Telework: Existing Research and Future Directions

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Telework, which is defined as work performed at home or a satellite office to reduce commuting, is attracting much attention as an alternative way to organize work. Numerous studies have pointed out a variety of advantages of telework for individuals, organizations, and society. Current telework research, however, displays many weaknesses that inhibit use of this alternative as an effective vehicle to promote distributive organizational design. This study was undertaken to characterize existing telework research, improve understanding of problems and issues of telework, and guide future research directions. A review of the relevant literature and a characterization of telework were conducted from 3 different angles: the research methodology, the focus of existing telework studies, and the research paradigm. First, an overall lack of robust research methodology was found in many studies. Second, although telework is an organizational phenomenon, disproportionate attention has been given to teleworker-related personal issues. Finally, the current telework paradigm was discovered to be characterized by suitability-based planning that selects appropriate persons and tasks and by ad hoc implementation in response to local needs. We suggest that future research could be enriched with more rigorous research methodology, more balanced focus for studies, and more flexible perspectives in the research paradigm.

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1. INTRODUCTION

Telework is attracting a great deal of attention from both academics and practitioners because of its multifaceted implications for individuals, organizations, and society. Variations in culture, organizational characteristics, and environments spawn regional differences in the form of telework (e.g., satellite offices in Japan and work at home in the United States). However, all implementations share similar agendas, such as enhanced organizational flexibility, curtailed business overhead costs, improved worker productivity, effective worker recruitment and retention, and reduced commuting time for workers. In addition, the rapid growth of telework is justified by such characteristics of mature social structures as unprecedented urbanization, rapid technological progress, growth in knowledge-producing jobs, the spread of virtual operations, and changes in the labor supply that demand a more flexible work style. In fact, as a large-scale diffusion of telework mandates a fundamental transition from the conventional form of organizational processes, its gradual spread appears unavoidable. Consequently, we are beginning to witness companies (especially in high technology) shifting large work forces into telework, especially since recent telework studies have expanded the understanding of its implications. It is, therefore, appropriate to step back and review the implications of existing research on telework to understand the problems and issues and for guidance in selecting future research directions. With this in mind, we conducted a survey of the relevant literature, formulated a characterization of telework, and used these efforts to promulgate suggestions for future research from three different angles: the research methodology, the focus of existing telework studies, and the research paradigm. Overall, the survey indicated that telework studies require more rigorous research methodology, more balanced foci, and more flexibility of perspectives in the research paradigm.

2. DEFINITION OF TELEWORK

There has been a high degree of inconsistency and arbitrariness in the use of the term *telework* among academic studies [1]. The absence of a common definition may have resulted from the evolutionary nature of the practice as well as the divergence of features among the different work modes [2]. In some studies, telework is viewed as encompassing a variety of intraorganizational functions (e.g., telecommuting, mobile work, and virtual corporation) and interorganizational relations (e.g., electronic data interchange [EDI] and interorganizational team-based working). Perceived this way, it includes any type of distributed work enabled by information technologies [3]. Other studies have used the term interchangeably with telecommuting.

In this study, we take the narrow definition of telework: "telecommuting," which refers to a reduction of commuting distance by working at home, in nontraditional satellite offices,[1] in telecottages,[2] or in neighborhood offices.[3] Self-em-

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[1]A collective telework where the location is usually determined by the concentration of employees in an area. It houses employees from different functional departments of an organization.

[2]These are established in rural areas to provide people access to information technology for a variety of purposes.

[3]Work centers where employees from different organizations share the facility to carry out their work.

ployed persons who operate home businesses and employees who work extra hours at home to supplement office work are not considered teleworkers. The selection of this narrowly focused definition of telework ignores the far-reaching implications of other forms of distributive working. However, the organizational motivation for adopting telework may be significantly different from that encouraging implementation of other distributive work designs, and maintaining the limited perspective permits a dedicated focus. Although reducing worker commuting is the key element in defining telework in our study, traditional (e.g., cost-saving) and nontraditional (e.g., organizational flexibility and learning) strategic considerations can be cited as optimizing the utility of a telework program. In addition, relevant research is expected to furnish valuable insights concerning implications of other distributive work designs, especially virtual organizations. In the next sections, we examine telework from the perspectives of research methodology, the focus of existing studies, and the research paradigm.

3. RESEARCH METHODOLOGY

3.1 Theories

A lack of theoretical support can be seen in most telework research. Only a handful of studies have adopted theories to develop relevant hypotheses or to guide the research. More theory has been introduced into studies of teleworker-related issues. Theories of freedom and control [4], role conflict models and human motivation [5], the attitude–behavior relation [6], and a job characteristics model [7] have been utilized to increase the understanding of teleworker performance and satisfaction.

Due to the scarcity of telework research from the organizational perspective, researchers have only recently begun to look at organizational theories as a way to facilitate understanding of the organizational implications of telework. Ruppel and Harrington [8] employed innovation theory to identify variables that affect organizational efforts to adopt a telework program. As an administrative innovation and a process-oriented change that responds to internal or external organization stresses or opportunities, telework requires an effort to react to a qualitatively different, postindustrial environment that forces frequent and faster organizational innovations [9]. Taking an innovation approach permits gaining an understanding of relations between organizational factors and telework. It also offers rich process theories that facilitate the cumulative progress of telework research based on different research streams [10]. Devey and Risman [11] adopted contingency theory to explain labor process reorganization of teleworkers at an organization. They suggested that work reorganization was the consequence of interactions among managerial goals, organizational constraints, and the power of employees. Gray [12] suggested that the agency theory that models the relationship between an owner (principal) and employees (agency) in determining optimal contracts can provide useful explanations of certain telework issues. For instance, a variety of research issues including contracting or compensation, outsourcing, design of an information system, and task assignments could be facilitated by adoption of the agency theory [13].

3.2   Nature of Studies

Out of the telework publications reviewed, about 60% were empirical and the rest were nonempirical. Several of the empirical studies relied on archival data such as a census rather than on data tuned and gathered for a specific research focus. Many of the empirical studies were exploratory in nature. Studies by Ruppel and Harrington [8], Venkatesh and Vitalari [14], Salomon and Salomon [5], Hamer et al. [15], Devey and Risman [11], Salomon et al. [16], Duxbury et al. [17], and Dubrin [7] belonged to the small pool of confirmatory studies.

Most nonempirical studies depended on anecdotal discussion of telework motivations, factors, advantages, disadvantages, and barriers. Appropriate personality requirements and task characteristics necessary for successful teleworkers were other popular issues. Many studies have covered telework issues rather broadly. Although generalities may have provided a better view of telework implications, the lack of focus in many studies has resulted in a paucity of research rigor.

Several conceptual models and research frameworks have also been presented. Brandt [18] proposed a conceptual framework for organizational design and applied it for the simultaneous design of the spatial structure, formal structure, and communication equipment of an organization. Mokhtarian and Salomon [6] introduced a model that depicts an individual's decision to telecommute. A framework to assess organizational feasibility for telework was proposed by Tamrat and Warren [19]. A cultural contingency model that accounts for the different telework development patterns in the United States and Japan was proposed by Higa et al. [20].

3.3   Spatial Structures of Telework

Most empirical studies of telework, especially studies conducted in the United States and Europe, were predicated on home-based work. On the other hand, those implemented in Japan collected data primarily from satellite offices or local offices because of the prevalence of collective telework arrangements initiated by organizations. Nakamura et al. [21], Rao [22], Shin et al. [23], Spinks [24], and Spinks and Wood [25] did empirical studies based on satellite (or local) offices.

The spatial structure of telework is an important issue that needs more attention. A collective form of telework is a compromised arrangement between home-based work and in-house (or centralized) work. As such, although work flexibility may be limited, the alleged side effects of home-based telework, such as the social isolation and the individual concern for career development, may be curtailed. In addition, increased confidence in worker productivity, higher levels of security, and better access to information and equipment may be benefits [26]. A reduced need for coordination and supervision can be expected because a less dispersed spatial structure requires less attention to some aspects of the formal structure of the organization [18].

Besides, the need to select the right teleworkers based on personality and task types and the enforcement of the teleworker's obligation to maintain appropriate contacts may become less important. The relaxation of selection requirements may speed up the large-scale diffusion of telework at an organization. For instance, it was

indicated that employees whose jobs are appropriate candidates for home-based telework constitute only a minority of potential teleworkers, but more than half of state employees may be able to work at satellite offices [27]. This evidence naturally warrants devoting more research effort to the collective mode of telework. A comparative study of individual and collective settings in terms of telework effectiveness (e.g., cost, productivity), teleworkers' attitudes (e.g., satisfaction), and the quality of organizational process (e.g., communication) is also important.

3.4   Sample Characteristics

Two sampling-process biases appear to be prevalent in telework research. First, substantial imbalance in the job characteristics of selected samples has been shown. Most empirical studies employed samples from information systems (IS) specialists such as IS programmers, IS analysts, computer center workers, and system developers. A few empirical studies adopted both IS and non-IS workers. Olson [28] used general professionals in addition to system specialists. General clerks, system personnel, and engineers were used in Rao [22]. The case study by Katz [29] employed a mechanical engineer. Studies by Kraut [30] and Olson [31] were based on professionals, managers, and clerical workers. Even in the studies that mobilized non-IS personnel, professionals occupied a large share of the samples. It may be that telework is a popular phenomenon among professionals whose tasks are well defined, who are able to work independently, who are knowledge workers, and who are working in the field of information technology (IT). Nevertheless, study results based solely on professionals' behavior are limited in their generalizability. Above all, organizational motivations for a telework arrangement for professionals (e.g., skill retention) could have been substantially different from those for nonprofessionals (e.g., cost reduction). Also, professionals appeared to have been given better working conditions (e.g., task design and technology support), which may have affected their performance positively [11].

A second source of potential bias is that, to ensure the success of the telework program, teleworkers in most studies were selected from a pool of people who met certain selection criteria for personality and the type of task performed. In some cases, the employee selection was influenced by his/her supervisor [32]. Data analysis based on screened workers who are predisposed to be motivated and effective can be expected to produce positive results for a telework program. However, such selectivity could pose a serious threat to the generalizability of empirical results.

3.5   Methods of Data Collection

Most studies adopted self-report surveys to collect relevant data from teleworkers. Heavy dependence on perception-based surveys could be problematic in telework research because of the significant gap between the perceptions and the actual behavior of people [33, 34]. This gap could be particularly substantial in a performance study of teleworkers. Exaggeration of job performance (e.g., productivity) by teleworkers becomes probable because of their circumstances. For instance, the

Table 1
Suggestions for the Methodological Improvement of Telework Research

Research Methodology	Possible Future Directions
Theories	Adoption of organizational theories
Nature of studies	Narrowed research focus
	Empirical validation
	Confirmatory research
Spatial structures	Balanced study between home offices and satellite offices
Sample characteristics	Use of nonprofessionals as well as professionals
	Use of nonselective samples
Data collections	Variety in data collection methods
	Information both from teleworkers and managers

pressing need for continued telework could result in false responses from teleworkers in their productivity evaluations. The substantial discrepancy in the evaluation of productivity between teleworkers and managers [35] appears to confirm that teleworkers' self-responses are indeed error prone. The possibility of self-report bias should be addressed in future research. For this, data can be collected in multiple formats (e.g., survey, interviews, logs) to counteract methodological weaknesses. Data collection from both teleworkers and managers (or supervisors) and comparison of their evaluations also could partially decrease response bias. Lastly, adopting a control group and a longitudinal approach whenever possible should certainly improve the reliability of an empirical study. Proposed future directions of telework research are summarized in Table 1.

4. FOCUS OF EXISTING TELEWORK STUDIES

Telework is hardly a narrow research field when its ultimate goal is considered to be improvement in both individual welfare and organizational interests. Naturally, research effort should be directed toward balancing the various aspects of telework for the systematic understanding of its implications. Existing studies, therefore, were reviewed from this perspective and characterized in terms of the research focus. Major categories of teleworkers, organization, society, IT, and cost effects were used for the review. Although cost effectiveness of telework is at the boundary of organizational issues, its importance warrants separate discussion.

4.1 Teleworker Focus

The largest number of studies placed their emphasis on teleworker-related issues. Teleworkers' legal and contractual issues were discussed by Hartstein and Schulman [36] and Heikkila [37]. Hesse [4] studied the potential of telework for disabled persons. Changes in worker motivation and job attitude resulting from telework were investigated by Katz [29] and Olson [32]. Work–family conflicts caused by telecommuting were studied by Duxbury et al. [17]. Dubrin [7], Pratt [38],

and Tamrat et al. [39] studied teleworkers' job satisfaction. Vitalari et al. [40] examined how home computer usage changed time allocation for other activities. Pratt [38] discussed social isolation, changes in work habits, and career development of teleworkers. The issue of appropriate jobs and adequate personality for telework was covered by a number of studies including those by Olson [31], Pratt [38], and Tamrat et al. [39].

4.1.1 Work Reorganization. Work reorganization or appropriate task design for achieving higher telework effectiveness was frequently visited as well. Although empirical studies rarely reported effects of telework on employees' task reorganization, academic opinions were largely divided into two schools of thought. The first of these suggested principles of task structuring and clustering of responsibilities. Dubrin [7] and Rao [22] indicated that assignment of structured and repetitive tasks was likely to make teleworkers more productive. On the other hand, other studies recommended that teleworkers given enlarged jobs with high degrees of control, autonomy, and responsibility might show better performance and satisfaction [11, 28, 32].

It appears that the issue should be understood from a contingency perspective based on such factors as the measurement benchmark of telework effectiveness (e.g., satisfaction, productivity), motivations of a telework program, nature of the assigned task, and the level of electronic linkage. For instance, one of the main justifications for advocating the structuring and clustering of teleworkers' responsibilities was the difficulty of maintaining effective communication among distributed workers. However, depending on the level of electronic linkage at an organization (e.g., multichannel communication, automated work flow, accessibility to an intranet), such clustering of similar tasks may not necessarily constitute a essential condition for effective work coordination and control. Profound technological advancement is literally allowing virtual work to be more productive in many cases, even for communication-intensive tasks. As another example, worker empowerment through job enrichment may be appropriate when an organization is more concerned about strategic opportunities (e.g., customer linkage) than labor cost control.

4.1.2 Teleworker Productivity. Changes in teleworker productivity were consistently of interest to a number of studies [2, 7, 32]. These studies were remarkably alike in pointing out the positive effect of telework in enhancing individual productivity. However, except for a few state-commissioned studies such as the Evaluation Audit and Review (EAR) Group Report [41], research that systematically investigated productivity changes resulting from telework has been rare. Most studies merely quoted anecdotal program reports or referenced nominal discussions based on hearsay without mentioning methodological details [35]. There are methodological and conceptual weaknesses in existing literature as well.

Several methodological weaknesses have been noted in the productivity research. First, the measurement of productivity change depended primarily on bias-prone self-reports. Telecommuters' and managers' different evaluations of productivity gains appear to exemplify perception bias [35]. Second, sample populations selected under particular personality and task criteria, in general, can be expected to have higher work motivation and, therefore, contribute to increased

productivity. Third, the relegation of other tasks to on-site workers may have contributed to increased telework productivity. Finally, higher productivity might have been the consequence of increased working hours. Motivated workers may have invested the commuting time saved in extra work. In such a case, if the productivity is measured as the ratio between inputs and outputs, an increased amount of work done during extended working hours does not necessarily mean increased productivity.

The traditional concept of *productivity,* the ratio between quantity of input and output, may not be appropriate for the measurement of knowledge work because of difficulty in its quantification. Accordingly, future research may be facilitated if subcomponents (or alternative measures) of productivity are identified. The effect of telework on each subcomponent (or alternative measure) and on the dynamics among subcomponents could then be examined. For instance, Gordon [42] proposed an effectiveness concept that covers multidimensional aspects of work characteristics in terms of quantity, quality, timeliness, and multiple priorities. Multiple priorities represent "how many things can be done simultaneously" [42] by a teleworker. Similarly, the EAR Group [41] investigated teleworker performance from perspectives of overall work productivity, quantity of work, quality of work, the ability to meet deadline, absenteeism, punctuality, and overtime work.

4.2 Organizational Focus

Although telework is an organizational phenomenon, relatively few studies have paid attention to its organizational implications. Organizational variables that facilitated telework adoption and diffusion were empirically studied by Ruppel and Harrington [8]. Brandt [18] discussed telework from the perspective of organizational design and spatial structures. Organizational motivations for a telework program were discussed by Frolick et al. [43]. Zamindar [44] studied the relation between organizational characteristics and the degree of telework adoption. Issues of organizational suitability for telework were discussed by Higa et al. [20]. Overall, the small volume of telework research in this category severely limits our understanding of its organizational implications and demands additional research.

There is notably little research on what forces effectively influence successful telework implementation at an organization. In some organizations, telework programs progressively evolved into an established organizational structure. In other organizations, attempts to establish the flexible work system failed or were abruptly terminated, often due to lack of employee response. However, our understanding of critical success factors in telework in organizations is highly limited. Relevant research requires identification of determinants or components of telework success, apportionment of potential indicators to each success factor, and empirical validations. Prospective telework success factors and relevant indicators are discussed next.

4.2.1 Measures of Telework Success. Telework success may not necessarily mean intraorganizational diffusion of the program. Rather, it is a multidimensional concept that applies to both teleworkers and organizations. Frequently stud-

ied variables in evaluations of telework effectiveness are satisfaction of employees, management and customers, productivity changes, and cost–benefit effects. Changes in organizational image and workers' interest in telework (e.g., number of inquires), number of teleworkers (diffusion), and number of teleworking days may become other operational measures of telework success [45] that are more practical and microlevel variables.

Telework success may be examined from the more theoretical perspective of organizational effectiveness. Although no general agreement exists on what comprises effectiveness, it is regarded as an ultimate goal of organizational design and changes. The competing values framework, for example, identifies four primary dimensions of organizational effectiveness [46, 47]. *Open systems* views effectiveness in terms of response to external environment. *Rational goal* places the focus on economic goals such as profit maximization, productivity, and efficiency. *Human relations* emphasizes an organization's personnel behavioral structure as exemplified by employee morale, cohesion, and commitment. Finally, the quality of organizational communication and control becomes an important criterion of *internal process.* Understanding telework success along effectiveness dimensions may offer systematic views on its potentials, strengths, and weaknesses and help an organization direct its future strategy.

4.2.2 Potential Indicators of Telework Success. The literature review revealed a number of contingency variables that may contribute to telework success. The nature of organizational motivations for telework may hold a key for the success. Telework initiated by organizations to meet certain strategic purposes may be easier to maintain than an adoption started to satisfy individual needs. Successful telework may demand effective marketing to employees. The marketing effort may entail managerial support for the telework program and the provision of carefully crafted organizational policies. The acceptance of telework by an organization or worker may be contingent on its compatibility with existing organizational norms. Compatibility is a positive indicator for the effective adoption and diffusion of an innovation [48, 49]. A telework program that fits into current organizational cultures, procedures, and value systems may have a higher chance of success.

Telework success may depend on internal and external organizational constraints. Telework may be less successful in an organization characterized by low job specialization (or professionalism), high centralization in decision making, and less formalized rules and job evaluation systems [8]. Task design for teleworkers including portability [14], autonomy, and responsibility [10] may comprise success factors. The degree of electronic linkage and technology support (or task–technology fit) may constitute technological constraints. Availability of underutilized resources that can help bear the cost of purchasing technology and other requirements of instituting a telework program may help lower a substantial hurdle to successful telework [28]. Organizational and worker attitudes for telework may be influenced by government regulations on teleworkers' status, compensation, and other incentives such as income tax credits [42].

Managerial attitudes may be an important indicator of a telework program success. The role of management as an effective influence for organizational change has been found in many studies [10, 49–52]. Management is the one force that can

abolish existing structural inertia [53] and direct organizational resources toward an implementation effort [51]. Studies indicate that top-down initiative is especially effective in encouraging adoption of administrative innovations [50, 54]. When telework is introduced in an ad hoc fashion based on employees' requests, it may be difficult to sustain as part of the organizational structure without support from upper-level management.

Major resistance to a telework program often comes from middle managers, primarily because they perceive that supervision and coordination will become more difficult and that their workloads will be increased by having to manage teleworkers appropriately [42, 51]. Preparing a cost–benefit analysis, safeguarding proprietary information, maintaining and monitoring telework equipment, and ensuring sound ergonomic telework practices are indeed additional tasks required by supervisors. Naturally, overcoming the concerns of middle managers and gaining their support may be critical to success. Supervisors also may have to increase their management-by-objective (or management-by-results) skills to set clearly defined goals, assess progress, and give regular feedback.

4.3   IT Focus

IT has been generally considered a moving force propelling telework, but only a few studies have focused on this issue. Olson and Primps [55] offered a framework describing how IT can improve the effectiveness of distributed work. Nakamura et al. [21] studied the impact of multimedia communication systems on telework. Teleworkers at several local offices of a Japanese company participated in the experiment in which the role of multimedia systems (e.g., voice and video conferencing) in improving the effectiveness of remote communications was examined. The potential of new technologies for addressing communication needs of small businesses was empirically studied by Gupta et al. [56].

Research on the role of IT in telework may be especially significant because the most notable negative effect of telework results from the deterioration of internal processes such as organizational communication and control. Concern about the degradation of internal processes is, in fact, the primary reason for the scarcity of employer-initiated telework programs [30]. However, state-of-the-art information technologies offer an effective mechanism for addressing this concern in ways that include information management, monitoring capability, and communication and collaboration support. In particular, the revolution in data communication technology enables any worker to belong to the virtual network of a company regardless of his/her geographical location. The enhanced quality of internal processes is expected to reduce frequently discussed side effects of telework such as isolation, role conflict and ambiguity, and difficulties in coordination and supervision of teleworkers.

One area that needs more research is media use by teleworkers and consequent work performance. A variety of available technologies include e-mail, voice mail, audio and video conferencing, fax, and the World Wide Web. These tools are vastly different in their information carrying ability, provision of accessibility to information and data, portability, transportability of work (e.g., workflow management),

and collaboration support. Mokhtarian and Sato [57] suggested that commonly available IT can have a marked effect on organizational processes. It appears that general-purpose IT applications (e.g., e-mail and the Web) have a larger impact than specialized IT (e.g., video conferencing) in reducing task uncertainties and facilitating better coordination between an organization and its teleworkers. It was also shown that effective adoption of a general-purpose communication medium (e.g., e-mail) gave teleworkers an information-rich tool that enhanced their work productivity [58]. Overall, more empirical investigations in this field should improve our understanding of the effect of IT on telework effectiveness and teleworkers' performance.

4.4   Cost-Analysis Focus

Telework and cost effectiveness is a complicated issue that may not be defined in a linear relation. Cost considerations could become a significant constraint in an organizational attempt to introduce a telework program. On the other hand, certain organizations adopt telework to reduce overall operational cost [2, 43, 59]. Measurement of its cost effectiveness at an organizational level is difficult because of confounding factors. First, many cost-bearing variables are not quantifiable and overall cost effectiveness is the composite result of both quantitative and qualitative costs–benefits. For instance, undetected benefits from improved productivity, satisfaction, and morale, as well as reduced absenteeism and turnover, could easily outweigh observable costs. Second, certain costs are frequently absorbed by teleworkers themselves. Examples include the purchase of a larger house to create office space, the purchase of office furniture and supplies, the installation of extra phone lines and equipment, interior decoration, insurance, and additional utility charges. When companies offer a telework program based on established policies, they typically reimburse all or part of the related costs. However, when such a benefit is not available, teleworkers may be responsible for the costs incurred.

Methodological difficulties of cost–benefit evaluation have resulted in few empirical studies. Yap [60] suggested an analysis based on cost items classified as start-up costs, capital costs, operating costs, and management costs. The EAR Report [41] examined overall cost impacts of telework from both organizational spending and teleworkers' personal expense perspectives. The study indicated that, overall, the cost burden of telework was not substantial and most supervisors (92%) felt that increased productivity, reduced absenteeism, and savings on office rent would compensate for any costs incurred. Salomon et al. [16] compared the telecommunications costs incurred during remote conferences with the traveling costs for on-site business meetings to demonstrate cost savings resulting from reduced travel. Wilkes et al. [59] discussed a variety of cost items necessary to cost–benefit analysis. Tamrat and Warren [19] showed a generalized formula that adopted fixed and variable costs for a cost–benefit analysis at an organization. Westfall [35] conducted a hypothetical economic analysis of telework that was contingent on cost items including support costs, productivity effect, and occupancy cost. Overall, more empirical work is needed to validate the cost effectiveness of telework at an organization. Relevant studies will become a valuable source of in-

formation, especially for practitioners, who often introduce telework to reduce operating cost.

4.5   Social Implications Focus

Several studies dealt with social impacts of telework. The relation between telecommuting and travel pattern was studied by Mokhtarian [26] and Hamer et al. [15]. Pendyala et al. [61] investigated changes in household travel behavior resulting from telecommuting. Nilles [62] conducted a study regarding the effect of telecommuting on the degree of urban sprawl. The relation between telework and energy consumption was examined by Himanen et al. [63]. In addition, several studies indicated its social benefits in terms of reducing traffic congestion, air pollution, and health costs related to air pollution and conserving energy [27, 64, 65]. Overall, results of the studies strongly suggest that large-scale telework could exert substantial social and environmental benefits.

In summary, the literature review revealed a considerable imbalance in the focus of telework research. Although much effort has been placed on studying teleworker-related factors, the issues of cost, IT, and organizational implications have received much less attention. This disparity has prevented an effective and balanced accumulation of telework knowledge. Also, heavy focus on personal issues appears to create a misconception that teleworkers are at the center of telework research. Telework is an organizational phenomenon, and the success of a telework program will be decided by organizational rather than individual factors. More effort, therefore, should be directed toward understanding the organizational consequences of telework (see Table 2).

5.   RESEARCH PARADIGM

Current approaches to telework design can be characterized as suitability-based planning, in which restrictive criteria are applied in selecting the right teleworkers and tasks and ad hoc implementation initiated to solve local and short-term problems of an organization (Figure 1). A number of telework studies have discussed suitability requirements in terms of personality, demographics, tasks, and occupations. It has almost become a standard that meticulous selection of workers and

Table 2
Suggestions for Future Directions in Telework Research

| Research Fields	Possible Future Directions
Work reorganization	Contingency-based approach
Telework productivity	Multidimensional measurement of work effectiveness
Measures of telework success	Theoretical perspectives of organizational effectiveness
Telework and information technology	Media use and work performance
Cost–benefit analysis	Theoretical framework for cost–benefit analysis
	Orientation for empirical studies
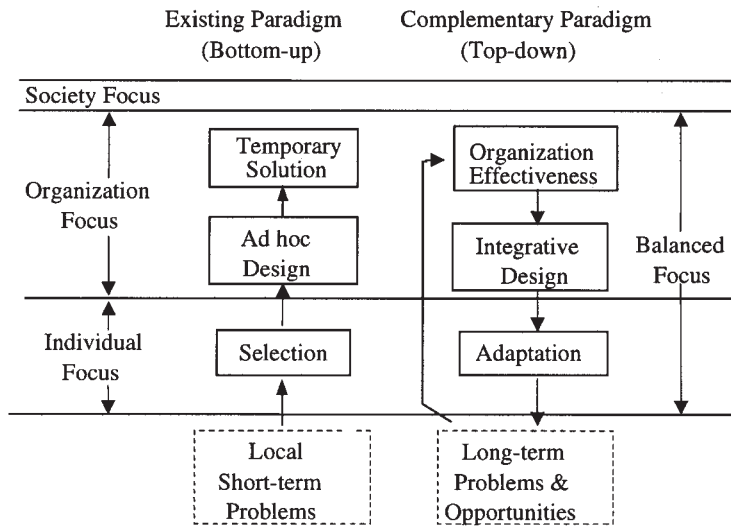
Figure 1.   Balanced paradigm of telework research.

tasks is the necessary condition for a successful telework program. Most empirical studies have used teleworkers screened by suitability criteria to measure the effectiveness of telework and the performance of teleworkers. To a certain degree, careful selection of teleworkers and tasks based on certain guidelines will increase the chances of success of a telework program. However, it may also be true that this selection paradigm is severely limiting large-scale diffusion of telework and realization of its full potential as a strategic choice for organizations.

Ad hoc telework is "arranged by local supervisors, without formal support from the company, to privately approve employees' requests to work at home" ([8], p. 104). In reality, telework initiated by employees as a bottom-up mode is much more common than telework initiated by management. It was indicated that over 80% of telework programs have been started on ad hoc basis [8]. Such a solution is a temporary measure for dealing with employee problems, and telework thus initiated may not be sustained as part of the organizational structure when top-down support for the policy is absent.

A more flexible research paradigm is deemed necessary to realize the full benefits of the distributed work arrangement and to achieve its large-scale infusion within organizations (Figure 1). Under the complementary paradigm, research effort also must be placed on the adaptation of telework to anyone and for any tasks (except those with generic limitations; Figure 1). Furthermore, teleworkers should be able to work full-time at home or at satellite offices and make visits to their company as necessary. In this regard, Hartstein and Schulman [36] maintained the importance of a nondiscriminatory telecommuting policy from the legal perspective. Similar arguments have been made that job function and personality requirements are not sufficient to determine the suitability of adopting telework [20].

For nonselective telework to be successful, organizations may have to take a more top-down, integrative, and goal-oriented design approach. Spinks and Wood [25] suggested that extensive adoption of telework, regardless of task and persons

involved, is viable if the training, support, and evaluation processes are elaborated and applied. We speculate that organizational mechanisms that effectively reproduce teleworkers' motivation and strict goal-oriented initiation of telework are additional factors that can relax the suitability assumptions. The success of Japanese local offices [20] formed for the recruitment and retention of local talent illustrates that such need-based initiation of telework could overcome the limitation of strict requirements regarding the right people and appropriate tasks.

6.   CONCLUSIONS

In this article, we have summarized and characterized existing telework studies and suggested different evaluation criteria for consideration in designing future telework research. The literature review revealed several weaknesses and limitations of current research practices. First, there has been a lack of rigor in research methodology in many studies. It was proposed that telework research could be improved in various ways, including active adoption of relevant theories, deviation from nominal discussion, reduction of sampling bias, and data collection in multiple formats (e.g., survey, interviews, logs) to complement one another. Second, it was learned that unbalanced attention has been placed on teleworker-related personal issues, although telework is an organizational phenomenon. Our current understanding of areas such as the organizational implications of telework, the role of IT in telework, and cost–benefit effects is limited, making further research imperative. Finally, having characterized the current telework paradigm as suitability-based planning that selects the right persons and appropriate tasks and uses ad hoc implementation responding to local needs, we proposed flexible adoption of a broader paradigm that encompasses development of a telework policy from selection to adaptation and moving from ad hoc solutions to goal-oriented planning for better fulfillment of telework's potential.

Telework research has been somewhat unfocused, and this review was intended to encourage improvement of research practices. As a final point, we conclude that telework is likely to produce more visible consequences when it is introduced to address front-end issues such as the reduction of overhead costs, increased productivity, and enhancement of employee satisfaction and morale. On the other hand, research attention should also be placed on strategic utilization of telework in terms of integration of virtual processes (e.g., customer responses), improvement of organizational resilience and flexibility, and facilitation of organizational learning. For instance, to certain businesses (e.g., the IT industry), internal experience can be an especially valuable learning tool to better understand telework and open possibilities for capturing a growing market for teleworking products and services.

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