basis of these expectations, most American corporations have now deployed their own intranet.

Beyond the hype and the sweeping claims however, little is known about the precise mechanisms through which intranets are deployed and configured, nor about the ways in which they really do transform work. Most justifications so far draw on straightforward applications, such as document distribution, where the initial savings in printing and shipping costs can easily be documented. The real benefits however, should derive overtime from intranet-enabled work reorganization, resulting from the co-evolution of the intranet infrastructure and organization that uses it. These mechanisms are much more elusive, but unless they are documented, understood and articulated, claims about the potential of this new communication technology will be difficult to substantiate.

This paper draws upon the early results of research within twenty US companies and organizations[1]. The intent of the project is to take a hard look at real-life Intranets to understand whether and how they are really changing American companies and American business. Combining in-depth interviews and broad-based surveys, this research is articulated around three key questions: (1) what role do Intranets play in the transformation of work and organizations? (2) how do Intranets matter to the competitiveness of their users? and (3) what new patterns of innovation creation and diffusion are associated with Intranets?

We first examine how organizational communication scholars have analyzed the deployment of new communications technologies. The bulk of the existing literature

documents the initial phases of this deployment: how a new technology is selected, how it diffuses through an organization, and how its use initially transforms communications among the organization's members. There is however little analysis of what happens next. Once a communication technology has been deployed, how does it change, and how the resulting infrastructure co-evolves with the organization that uses it? In a sense, the existing literature largely assumes fixed technologies (the main questions then are about selection and diffusion of technologies, not their evolution) and passive users (questions are effects of technologies on users, not the reverse).

Digital networks in general --and intranets in particular-- fundamentally challenge these two assumptions. Their configuration is programmable, so that once deployed, they can be reconfigured and adapted to changing organizational needs. Furthermore, many of their users are anything but passive. They can directly shape and configure the networks they use, adapting the communication technology to the organizational needs it serves. We argue that these characteristics foster new mechanisms leading to co-evolution between network and organization. We propose a cyclical model to analyze this co-evolution, identifying three-steps in each cycle: automation (new communication technologies are applied to the execution of existing tasks), experimentation (end-users conduct hands-on exploration of further possibilities of these new technologies), and reconfiguration (network configuration changes to support a new work organization).

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[1] Including Adaptec, American President Lines, Charles Schwab, Cisco Systems, Handsnet, Levi Strauss & Co., Microsoft, PeopleSoft, Silicon Graphics and Sun MicroSystems

Communication Technology Adoption Process: A brief literature review

The corporate deployment of information and communication technologies has been an area of active academic study for several decades. Understanding how and why information technologies are used in organizations is central to the ability to prescribe and predict organizational arrangements and outcomes (Markus 1994). Most research to date has focused on understanding the mechanism and decision making processes that lead to adoption, selection and embedding of new technology into organizational routines. Obviously, this analysis applies to the selection and deployment of corporate intranets, as it does to other communication technologies. However, this is but the beginning, not the end, of the theoretical understanding necessary to fully comprehend how intranets have been developed and where their ultimate potential may lie.

A first category of studies have explored the reasons why a specific technology is chosen over another. They have investigated individual as well as structural reasons guiding this process. From the viewpoint of the individuals in charge of selecting communication technologies, the technical capacity of a telecommunications medium must meet a minimum level of functional requirement expectation. However, the choice between competing media is more often influenced by sociological rather than technological factors (Sproull and Kiesler, 1991). A key sociological factor is the ability of a medium to convey a sense of social presence between the sender and receiver. Stronger contextual bonds between parties implies a richer medium.

The underlying premise behind media richness theory is that communication media vary in their capacity to process rich information (Daft and Lengel 1986). The key criterion for media choice is message ambiguity. Identifying the level of ambiguity is central to understanding the amount and kind of interaction that will be required and the communication medium most appropriate for delivering the message. The media richness hierarchy ranks media in terms of their capacity for processing equivocal information. The richness of each medium is based upon a blend of four criteria: (1) the availability of instant feedback, making it possible for communicators to converge quickly upon a common interpretation or understanding, (2) the capacity of the medium to transmit multiple cues, such as body language, voice tone, and inflection, to convey interpretations, (3) the use of natural language, rather than numbers to convey subtleties, and (4) the personal focus of the medium (Trevino, Lengel et al. 1987; Trevino, Daft et al. 1990).

Three factors influenced managers' media choices: (1) ambiguity of the message content and richness of the communication medium, (2) symbolic cues provided by the medium, and (3) situational determinants such as time and distance. When meaning is ambiguous, face-to-face communications will dominate, while in unambiguous situations media such as memos, letters, and electronic mail are sufficient to carry the message. Symbolic cues such as glamour or high-technology images are often associated with new technologies such as teleconferencing, Groupware products and the intranet. Situational determinants such as geography and time make the asynchronous and rapid deployment capability of electronic mail and the intranet attractive to managers.

The media richness model has some inherent limitations that make it an inadequate as a sole explanatory theory for intranet behavior. The first is that it is a static model – media are viewed as occupying a singular technological niche. There is no mechanism to allow a medium to exist in multiple hierarchical positions depending on contextual factors. Information richness theorists implicitly assume that richness lies in the medium, as perceived by individuals. The second is that the distinction between media and communication genre are blurred in this model. The face-to-face, telephone and electronic mail are media. Formal letters, memos, personal notes and bulletins are communication genres in these media. In contrast to single-purpose media the intranet – with its full breadth of multimedia capability – supports a wide variety of communication genres and is difficult to place at a single point on the media richness scale. Organizations choose to implement the intranet differently – deploying it for different applications in varying departments – as compared to the inter- and intraorganizational consistency in which a fax machine is implemented and deployed.

A complementary interpretation of individual media choice is provided by social presence theory (Short, Williams et al. 1976). Social presence theory is closely aligned with media richness theory in its evaluation of media. The key premises are (1) media differ in their capacity to convey a sense of social presence between sender and receiver and (2) social presence differs among communication media according to such factors as their sociability, warmth, personalness, and sensitivity. Social presence is a measure of the degree to which the medium facilitates awareness of the other person and interpersonal relationships during the interaction (Fulk, Schmitz et al. 1990). Thus, analogous to media richness theory, media are positioned along a single continuum

according to their social presence. Face-to-face is seen to have the greatest social presence followed by audio with video, audio only, and print. The social presence approach proposes that when a task requires a strong interpersonal component individuals will prefer media with more social presence. For simple information exchange, media with less social presence will be acceptable and effective. Media richness and social presence theory would suggest that mass publication and broadcast would be ideally suited to the intranet and that interactive and interpersonal tasks would not be well accommodated. This expectation is partially consistent with field observations.

The intranet, unlike the telephone, fax and email, is a multi-faceted medium that is not restricted for use with a single genre. Many of the constraints imposed by older communication media technology can be eliminated. The intranet is capable of integrating text, graphic images, audio, and video in a single user application. From communication and information exchange applications that need no more than a very lean media to reduce uncertainty to those demanding a very rich environment to avoid ambiguity, or from applications wherein social context is unnecessary to those applications where it is critical, the intranet can be appropriated and modified by user to serve multiple organizational requirements.

In contrast to the single decision-maker look at communication technology choice, communal or collective action can be analyzed from an institutional theory point of view. Institutional theory's main premise is that social, technical and economic forces influence organizational environments. It has been widely observed that the use of electronic mail, a comparably old technology as compared to the intranet, varies widely between organizations (Schmitz and Fulk 1991). While media richness theory predicts

that the use of this media would be relatively invariant across social units, institutional theory predicts that social definitions and uses of electronic mail and other new media, such as the intranet, may vary dramatically across social units. Members of social units develop a mutual assessment of technology benefit in the process of using it (Barley 1986). In looking at information technologies, such as electronic mail and the intranet, the social definition of appropriateness may not conform to objective definitions derived from its location on the information richness scale. The attitude and leadership by key members of an organization legitimates the behavior and promotes diffusion. Once established, the behavior and diffusion is perpetuated through socialization of new members.

Practices and behavior patterns vary in their level of institutionalization depending on how long they have been in place and on how widely they are accepted by members of an organization (Tolbert and Zucker 1983). The creation, enactment and widespread replication of scripts – common solutions for common problems – drives the process of institutionalization (Giddens 1984; Barley 1986; Barley and Tolbert 1995). When technology is appropriated and applied in a uniform and consistent manner across an organization institutionalization is more likely to occur.

> "If change is to occur in highly generalized institutions, a relatively large number of actors must alter their behavior in similar ways. This is most likely to occur when common conditions affect many actors, more or less simultaneously, in much the same way and when the social networks among the actors are relatively dense." (Barley and Tolbert, 1995)

Institutional theory also provides a model to study the effect of external forces on technology adoption (DiMaggio and Powell 1983). Using an institutional isomorphism analysis one can ask "do communities mimic each other in deployment of information

technology?" As a result of mimetic or normative influences organizational decision makers have been shown to adopt institutional designs and to model their own structures on external patterns perceived to be more modern, appropriate, or professionally representative (Scott 1987). The widespread adoption of and access to internet-based web application, the World Wide Web, has greatly enhanced the spread of best-practices models. The ease at which the infrastructural design of web pages can be copied and modified from both internal and external sources allows late adopters to quickly catch up to and leverage the intellectual efforts of early adopters and widely recognized leaders.

Once a particular technology has been chosen, the factors affecting its diffusion becomes the next focus of study .Incumbent with the introduction of any new technological innovation are organizational obstacles to overcome. Within any given population there will be a distribution between the initial adopters, those people on the leading edge, the early and late adopters, and the laggards or never adopters (Rogers 1962). Personal aptitude and attitude towards new technology will impact the rate of diffusion through the organization. Corporate provided explanation regarding the choice to implement a new technology has positive impact on the rate of acceptance (Astebro 1995), as does formal training and education programs (Davenport 1994). The Intranet is a radical departure from existing information technology tools. Users must be trained to forget old habits and to embrace new techniques. In the absence of new awareness regarding the new collaborative and interactive capabilities of the Intranet this technology may be interpreted in terms of more familiar personal and stand-alone technologies, such as email and shareable file products such as spreadsheets, word processing, and project management applications (Orlikowski 1993).

The classical explanatory model used to understand how and when new information technology will be adopted and then spread throughout an organization is diffusion of innovation theory (Rogers 1962). Diffusion of innovation theory predicts that early adopters do so because they will gain the greatest utility. With the interactive and interdependent nature of information technology users gain utility only in the sense that they share participation in the media with other members of their community. Communication technologies by their very nature must have a sender and a receiver for information transfer to occur. The highly interactive and interdependent nature of organization information exchanges suggests that bilateral influence or reciprocal interdependence (Thompson 1967) will occur – users will moderate their communication behavior based on feedback and interaction with communication partners. Thus, the establishment of use across a critical mass within a work group or peer group is necessary for benefits to be realized. Critical mass is defined as a small segment of the population that chooses to make the initial investment of resources, such as time, money or support, to develop a new technology to the point that it is sustainable as a public or community good (Thorn and Connolly 1987; Fulk, Flanagin et al. 1996). The collective action or community good relevant to a newly introduced interactive medium, such as electronic mail or the intranet, is the achievement of universal access. Universal access allows each member to the community to gain full benefit from the information technology. An organization can migrate resources to a new technology from older technologies only if universal access is achieved (Markus 1990). Diffusion of innovation and critical mass theory analysis allows us to understand what conditions are required to facilitate the

spread of intranet technology throughout an organization.

Toward a cyclical model of network deployment

Overall, this literature takes a linear view of the deployment of communication technology. It views the technology deployment process as a finite process, with a progressive succession of steps leading from beginning (selection) to end (replacement). Its principal focus is on how the deployment of a given technology will affect the organization using it. In doing so, it implicitly makes two important assumptions about communication technology and its users.

First, it assumes relatively stable communication technologies. They might change at the margin, but do not evolve much between the different phases of their selection, adoption and diffusion. Second, it assumes that the technology's users are passive in their relationship with the technology. they can adopt --or not adopt-- a new communication technology, but do not create, shape or transform the technology they use. This, we believe, largely explains the literature's focus on selection, adoption and diffusion. If the technology doesn't change and if the users' role is limited to adopting the technology, these questions are indeed the most interesting. However, with digital networks in general, and with intranets in particular, Neither of these two assumptions is true.

First, Intranet technology is anything but static. Indeed, like the internet, it is proving enormously malleable. As soon as it is adopted, it begins to change and new uses begin to emerge, beyond those that initially justified its adoption. New functions are created, new patterns of communications supported, and fundamentally new uses for the

technology quickly emerge. With the internet, any period's applications become the building blocks upon which the next period's applications will be built. Therefore, we need a model that can describe the evolution of the underlying communication infrastructure over time, not simply from adoption to obsolescence, but through its successive transformations.

Second, Intranet users are anything but passive. They are empowered by the technology's characteristics, which allow its end users to create new applications, and shape the configuration of the underlying communication infrastructure to serve their needs. This represents a fundamental shift from the past: with digital technology, the ability through software to control and configure networks has become flexibly separable from network ownership. In the past, only the network owners (e.g. the phone company) could configure the network. Today, a variety of actors, in particular the networks' end users, can control the configuration of the networks they use. As a result, we need to study not only the effects of the technology on the organization using it, but also the effect of the organization and its users on the technology, as the two co-evolve.

Therefore, by contrast with much of the existing literature, we believe that understanding this critical features of the deployment of digital networks calls for a cyclical model of network deployment. Our research shows that Intranet deployment follows an iterative, cumulative, path-dependent learning cycle. Throughout this evolutionary cycle, Intranets constitute both the support and the object of innovation. They help companies articulate organizational change and the experimentation they support often results in the development of new Intranet applications, leading to the co-

evolution of the network infrastructure and the organization. We describe this process as a three-step cycle: automation, experimentation, and re-configuration.

The initial wave of Intranet deployment can largely be characterized as "automation": Intranets are used to perform previously existing tasks in a new way. A typical example is the automation of document dissemination, where the Intranet serves to distribute documents electronically. These are essentially the same documents as in the pre-Intranet era, prepared in similar ways and distributed to similar groups of people, integrated in similar tasks. Cost reductions provide a straightforward justification for Intranet-based automation and the return on investment for this initial wave of Intranet is easily documented. To date, the vast majority of Intranet activity observed in our study still corresponds to this automation phase. What is especially interesting however, and different from previous rounds of corporate network deployment, is the wide range of tasks that are being automated upon a single, easily accessible platform.

Selection and adoption are near instantaneous decision events in the life history of a new technological innovation. Full acceptance or conversion to a new technology requires time. Several researchers have looked at longer term, time dependent cycles that must be completed for a new technology to become dominant. Information technologies such as the telegraph, telephone and vertical filing cabinets, were available immediately upon design to the business communities of their time. Yet there was a lag, oftentimes twenty to thirty years, between the first early adopters and the time at which the technology was recognized as widely deployed and contributing significantly to process or system improvement in the business world in the aggregate (Yates 1989).

By contrast, the deployment of Intranets has been extremely rapid. A few years only after their introduction, they have been deployed throughout entire organizations. Critical mass was reached very quickly, and universal access came soon thereafter. In large part, this is due to the fact that intranet deployment is relatively cheap: most companies were able to deploy their intranet as a simple overlay atop existing local area networks. The cost of user training was similar low, both because the intranet tools are increasingly accessible and because the technology is similar to what users had become familiar with on the Internet. This has lead to the rapid deployment of a pervasive, universal communication infrastructure in organizations, which laid the groundwork for the next stage of our evolutionary cycle.

The introduction of new communication technology affects organizations at two levels. The first level of effects is the anticipated technical gains in terms of efficiency and productivity that justify an investment in new technology. The second level effects are unanticipated consequences and are caused by behavior that the technology makes feasible and by how people use those options. Second level effects are not caused by technology operating autonomously on a passive organization or society. Instead, they are constructed by people as their design and use of technology interacts with, shapes, and is shaped by the technological, social, and policy environment (Sproull and Kiesler 1986). With first exposure to new information technologies the natural tendency is to apply the new application as a solution to an existing situation – 'to do to olds things in a new way' – to automate not innovate. Experience has shown that the most important effects of a new technology may be not to let people do old things more efficiently, but to

do new things that were impossible or infeasible with the old technology (Kiesler and Sproull 1992).

The Intranet infrastructure deployed to support the initial phase of automation enables such second order effects through a second phase of "experimentation". Once the Intranet is in place, individuals and organizations begin to explore the possibilities it creates. This ranges from extensions of the initial automation applications (on-demand, targeted publishing would be a good example of such experimentation to extend automated document dissemination), to more complex applications made possible by the existence of a web-based infrastructure (e.g. web-based transactions allowing employees to order supplies or modify their retirement plans). It involves re-combination of individual application elements into new arrangements, a process of "bricolage" leading to the invention of new applications riding the existing infrastructure. This experimentation is often accompanied by partial reorganization of the underlying work processes. Its justification therefore goes beyond strict cost-reduction, and begins to include more systemic benefits such as cycle time reduction. Our research uncovered a number of such examples, emerging from a variety of places within the organizations under study. Significantly, we found that unlike previous rounds of corporate networking, this experimentation process draws widely upon the technology's end-users, rather than simply the technology's providers (such as Intranet vendors or corporate MIS departments)

Through experimentation, the communication technology becomes more integral to the daily business of the organization using it. Yin (1979) has described the process as routinization, the life cycle of a technology when it appears to have disappeared as an

independent entity – when the technological innovation becomes part of standard provided services. The complete technology 'life cycle' described by Yin has three phases: improvisation, expansion and disappearance. The improvisation stage is a limited and less formally structured period for the new technology. First year functionality and expectations are intentionally limited. Experimentation and exploration are encouraged. Rigorous justification and financial benefit substantiation are not required. During the improvisation period governance policies and procedures necessary to embed the new innovation within the existing infrastructure are just beginning to be formulated. With expansion comes continued growth in the number and scope of applications being supported. The innovation receives formal recognition through incorporation in the organizational budgetary and resources allocation mechanisms. Standard operating procedures and policies begin to reference or depend upon the use of the new technology. New job classifications are proposed and implemented that could not exist prior to the introduction of the new innovation. In the final phase, disappearance, key personnel associated with innovation move on to new positions in the organization. There is considerable turnover and replacement of initial coordinating personnel as expansion to full organizational use is achieved. The technology is no longer considered new or innovative. It has been absorbed as a standard operating tool. The effectiveness of new information technology depends on its ability to become embedded in the organizational structure (Poole and DeSanctis 1990).

Yin's definition of routinization however primarily addresses the governance issues associated with technology deployment. These issues, which need to be resolved before routinization occurs, include creation of new job skills and job classifications, long

term budgetary and resource support, the establishment of training programs, incorporation and acknowledgement in administrative policies and procedures, and the establishment of long term support for maintenance operations. Yin's technology life cycle addresses the changes of a dynamic organization around a static communication technology. The intranet now presents organizations with an addition level of complexity – a moving target. User modification of the underlying technology and concurrent infrastructural changes to the corporate network proceed simultaneously with organizational acceptance and routinization. As a result, rather than routinization becoming the end of a linear process of infrastructure deployment, the experimentation phase merely sets the stage for the next step of the cycle.

Intranet-based experimentation typically runs into the limitations imposed by the infrastructure deployed during the automation phase, provoking the need for a third phase of "reconfiguration". The Intranet's architecture itself needs to be re-configured and several of the work processes it has come to support need to be re-organized to take full advantage of the technology's possibilities. A few of the companies in our sample have undergone one or several such reorganizations. The process usually involves an extensive re-design of the company's Intranet (navigation, content, applications supported,...), a thorough transformation of the Intranet's governance (who controls it, how can it be changed, how can content and features be contributed,...) and often significant re-organization of the process supported by the Intranet (examples of processes undergoing such re-organization in our sample range from the assimilation of newly hired employees, to requisitions, and sales-team management). As a result of this re-organization, companies find themselves with a new Intranet infrastructure, upon

which they can start automating and experimenting anew, embarking on successive Intranet cycles.

Malone and Rockart (1991) provide a complementary interpretation of the events that follow selection and early adoption. They describe the transition path from existing to new technology as being one of 'substitution-extension-replacement'. New technological innovation moves along an evolutionary path. Substitution begins when new technology is chosen in lieu of older, existent tools. In the extension phase perceived enhanced usability and functionality compared to the older technology cause a demand shift. In the final phase leading to full incorporation older structures are removed and the new technology is left as the dominant paradigm. Again the model they describes addresses changes to usage patterns and organizational acceptance of a static technology.

Recognizing that technologies do indeed mature and evolve through a series of redesigns and reconfiguration a new level of incorporation, going beyond adoption and routinization, has been defined as infusion (Zmud and Apple 1992). An infusion is represented by a sequence of configurations for the new technology, each one based upon the previous, but with increasing levels of work related innovation. With each cycle the interconnectedness of workflow increases and becomes more dependent of the new technology. Zmud and Apple define routinization as a necessary but insufficient cause to produce high levels of infusion. High levels of both routinization and infusion are required to achieve full diffusion in an organization.

The resulting co-evolution of network infrastructure and organization process is iterative, cumulative, path dependent, characterized by structured learning, and results in embedded knowledge.

Conclusion

While we observe such a cyclical pattern in all the companies we have studied, there are however important differences. Companies show differing abilities to learn (about themselves and about the Intranet technologies) as they go through these cycles. They exhibit various levels of expertise in embedding the knowledge gained at each step within the Intranet infrastructure they deploy in successive steps. Our research traces these disparities to differences in the corporate governance of Intranets, including the organizational allocation of control over Intranet architecture and evolution, and the level of integration of the firm's various web-based efforts (Intranet, Extranet, and Internet)

Our findings also have important and broader implications for telecommunication policy. They show that the adoption and deployment of Intranets follows evolutionary patterns similar to those uncovered in our earlier research on previous generations of private networks (Bar et al., 1989). In particular, they confirm the importance of network control and management mechanisms, and the critical role of end-users in network-based innovation processes. However, Intranets are different from earlier generations of corporate networking in very important respects: they rest on Internet technologies, characterized by open standards, and widespread throughout publicly accessible infrastructure. The paper concludes with an examination of the implications of this empirical research in the two key policy areas of interconnection and universal service.

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