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INFORMATION TECHNOLOGY AND MIDDLE MANAGEMENT DOWNSIZING:

A TALE OF TWO CITIES

Abstract

Middle management downsizing is a strategic issue in today's organizations. It is used to make firms more flexible and responsive in highly competitive and turbulent environments. Despite the fact that the effects of information technology (IT) on organizational downsizing have been studied extensively over thirty years, little is known on how they occur and what role IT plays in the downsizing process. The paper addresses this particular topic. In-depth case studies were conducted in two American city governments over a ten year span to determine how IT leads to middle management downsizing. The findings indicate that top managers of the more computerized city were able to reduce middle management more than top managers of the less computerized city. IT effects seem to be taking place through a classical capital-labor substitution mechanism. By increasing efficiency of middle managers at performing routine tasks, IT creates slack resources which are used by top managers to downsize middle management. In addition, in an effort to offer a constant level of services to the population at lower cost, IT-induced slack resources are used by top managers to redeploy human resources from management to operations, and to shift the overall allocation of human resources from internal departments (e.g., administrative services, community development) to public-related departments (e.g., public safety, public works).

INTRODUCTION

Middle management downsizing is a strategic issue in organizations as top managers recognize that surgical downsizing in response to changing environmental conditions produces better results than wholesale downsizing. The view that the introduction of information technology (IT) would result in reduction of middle management was put forth by Leavitt and Whisler (1958) as they argued many decisions would be automated and information would be widely and easily accessible throughout the organization. As a result, some middle managers would be pulled into upper management, whereas others would be pushed down into first line supervision, but many would no longer be needed. Leavitt and Whisler's predictions have proven to be problematic on several theoretical grounds (Markus and Robey, 1988), and reviews of empirical research indicate that the impacts of IT have been anything but monolithic—IT has both increased and decreased the number of middle managers in organizations and it has both centralized and decentralized authority (Attewell and Rule, 1984; George and King, 1991; Orlikowski and Robey, 1991; Pinsonneault and Kraemer, 1993). Recent empirical research indicates that IT can be used to reduce the number of middle managers, but it is likely to do so only in centralized organizations (Pinsonneault and Kraemer, 1997).

To date, little is known about how this middle management downsizing takes place, and about the specific role IT plays in the process. Better understanding of this mechanism would provide useful insights for the current wave of reengineering and automation that appears to be aimed particularly at middle managers (*The Economist*, 1996). This paper presents a theoretical explanation and explores it in two organizational case studies over a ten year span. It reviews research on managerial downsizing pointing to the need for further understanding the mechanism by which it occurs. It develops an argument, based on reinforcement politics that explains the

conditions under which top managers might reduce middle management through the use of IT. It then presents the results of a case study comparing the middle management effects of IT use in two American cities which employed different strategies and different IT to offset declining revenues. It shows that the use of IT allowed the downsizing of middle management, which created slack resources that were used by top managers to redeploy human resources. Finally, the paper discusses the implications of these findings for research and management practice.

LITERATURE REVIEW AND THEORETICAL PERSPECTIVE

Leavitt and Whisler's (1958) seminal article generated a vast amount of speculation and research on how IT affects middle managers and their work, and the continued prediction that IT would decrease the number of middle managers in organizations (Child, 1984; Drucker, 1988; Malone, Yates, Benjamin, 1987). These authors argued that middle managers perform mainly informational roles and that IT, by permitting top managers to bypass middle managers in both downward and upward communication activities, will take over most of middle managers' tasks. Thus, fewer will be required. Over the years, a number of empirical studies provided support for this view (Brynjolfsson, Melone, Gurbaxani, 1988; Crowston, Melone, and Lin, 1986; Pinsonneault and Kraemer, 1997).

Other researchers posited that IT increases the number of middle managers in organizations. They argued that IT increases the complexity of organizations, which requires greater coordination across units and makes middle managers' jobs more complex, both of which increase the number of middle managers needed in organizations. This occurs because middle managers perform far more than just informational roles; they also perform interpersonal and decisional roles, and they use processes and information not amenable to computerization.

Moreover, the use of IT overloads organizations with data that need to be further processed by middle managers to become endowed with relevance and purpose. This plethora of data further increases the number and range of decisions made by middle managers, and also uncovers previously unknown details relevant to management decisions. As a result, middle managers perform richer information roles, make more complex decisions, and analyze more alternatives in greater depth than before. These activities increase rather than decrease the number of middle managers needed. Again, there was support for this view in some empirical research (Lee, 1964; Millman and Hartwick, 1987).

Leavitt and Whisler's predictions, and many of the foregoing studies, were based upon a model of technological determinism which posited middle management downsizing (or upsizing) as an inexorable result of the introduction of IT. However, theory and research has demonstrated that the *technology per se is not a determinant of organizational outcomes, but an enabler, with its effects dependent upon how the technology is used* (Attewell and Rule, 1984; Markus and Robey, 1988; Orlikowski and Robey, 1991; Robey and Sahay, 1996). This recognition of the malleability of IT is found in various perspectives from organization theory, which posit that how the technology is used is contingent upon a number of organizational factors.

The reinforcement politics perspective (Dutton and Kraemer, 1977) posits that the impacts of IT are dependent upon the structure of decisional authority and the motivations of various organizational actors such as top managers and middle managers. According to reinforcement politics, there is a dominant coalition in any given organization (Danziger, Dutton, Kling, Kraemer, 1982; Kling, 1978). The dominant coalition might be comprised of a managerial elite, a technocratic elite or a pluralist array of actors. The coalition might itself be further comprised of subgroups such as top managers and middle managers. Whose interests are

served depends upon the system of decisional control and the motivations and strategies of these actors. When decision control is centralized, top managers constitute the managerial elite. They have great influence over decision making and their interests will be better served. Conversely, when control is decentralized, middle managers will have greater influence and their interests will be better served. Reinforcement politics further argues that the interests of the dominant coalition will be enhanced to the extent that control over IT is congruent with the general control structure in organizations. That is, top managers will have greater influence when both IT decision authority and the organizational decision authority are centralized. Given the fact that top managers are interested in greater ability to respond to environmental change (which is best accomplished by leaner organizations), they are likely to choose and use IT that increases efficiency in performing some tasks at the middle management level, which facilitates the downsizing of middle management. Conversely, middle managers will have greater influence when both IT and the organization decision authority are decentralized, and, because they are primarily interested in preserving and expanding their domain, they will choose and use the IT that enhances their information, decision, and communication capabilities.

A recent study examined these two contingencies and found strong support for the predicted effects of IT on middle managers (Pinsonneault and Kraemer, 1997). The effects of IT were contingent upon the "congruence" between the IT and organizational decision authority structures. That is, when both organizational authority and computing authority were centralized (extensive centralization), the higher the extent of IT penetration, the lower the number of middle managers. Conversely, when both decision authority structures were decentralized (extensive decentralization), the higher the extent of IT penetration, the higher the number of middle managers. When computing decision authority was centralized but the organization

decentralized (partial decentralization) or vice versa (partial centralization), the effects of IT on the number of middle managers was not significant.

Taken together, these findings indicate that the use of IT in organizations will reduce middle managers in centralized organizations. But so far, only the structural contingencies in the reinforcement politics argument have been tested. Management motivations/strategies and the role of IT per se have not been examined. The current study furthers the analysis of IT impacts on middle managers by studying the mechanism by which middle management downsizing takes place in two cities that are remarkably similar, except for management motivation/strategy and the extent of IT penetration and usage. The key question this study addresses is: How does middle management downsizing take place and what is the role of IT in the process?

We try to answer this question through an overall argument that links the role of IT, management strategy, structural congruence and environmental conditions. The argument is that the use of IT in organizations permits middle managers to perform routine and structured tasks more efficiently, thereby creating slack resources at the middle management level. Whereas the slack resources might facilitate greater decentralization of decision authority in some organizations (George, 1986; Klatzky, 1970), we argue, based on the reinforcement politics and on the downsizing literature, that the slack resources are eliminated or redeployed when organizational and IT decisions are both centralized and when environmental threats or opportunities motivate top managers to reorient and rationalize the organization.[1]

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[1] Although not pursued in the present paper, the converse argument is that when such decisions are decentralized and the organization's environment is stable, middle managers are in greater control over the use of computing and will instinctively use it to maintain or increase their numbers in a classic bureaucratic expansion/self-preservation strategy. Further, when there is lack of congruence between organizational and computing decision structures, the outcomes for middle managers will be marginal (only small increases or decreases).

The above argument is supported by research on the impact of IT on managerial work which indicates that IT usage makes middle managers more efficient in performing some activities, and that IT impacts are mainly determined by the context in which it is implemented, rather than by the technology itself (Pinsonneault and Rivard, 1997). The argument is also supported by research on organizational downsizing which indicates that downsizing is undertaken purposively by top managers and middle managers. Whether and how downsizing occurs depends upon which of these actors controls change efforts and their motivations/strategies (Tushman and Romanelli, 1985). Top managers control downsizing efforts primarily during episodic periods of organizational reorientation when they are motivated to reverse poor performance or prevent threats to good performance. They adopt strategies aimed at reducing costs by systemic change in structure, technology and work which usually results in dramatic downsizing of staff, including administrative staff.[2] In contrast, middle managers control downsizing during the much longer periods of convergence, stability and adaptation, and are motivated by preservation if not growth of their domain. They adopt strategies which maintain existing structural arrangements while changing the nature of work, technology or domain. Work will tend to be supported and reinforced by the technology, and the middle management domain might be enlarged by pulling down work from higher level managers.

Thus, the downsizing literature suggests two explanations for why the predicted reductions of middle managers as a result of IT penetration might not have shown up clearly and

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[2] The downsizing literature indicates that three kinds of changes can be undertaken in order to accomplish the organization's mission with fewer people: changes in work, in technology, or structure. Freeman and Cameron (1993) argue that these operate in a nested hierarchy in which changes in technology are more radical and require more redesign than changes in work. Similarly, changes in structure require more redesign than changes in technology. Thus, managers using an incremental approach to downsizing will focus their efforts most heavily on changes in work, followed by changes in technology, and lastly by changes in structure. In contrast, managers

strongly in the empirical research before the nineties. The first is that environmental conditions were relatively stable and did not require top managers to change their organizations dramatically, or at least did not require them to change the management/worker ratio dramatically. Consequently, they did not downsize middle management even though the technology might have enabled such downsizing. The second is that middle managers were in charge of change efforts during this period and their incentives were to use the technology to enlarge their domain. Consequently, the downsizing potential of the technology might have been countered by middle managers who sought to expand rather than contract their domain. It is likely that both situations occurred in many organizations, and therefore the predicted reductions in middle management did not occur.

In short, the downsizing and the IT literatures indicates that it is the environmental conditions, the key managerial actors, and the motivations/strategies underlying choices about downsizing that fundamentally determine whether and how downsizing might occur, and what role IT plays in the process. This current study contributes to that literature by indicating the nature of the *mechanism* through which the number of middle managers are decreased. In the process, it also contributes to the more focused discussion in MIS about the impact of IT on middle managers harking back to such classics as Leavitt and Whisler (1958) and the later writings by Drucker (1988).

RESEARCH METHOD

We were interested in understanding how IT affects middle management in centralized organizational settings because prior research indicates that this is where middle management

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facing reorientations will focus most heavily on changes in structure followed by changes in technology and work.

downsizing occurs. We chose a replication logic (studying similar sites) over a sampling logic (studying sites of different natures). We did so because we preferred developing a stronger explanatory model in a limited context and then testing it with organizations in different contexts in future research, rather than increasing the complexity of this study and possibly misunderstanding how IT impacts occurred. In addition, we chose to study cities because they are structured similarly and they perform common functions across the U.S., thereby eliminating potentially confounding variables. We also chose to study growing cities because they could mitigate decreasing revenues from federal and state governments and tax limitations (e.g., California's Proposition 13) with their own initiatives if they chose to. Finally, we used an embedded case study design (performing multi-level analyses in each site) in which the sites were selected so that they included departments where the extent of IT penetration was high, as well as other departments where penetration was low. This increased the probability that there would be significant differences in impacts and it permitted comparison of IT impacts at both the departmental and organizational levels, thereby allowing a finer and richer analysis.

About twenty candidate sites were identified from a nation-wide survey of computing in city governments. Two medium-size California cities were chosen for their environmental similarity on the one hand and their varying degrees of IT penetration at departmental level on the other hand.

The study was conducted over a ten year span and three main data collection methods were used: questionnaires, interviews, and documents. *Questionnaires* were used to obtain factual data for the 1985-1990 period.[3] One questionnaire assessed the extent of IT penetration with an inventory of 468 city government IT applications, 187 of which were most likely to affect middle

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[3] These questionnaires were developed and tested in a nation-wide survey of computing in city governments

management. These managerial applications, (a) crossed hierarchical levels and allowed higher-level managers to monitor lower-level activities and to disseminate information directly, without middle management intervention (e.g., EIS, budget control, scheduling, inventory management, dispatching systems), (b) supported inter-unit communication and coordination across units or departments (e.g., GIS, financial systems, electronic mail); and/or, (c) increased middle managers' personal efficiency and productivity (e.g., word processing, spreadsheets). Two other questionnaires, completed by the City manager or an equivalent official, assessed the cities' environmental and organizational contexts (e.g., local and state economy, population growth, number of employees, revenues, expenditures).[4]

Following the survey, 40 in-depth structured *interviews* (21 in New City and 19 in Old City) were conducted with city managers, department heads, middle managers, and the IT managers to analyze the relationship between IT penetration, management strategy, and middle management downsizing.

Documents, such as annual budgets, job descriptions, organization charts, and newspaper clippings were used to supplement and validate the data collected through the questionnaires and the interviews over the ten year period.

FINDINGS

Site Description: A Tale of Two Cities

Table 1 presents the environmental, organizational, and IT contexts of New City and Old City. With respect to their **environment**, both cities were located in Orange County, California and had a population of about 120,000 in 1995. New City was formed in 1963, whereas Old City

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conducted. The detailed research design and of that study is reported in Danziger and Kraemer (1991).
[4] Questionnaire development and pre-test procedure, as well as reliability of different measures, are presented in Pinsonneault and Kraemer (1997).

was formed in 1888. Both cities were growing, but New City was growing faster than Old City, adding over 4,000 new residents per year between 1985-95 versus 2,000 for Old City. New City was growing in all direction and Old City was growing mainly at the eastern edge of the city. Both cities' economies were mixed, with New City having high-tech industry and high-end businesses and Old City more in the middle of the spectrum (Table 1).

Insert Table 1 about here

The **organizational context** of the cities was also similar. Both had highly centralized organizational decision authority exemplified by the city manager form of government with its strong chief executive and five levels in the management hierarchy, two of which were middle management. The number of employees in New City had decreased by 55 between 1985-95 while its population increased by 50%, thus lowering its ratio of employees per 1,000 residents from 7.28 to 4.41. In contrast, Old City grew by 25 employees during the same period, with its population increasing by 21%, and its ratio of employees per 1,000 residents decreasing from 6.98 in 1985 to 5.35 in 1995.

Table 1 presents the financial situation in two distinct periods of time (1985-90 and 1990-95). Between 1985-90, both cities, as well as most American cities, suffered decreasing revenues from federal and state governments. In addition, California cities suffered from reductions in local property taxes as a result of California's Proposition 13 tax limitation measure. However, both cities had healthy and growing local economies and so tax revenues grew, although they lagged city expenditures. Consequently, other measures were needed too. Top management in the two cities chose fundamentally different strategies to further mitigate revenue reductions.

Management in New City was very conservative with its finances, keeping a large reserve fund, whereas Old City spent close to the level of its revenues. New City sought to mitigate revenue reductions by a strategy that focused on increasing license and permit fees, adding new fees, using bond financing for capital projects, and increasing long-term debt. In order to cover an operating deficit during one year, New City raised taxes and reduced internal operating expenses. New City's strategy also relied on personnel measures. For example, management in New City decided to temporarily reduce the hiring of new employees, to eliminate vacant positions, and to hire more part-time workers. In contrast, top management's strategy in Old City relied on revitalizing the local economic base, providing incentives to attract new firms while also trying to retain old ones, and encouraging business to expand within the city. It also issued bonds to pay for infrastructure improvements needed to support retention and expansion. Old City also increased collection of receivables, accelerated collection of revenues, increased license and permit fees, and established new fees for selected services. Finally, top management in Old City, unlike New City, opted to restrain increases in employees' salaries and fringe benefits rather than reducing the number of employees, or new hires. Although the strategies of top management were different, both cities were successful in mitigating revenue reductions such that by 1989, both cities were experiencing increasing revenues. Moreover, both cities held to small increases in personnel despite considerable growth in population and demand for services.

The 1990-95 period was characterized by a major economic downturn in the state and the county. Consequently, the organizational strategies used by top management in New City and Old City in 1985-90 were no longer sufficient to offset decreasing revenues in 1990-95. The average annual revenue growth of New City between 1990-95 was one-eighth that between 1985-90 ($1.0 million per year compared to $8.6 million per year, respectively). Similarly, the

revenue growth of Old City dropped from an average of $1.7 million per year in 1985-90 to an average of $1 million per year in 1990-95. Operating expenditures also shrank dramatically for both New City (from an average of $6.3 million per year in 1985-90 to $1.8 million per year in 1990-95) and Old City (from an average of $4.4 million per year in 1985-90 to $.78 million in 1990-95). Consequently, top management of both cities reverted to additional strategies to mitigate revenue reduction, freezing hiring and favoring early retirement. Top management in New City initiated a major reorganization by the end of 1991, eliminating the Public Services department and merging its operations with the Public Works and Community Development departments. Top management in Old City opted to rationalize operations and to reduce employment in city hall.

While the environmental and organizational contexts of the two cities were similar, the **IT context** of New City and Old City was different in important ways. *First, in contrast to Old City, top management in New City was investing heavily in IT as a matter of policy throughout the 1985-1995 period.* Table 1 indicates that IT budgets increased fourfold between 1985 and 1990 in New City while revenues and expenditures increased by only two times. The IT budget reached its peak in 1995 at $2.851 million for a 12% increase from 1990 while revenues and expenditures increased by about 5% between 1990 and 1995. On the other hand, top management in Old City consistently starved the IT department for funds and staff. Although the IT budget more than doubled from 1985 to 1990 ($748,000 versus $1,695,000, Table 1), the budget almost returned to its 1985 level by 1995 ($869,000, Table 1). By comaparison, Old City's IT budget was less than one-third of New City's IT budget in 1995.

Second, top management in New City had accumulated and maintained a considerably higher level of IT penetration than Old City. New City had 100 PCs/terminals installed in 1985

and it added over 350 micro-computers in 1990-95, reaching 490 personal computers in 1995, or nearly 1 terminal/PC for every employee. In a conscious effort to reduce IT operations cost to be able to pursue its investment in managerial applications, top management outsourced all maintenance, support, and cabling to a local vendor in 1990. Top managers used the savings to add 10 new major managerial applications, such as the Geobase system, even in a period of economic strain, reaching a 73.8% level of IT penetration by 1995.

Old City's level of IT penetration was lower than that of New City. In 1985, Old City had 96 managerial applications in operations (25% less than in New City), and by 1995, it had 105 managerial applications in operation (31.4% less than New City). Old City's applications were also much less accessible, having one PC/terminal for every three employees. Old City outsourced its IT operations in 1984, but retained a team of 6-7 programmers and analysts under the senior assistant to the city manager. Authority for computing decisions, including the outsourcing contract, was centralized in the assistant to the city manager who chaired an interdepartmental IT steering committee, established the plan and priority for applications, and developed requests for funding. Old City's decision to outsource its IT operations was essentially a cost reduction effort. Contrary to top management of New City who reinvested outsourcing-related savings into IT applications, top management of Old City used the savings to reduce IT budget.

Third, New City's automation was qualitatively different than that of Old City as top management gave relatively greater emphasis to managerial applications. New City favored a database approach, integrated applications, and network technologies, whereas Old City relied on stand alone applications (oftentimes using incompatible hardware and software) that did not allow sharing and integrating data across applications. New City used the Pick programming

language, which made applications amenable to on-line database applications and gave the city a leg-up on its computing in two regards: new applications could be brought up faster and managerial applications could be developed more easily because of the database features. New City first automated the basic operational information systems (e.g., purchasing, accounts receivable/payable, payroll and inventory systems), but in later years refocused development efforts towards managerial applications (e.g., budgeting, simulation, geoprocessing, vehicle dispatching, manpower allocation systems). Old City's applications ran on a Prime computer installed in 1986. Soon after Old City had bought its computer, the manufacturer went out of business and the computer could no longer be upgraded easily. Old City automated some operational applications first; however, the lack of integration, and the impossibility to upgrade the computer made it difficult to successfully develop, implement, and use managerial applications, which left managers with very limited IT support. For example, controlling budgets was a very tedious task for managers, as expenses were entered on several different applications that did not update the budget monitoring system on a real time basis. Managers had to wait thirty days beyond the end of a given budgetary period to get information on their respective budgets. Most IT investments in the 1990-95 period was made to revamp its IT infrastructure, like buying a new HP 9000 computer, installing networks, and beginning to replace and integrate some operational applications like building permits, business license, and utility billing systems.

In summary, while New City and Old City were similar in most features of their environmental and organizational contexts, they differed in several important ways with regard to top management strategies for mitigating revenue problems and managing IT. Top management in New City used more internal options such as cutting costs, freezing new hires and eliminating vacant positions to deal with revenue problems, whereas Old City used more external options

such as stimulating business and industry through community development. Old City reverted to internal options in 1990, when the local economy could not sustain decreasing state and federal revenues. New City was more automated than Old City, gave to managerial applications, and provided employees with greater access to IT.

The implication of these differences between the two cities are several. First, the character of IT in both cities supported reduction of middle managers should top management decide to do so, but the nature of IT in New City was more suited to facilitating such an agenda because of its wider penetration in city hall, more integrated databases, and greater proportion of managerial applications (28% more then in Old City). Second, New City's approach to mitigating revenue problems focused heavily on reducing staff and its automation fit such a strategy well. Thus, one would expect the impact of IT on middle management to be greater in New City than in Old City.

IT Impacts: The Tale Continues

Table 2 and Table 3 present the data concerning changes in the number of operations employees, the number of middle managers, and IT penetration over a ten-year period in New City and Old City. The analysis is first performed at the organizational-level for both New City and Old City, and it is then conducted at the departmental-level. It ends with a cross-case assessment that summarizes the impacts of IT in New City and in Old City.

IT Impacts: Organizational-level analysis. The data of Tables 2 and 3 indicate that the overall level of employment remained stable (-3%) in New City during 1985-1990 (bottom row, Table 2), while the overall level of employment increased by 17% in Old City during the same period (bottom row, Table 3). Further, Old City's increase occurred in both internal and public-related departments (22% and 15%, respectively, Table 3) and for both operations employees and

middle managers (19% and 7%, respectively, Table 3). This seems to reflect the strategies used by each city to offset revenue reductions (New City focusing mainly on reducing internal operating expenses, Old City focusing mainly on revitalizing local economy) and the nature of New City's IT applications and its greater IT penetration, which allowed it to control personnel growth better. This is illustrated better in the second period (1990-95), when drastic strategies for mitigating decreasing revenues were needed and when both cities reverted to reducing operations expenses. Top managers of New City were able to reduce the overall employment by over 20% (681 to 539, Table 2), whereas top managers of Old City were only able to reduce it by 11% (797 to 706, Table 3). Also, the number of middle managers was reduced more in New City (-32%) than in Old City (-26%). During 1990-95, New City's greater success at reducing personnel, middle managers in particular, than Old City seems to result less from a matter of policy (both cities had reverted to personnel reduction in that period) and more from its better IT infrastructure. This is clearer when the analysis is performed at the departmental level.

Insert Table 2 about here

IT Impacts: Departmental-level analysis. The data of Table 2 indicate that during 1985-90, middle management downsizing occurred only in highly automated public-oriented departments of **New City**. The number of middle managers decreased by 14% in both Public Safety and Public Services (67% and 71% IT penetration, respectively), while the number of operations employees rose by only 13% and 9% in each department respectively. On the other hand, the number of middle managers and operations employees in Community Services (30% IT penetration level) increased by 19% and 41% respectively (Table 2). The employment pattern in

Public Works, a highly automated department where the number of middle managers increased by 42% and the number of operations employees decreased by 5%, may seem to contradict previous findings, but actually it does not. The increase simply reflects the peculiarity of Public Works of New City which contracted out almost half of its operations. Because middle managers were responsible for letting and managing contracts, their number varied directly with growth in contracting. Also, the very nature of their job made potential IT impacts minimal, as a major portion of their job involved establishing and maintaining contacts with the contractors in the field and resolving problems as they occurred.

In contrast, top managers did not use IT to downsize middle management in the internally-oriented departments. Overall, middle management grew faster than operations employees (59% versus 51%, respectively, Table 2). The number of middle managers increased by 33% in Administrative Services (82% IT penetration) while the number of operations employees increased by only 13%. Similarly, the number of middle managers grew by 7% in Community Development (73% IT penetration), while the number of operations employees decreased by 15%.

The change in employment was markedly different in 1990-95, when New City was under very strong pressures to rationalize operations and when top managers reverted to such a strategy. The data of Table 2 indicate that the change in employment pattern was different between internally-oriented departments, where the number of both middle management and operations employees decreased by 42%, and the public-oriented departments, where the number of middle managers decreased by 22%, while the number of operations employees decreased by only 6%. In particular, the number of middle managers decreased more then the number of operations employees in the Administrative Services department (-42% versus -32%,

respectively), where major IT deployment had taken place (i.e., completing the budgeting systems, central store purchasing and inventory). In contrast, the number of middle managers decreased less than the number of operations employees in the Community Development department (-41% versus -51%, respectively), where no new IT applications had been implemented.

In the public-related departments, the number of middle managers was decreased more than the number of operations employees in all departments. Major IT deployment occurred in Community Services (i.e., parks and recreation facility inventory, vehicle and manpower scheduling and dispatching during) in that period, and it is where middle management reduction was the strongest, decreasing by 26%, compared to an increase of 28% in the number of operations employees. In addition, geographic information systems were implemented in the Public Works department at the end of 1990. This allowed a better coordination and control of activities between Public Works and Public Services. It also provided the IT infrastructure needed by top managers of New City to integrate the operations of these two departments (beginning of 1991) and to substantially reduce the number of middle managers. The number of middle managers was decreased by 17% in Public Safety, while the number of operations employees decreased by only 2%.

Table 3 presents the data on changes in employment of operations employees and of middle managers, and data on level of IT penetration for **Old City**. Table 3 indicates that middle management and operations employees grew in all departments in 1985-90. However, the number of middle managers grew less in highly automated departments than in less automated departments. In addition, their growth was much lower than that of operations employees in highly automated departments. This is particularly noticeable in the public-related departments.

The number of middle managers grew at a much lower pace than the number of operations employees in Public Safety and Public Works (55% and 42% IT penetration level, respectively). In contrast, middle management employment grew by 20% in Community Services, a public related department with a low level of IT penetration (15%), while the number of operational employees grew by only 7%.

In internally-oriented departments, IT had limited effects on middle management employment in 1985-90. The number of middle managers increased by 5% in Administrative Services (71% IT penetration level), and by 11% in Community Development (IT penetration level of 60%).

The important growth of the number of operations employees compared to that of middle managers in Community Development reflects Old City's fiscal strategy of attracting new businesses and retaining existing ones in order to mitigate revenue reductions. This strategy gave particular importance to the Community Development department, especially to operating employees who went in the field to successfully implement the strategy. It conferred a special role to this department, which became increasingly "public oriented". The growth in middle managers followed the increased workload of that department with the implementation of the City's strategy. This explains why IT impacts in Community Development are similar to those in highly automated public-related departments; that is, a lower number of middle managers and a higher number of employees in direct contact with the population.

Insert Table 3 about here

The pattern of employment is different in 1990-95 in Old City. Top managers decreased the number of middle managers in all departments, but the reductions in middle management employment was more pronounced than that of operations employees only in public-oriented departments. In highly automated public-related departments (Public Safety, Public Works), the number of operations employees grew by 6% and 21%, respectively, while the number of middle managers decreased by 7% and 77%, respectively. In contrast, middle management reduction was less than that of operations employees (-17% versus -33%, respectively) in Community Services, a department with a low level of IT penetration.

In contrast, employment reductions in internally-oriented departments favored middle managers. The number of middle managers was reduced by 35% and 20% in Administrative Services and Community Development, while the number of operations employees decreased by 40% and 71% in these two departments, respectively. Community Development is an interesting case. Its mission was transformed in 1985-90, as the city chose to mitigate revenue reductions by revitalizing the local economy. It became essentially a public-oriented department, and IT impacts occurred accordingly; that is, a proportional reduction in the number of middle managers. Given the poor state of the local economy, and very limited success in revitalizing it, top managers decided to almost completely abandon their revitalizing strategy, making Community Development an internally-oriented department once again. IT impacts in 1990-95 in that unit were more like internally-oriented departments, decreasing operations employees more than middle management (71% versus 20%, respectively).

Summary and comparison of IT impacts in New City and Old City. IT penetration and middle management downsizing are closely related in New City. The data indicated that IT effects occurred primarily in departments serving the public directly rather than in internal

administrative departments and that they were more pronounced in the period of high fiscal strain (1990-95). The number of middle managers decreased substantially in Public Safety in 1985-90 and in Community Services in 1990-95, periods at which extensive automation occurred in each department. In contrast, the number of middle managers grew in the public-related departments with low levels of automation (Community Services, 1985-90). The internal administrative departments showed little change in middle management employment related to automation.

When greater pressures to rationalize occurred (1990-95), the number of operations employees and middle managers was reduced equally in the internally-oriented departments. In contrast, the number of middle managers was decreased substantially more than that of operations employees in highly automated public-related departments.

The data indicates that IT is related to middle management downsizing in Old City, but to a lower extent than in New City, and it occurred in the public-related departments only in the period of high fiscal strain (1990-95). Both middle managers and operations employees grew in numbers during 1985-90. The data also indicate that the growth of middle managers in highly automated public departments was lower than that of operations employees (Public Safety, Public Works). In contrast, the growth of middle managers in Community Services (low IT penetration) was higher than the growth of operational employees.

During the 1990-1995 period, middle management downsizing was more pronounced than that of operations employees, overall (-26% compared to -10%, respectively). This was due to stronger reductions in middle management compared to operations employees in the highly automated public-related departments. The number of middle managers decreased in internally-oriented departments, but at a lower rate that the reductions in the number of operations employees, notwithstanding the level of IT penetration.

Thus, the findings support the contention that IT can reduce middle management in centralized organizations. Three additional observations can be made regarding IT and middle management downsizing in New City and Old City. *First, the stronger relationship between IT and middle management downsizing in New City can be attributed to the higher IT penetration into the organization and to managerial strategies.* Recall that top managers of New City favored internal options such as reduction in "new hires" to mitigate revenue reductions. In contrast, top managers of Old City favored fiscal and external options such as increased bond financing. Top managers of New City had a greater propensity to use IT to facilitate mitigation of revenue reductions through staff reductions. The level of IT penetration was higher in New City than in Old City, and so were the impacts of IT. Excluding Public Works (because of its peculiar nature in New City as discussed earlier), New City's average difference between the growth in the number of middle managers and the growth of the number of operations employees in highly automated departments was -16% in the 1990-1995 period. In Old City the average difference was -1% in the same period. New City was able to both reduce the number of middle managers in highly automated public-oriented departments and reallocate resources to operations employees in these departments, and to use IT to redeploy resources from internally-oriented departments to public-oriented departments. In contrast, top managers of Old City were only able to use IT to reduce middle management in public-oriented departments, but not to redeploy resources from internal to public-oriented departments.

Second, the reduction of middle managers is more pronounced in public-oriented departments than in internal administrative departments (relatively to changes in the number of operations employees). Not only was middle management downsizing more pronounced in highly automated public-related departments than in internally-oriented departments in both New

City and Old City, but decreases in the number of middle managers were almost always accompanied by increases in the number of operational-level employees in the highly automated public-oriented departments in both cities. In contrast, the change in the number of middle managers compared to the changes in the number of operations employees in the internally-oriented departments favored middle managers in both cities for the 1990-1995 period. This finding regarding differential impacts of IT in the public-related departments and internal administrative departments is highly consistent with the organizational downsizing literature which indicates that the administrative ratio might not respond, might respond more slowly, or might even continue in the same direction after the introduction of changes such as IT (Liberson, 1985; McKinley, 1992; Marsh and Mannari, 1989; Montanari and Adelman, 1987).

Third, the cities' fiscal condition triggered IT impacts on middle management downsizing. In both cities, the stronger decreases in revenues that occurred in 1990-95 incited managers to reduce or limit the size of the middle management workforce, even when the city was growing, and the workload was increasing. This finding is consistent with the broader research on organizational downsizing. Romanelli and Tushman (1988) argued that top managers are more responsive to changes in their external environment and are more inclined to redirect their organizations in disequilibrium periods (poor performance, weak or declining revenues).

DISCUSSION

Empirical evidence indicates that computing can indeed be used to reduce the number of middle managers in centralized organizations. The mechanism through which IT impacts materialize is as follows. *IT permits middle managers to perform routine, structured tasks more efficiently, thus creating slack resources at the middle management level.* Some authors

suggested that the creation of such slack resources leads to greater decentralization of decision authority (George, 1986; Klatzy, 1970). In contrast, others have found that the reallocation of slack resources depended on whether or not the firm was reorienting its strategy (Pinsonneault and Rivard, 1997). In convergent periods, slack resources were reinvested by middle managers in existing tasks in such a way that their job, overall, remained unchanged. Status quo prevailed. However, in periods of strategic reorientation, slack resources created by IT use were redeployed by top managers to change middle managers' jobs in such a way that they became aligned with, and they reinforced the firm's new strategic orientation. The case studies in this research do not support the decentralization argument, but are convergent with the finding that reallocation of slack resources is contingent upon the organizational context. They indicate that the slack resources created by increased efficiency were eliminated in a classic capital-labor "substitution mechanism", where they were used by top managers to consolidate middle management jobs, and to reduce their number. IT permitted fewer middle managers to perform the same amount of work or even more work.

In addition, the case studies indicate that the reallocation of slack resources occurred through a two level substitution mechanism. The first level was a *simple redeployment of human resources*—from management to operations. The case studies, and Tables 2 and 3 in particular, indicate that the reduction of middle managers in public-oriented departments was accompanied by systematic increases in the number of operational employees in both New City and Old City. In other words, the surplus generated by middle management downsizing was redeployed in line operations.[5] The second level was a *shift in the overall allocation of human resources* from

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[5] The business press is replete with stories indicating that such substitution occurred in many corporate downsizing efforts too. Where downsizing of middle managers has occurred in corporations, middle managers in administrative jobs and headquarters jobs were usually given the option of going back into sales and service jobs aimed at

internal departments to public-related departments. When strong pressures to reduce expenditures existed (1990-95), top managers of New City and Old City reduced substantially the number of employees in the internally-oriented departments, while keeping almost constant the number of operations employees in the public-related departments. Top managers of New City were able to use IT to downsize middle management substantially more than operations employees in internally-oriented departments, leaving the operations of those departments almost untouched, and they were able to transfer more slack resources to operations in externally-oriented departments.

The case studies, and the interviews with managers in particular, provided a detailed explanation of how and why these shifts in employment occur. Declining revenues in both cities (the loss of federal and state funding as well as tax limitations) decreased expenditures, which in turn lead to a reduction, in real or proportionate terms, in the number of operations employees and in the services provided to citizens. This led to dissatisfied citizens, and heightened the pressure on top managers to increase the level of services. Even under normal circumstances, the task of increasing service levels to match rapid growth is exceedingly difficult because revenues follow growth rather than precede it, and the difficulty is exacerbated in periods of fiscal stress. Feeling this pressure, top managers tried to increase services by increasing the number of operational employees, but were limited by expenditure constraints. In response, top managers initiated the choice and/or usage of IT that helped downsize middle management thereby creating slack resources that could be redirected. Top managers then used the slack resources to increase the number of operations employees. This increased the service level and decreased citizen pressures, while respecting expenditure constraints.

increasing revenues, or terminating their employment. The shift, as in the two cities, was from management to

Top managers thus strategically transferred outside pressures to within the organization, where they were less vulnerable and where they controlled matters. In cities, top managers are evaluated and rewarded by elected officials more on the basis of the quantity and quality of services provided to the public, than on the basis of efficiency or any other measure of the internal functioning of the organization. Therefore, a key goal is increasing actual and perceived service levels. The top managers in the case study cities attained their goal by increasing service levels and the number of operations employees, which reduced citizen dissatisfaction and the pressure exerted on them by elected officials. Top managers of New City were better able to achieve this because of its more extensive IT penetration and the nature of its IT infrastructure. Interviews with managers also indicated that the shifts were highly symbolic. There were seen by elected officials and citizens as evidence that top management was proactive. Moreover, by eliminating internal staff positions and redirecting those resources to public-oriented departments, they were responding to community values and priorities even in a time of fiscal strain. However, because the number of employees involved was not large the managers assessed the actual effects of redeployment on services levels as low, but the political and public perception of the effects as very high. This finding is in line with Romanelli and Tushman's (1988) idea that organizational disequilibrium created by adverse environmental conditions leads top management to redirect the organization.

Another illustration of strategic behavior by top managers can be seen by looking at the actual and symbolic effects of outsourcing the information systems (IS) function. Outsourcing *per se* was perceived by elected officials and citizens as another illustration of the top management's commitment to community values in a time of continuing fiscal strain, thus the

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operations and from internal staff departments to customer-oriented departments.

symbolic effect. In addition, outsourcing actually reduced the costs of IT operations, but the two cities used the savings differently. Old City used outsourcing savings to keep IT budgets at the lowest possible level over time. In contrast, top managers of New City used the outsourcing savings to invest even more in the development of managerial applications that allowed top management to further its strategy of redeploying and shifting resources from internal departments to external ones, and from middle management to operations employees.

As the case studies and these illustrations suggest, the importance of top management's strategic behavior in determining the impacts of IT cannot be over-emphasized. While IT might be an enabler of particular strategies, the external environment might be a stimulant to managerial action, and structural congruence might increase the efficiency of action, it is management motivation/strategy that determines whether and how the potential of IT is used, and, therefore, its effects. This conclusion is reinforced by another study, which relates well to present findings although it is different in scope. Kraemer, King, Dunkle, and Lane (1989) studied six local governments in an effort to determine the roles and the relative importance of environmental changes and managerial strategy in IT changes over a 30 year period. In particular, they were interested in determining the role of management strategy in mediating the effects of environmental changes such as growth and decline (population, economy, revenues) on the development path of IT in each government. They found that, while both factors were important, managerial strategy was consistently the most significant force in determining the development trajectory in IT in the six governments. Moreover, in some instances managers did not merely use IT to respond to environmental challenges, but initiated changes in IT in an effort to enhance an already positive external environment. For example, one city invested heavily in IT in order to speed-up the processing of building permits and inspections, the inspection and

demolition of dilapidated housing, and the rezoning of land use to encourage urban investment and development in an effort to enhance a strong tax base. The key point is that managerial strategy in response to environmental changes usually determined whether or not environmental conditions would affect IT, and if so, in what ways.

This broad mechanism fits our case findings well. We found that IT creates slack resources in the form of excess middle managers in centralized organizations. Whether the gains from these slack resources are captured (through downsizing, redeployment, reallocation) or ignored depends upon management motivation/strategy. In many cases, competitive pressures in the external environment act as a trigger to management action, but these pressures are not the key determinant of the managerial response. Management motivation and strategy is the key determinant. Thus, the substitution mechanism elaborated in the present paper converges with the managerial action of Kraemer et al. (1989), and it is in line with the Romanelli and Tushman (1988) study, which indicates that the environment simply acts as a trigger to downsizing by top management. The findings of this study also converge strongly with those of Robey and Sahay (1996):108 who say: Similar technologies may be introduced in different organizations to support similar kinds of work, but the social processes and contexts surrounding their implementation may be so different as to occasion divergent outcomes. For Robey and Sahay, it was the centralized vs. distributed nature of Geographic Information System (GIS) implementation and its consequences for organizational learning that determined the divergent outcomes. For our analysis, it was the substitution-oriented managerial strategy facilitated by technology that occasioned outcomes.

LIMITATIONS AND FUTURE RESEARCH

This study is important because of how it supplements previous studies. Past research has looked at the impact of IT on the occupational profile of middle managers at an aggregated level of analysis. This study disaggregated the level of analysis and looked more closely at the process by which middle management downsizing occurs and what role IT, managerial strategy, and environmental pressures play in the process.

A first limitation of this study is that it focuses strictly on city governments, which might not be representative of other types of organizations. Further research now needs to be conducted to determine whether the findings of this study are specific to local governments or whether they also apply, as we expect they do, to a broader spectrum of organizations. Therefore, it would be useful to replicate this study in private sector organizations. The findings of the present study might indicate that in private organizations, top managers are likely to reduce the middle management workforce in the sales, marketing, and production departments while increasing the operations level workforce (mostly the sales and service workforce) so as to compete better and strengthen the economic and fiscal conditions of the firm. This is consistent with Brynjolfsson et al. (1988) who found that IT favored market coordination mechanisms over hierarchies.

A second limitation is that the substitution mechanism and the conceptual framework proposed in this paper were developed based on in-depth case study of two cities, both of which were experiencing adverse environmental conditions and were extensively centralized. It would be beneficial to explore and further test the substitution mechanism and the conceptual framework proposed in this study. Although the case studies have a defensible logic and are based on extensive empirical work, further tests in government and in industry could certainly enhance and refine them. For this, both large scale survey, and in-depth case studies of a few

organizations are needed. It would also be useful to study the impact of IT on middle managers in stable environments and in growing environments. It may be the case that when top managers perceive no pressure from the population, they, and middle managers are likely to use IT to increase the middle management workforce. This is because the motivation and interest of managers in hierarchical organizations is to increase the number of people they supervise. The motivations behind managerial actions became clear in the case studies. As expected and often posited in the management literature, the interests of middle managers are reflected in two forces: on the one hand, an identification with top managers and their goals of growth, greater efficiency, centralization of decision authority, and survival of the organization; and on the other hand, an attempt to further personal ambitions (autonomy, achievement, greater decision authority and power) through the growth of their unit, and the circumvention of control systems (Stewart, 1987).   Middle managers favor the attainment of personal objectives through computing because their prestige, status, power, and salary basically depend on the size of the unit they manage. It is clear that the interests of higher level managers are also reflected in two forces regarding middle managers. On the one hand, top managers have interests in reducing the number of middle managers. Middle managers are a source of uncertainty for top managers because they may consciously or unconsciously alter the information they transmit and receive. This creates uncertainty for top managers because the interests of the two groups are not totally compatible. Top managers reduce this uncertainty by using IT to gain greater control over information, and to eliminate middle managers. On the other hand, top managers, like middle managers, also have an interest in increasing the number of middle managers reporting to them because their status, prestige, and salary increase with the growth of the units they manage. Therefore, *in absence of environmental pressures*, attention to unstructured decisions might

expand so as to fill the time available to middle managers, which increases their importance to the organization and their number.

Along with Pinsonneault and Kraemer (1997), the findings of this study clearly indicate that more knowledge about the impact of IT on the middle management workforce can be gained by sector specific research. As stressed in this paper, and in Pinsonneault and Kraemer (1993), more precise and clearer definitions and conceptualizations of the concepts of middle managers and IT are needed if we want to understand better the relationship between them. Further research is also needed to test and refine the different types of IT applications, and to better understand their impact on middle managers. This can be best achieved with homogeneous samples. Also, the findings stress the importance of some external environmental factors, which are more easily recognized, understood, and taken into account when one focuses on a set of organizations sharing a common environment. For example, the case studies indicate that the economic conditions of the city and the trend of its revenues trigger a mechanism by which the population puts pressure on the top managers of the city, and the top managers handle this pressure by reducing the middle management workforce, and by increasing the operations employees workforce. These important environmental factors surrounding the organization and how they affect the IT are not easy to recognize and understand using a cross-sectional approach. Also, the findings of the study increase the complexity of the research on this subject. Previous studies mainly focused on the relationship between one dimension of IT and the number of middle managers.

This study also heightens the importance of broadening the research attention to also consider who controls computing decisions, and what interests are being served through its usage. This necessitates an understanding of the capabilities of IT and the roles of middle

managers, on the one hand, and of who controls major computing decisions, what dynamics computing decisions entail, and what the nature and mechanisms of political mobilization are, on the other hand.

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Table 1
Environmental, Organizational and IT Contexts (1995)

	New City		**Old City**	
Environmental Context				
Location	Orange County, CA		Orange County, CA	
Population size (1985-1995)	81,613 to 122,213 (4,060/year)		97,453 to 117,943 (2,049/year)	
Growth	Newer (1963), growing in all directions		Older (1888), growing at eastern rural fringe	
Local economy	Mixed, high-tech industry, high-end business		Mixed, business and industry in middle of spectrum	
Organizational Context				
Centralization of decision authority	Centralized in City Manager and assistants 5 council members 5 managerial levels 2 middle management levels		Centralized in City Manager and assistants 5 council members 5 managerial levels 2 middle management levels	
Government size (1985 to 1995)				
Number of employees	594 to 539		681 to 706	
Average employees/1,000 pop.	7.28 to 4.41		6.98 to 5.35	
Financial situation	1985 to 1990	1990 to 1995	1985 to 1990	1990 to 1995
General revenues	$46.5m to $89.7m	$89.7m to $94.7m	$67.9m to $76.3m	$76.3m to 81.7m
Growth per year	$8.6m/year	$1m/year	$1.7m/year	$.81m/year
Operating expenditures	$30m to $61.7m	$61.7m to $70.7m	$40.3m to 62.5m	$44.4m to $66.4m
Growth per year	$6.3m	$1.8m	$4.4m/year	$.78m/year
IT context				
Centralization of decision authority	Centralized in IT unit directly under assistant City managers		Centralized in assistant to the City manager	
IT penetration				
Managerial applications (1995)	133 running applications		105 running applications	
Ratio of PCs and terminals per employees (1995)	1 to 1.1		1 to 3	
IT spending	1985 to 1990	1990 to 1995	1985 to 1990	1990 to 1995
Budget	$0.616m to $2.520m	$2.520m to $2.851m	$0.748m to $1.695m	$1.695m to $0.869m
As % of operating expenditures	2 % 4%	4% 4%	1.8% 2.95%	2.7% 1.3%

Source: *Financial Transactions Concerning Cities of California,* Annual Report 1984-85 to 1995-96, State Controller, Sacramento:CA.

Table 2

Changes in Employees by Department: New City

Departments	1985 to 1990			1990 to 1995		
	Change in operations employees	Change in middle managers	Level of IT penetration[6]	Change in operation employees	Change in middle managers	Level of IT penetration
Public Related						
Community Services	+41% (34 to 48)	+19% (16 to 19)	30% (6/20)	+28% (48 to 61)	-26% (19 to 14)	50% (10/20)
Public Safety	+13% (154 to 174)	-14% (14 to 12)	67% (28/42)	-2% (174 to 170)	-17% (12 to 10)	69% (29/42)
Public Works	-5% (89 to 85)	+42% (12 to 17)	68% (26/38)	-20% (162 to 130)	-21% (19 to 15)	69% (41/59)
Public Services	+9% (99 to 108)	-14% (14 to 12)	71% (15/21)	Included in Public Works and in Community Development		
Total Public Related	+2% (376 to 384)	-11% (56 to 50)	62% (75/121)	-6% (384 to 361)	-22% (50 to 39)	66% (80/121)
Internal						
Administrative Services	+13% (63 to 71)	+33% (18 to 24)	82% (42/51)	-32% (71 to 48)	-42% (24 to 14)	92% (47/51)
Community Development	-15% (67 to 77)	+7% (14 to 15)	73% (11/15)	-51% (125 to 61)	-41% (27 to 16)	73% (11/15)
Total Internal	+51% (130 to 196)	+59% (32 to 51)	80% (53/66)	-44% (196 to 109)	-41% (51 to 30)	88% (58/66)
Overall Total	-4% (506 to 486)	+2% (88 to 90)	68% (128/187)	-19% (580 to 470)	-32% (101 to 69)	73.8% (138/187)

[1].

Numerators indicate the number of IT applications in operation and denominators indicate the total number of "middle management applications" in a department

Table 3
Changes in Employees by Department: Old City

Departments	1985 to 1990			1990 to 1995		
	Change in operations employees	Change in middle managers	Level of IT penetration[7]	Change in operation employees	Change in middle managers	Level of IT penetration
Public Related						
Community Services	+7% (57 to 61)	+20% (5 to 6)	15% (3/20)	-33% (61 to 41)	-17% (6 to 5)	15% (3/20)
Public Safety	+17% (267 to 313)	+7% (42 to 45)	55% (23/42)	+6% (313 to 333)	-7% (45 to 42)	59% (25/42)
Public Works	+19% (106 to 126)	0% (13 to 13)	42% (25/59)	+21% (126 to 153)	-77% (13 to 3)	45% (26/59)
Public Services				Included in Public Works and in Community Development		
Total Public Related	+16% (430 to 500)	+7% (60 to 64)	42% (51/121)	+5% (500 to 527)	-17% (60 to 50)	45% (54/121)
Internal						
Administrative Services	+18% (137 to 161)	+5% (19 to 20)	71% (36/51)	-40% (161 to 97)	-35% (20 to 13)	77% (39/51)
Community Development	+62% (26 to 42)	+11% (9 to 10)	60% (9/15)	-71% (42 to 12)	-20% (10 to 8)	60% (9/15)
Total Internal	+24% (163 to 202)	+2% (28 to 30)	68% (45/66)	-46% (202 to 109)	-33% (30 to 20)	68% (45/66)
Overall Total	+19% (593 to 703)	+7% (88 to 94)	51% (96/187)	-10% (703 to 636)	-26% (94 to 70)	56% (105/187)

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[7] Numerators indicate the number of IT applications in operation and denominators indicate the total number of "middle management applications" in a departmer