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Integrating service design principles and information technology to improve delivery and productivity in public sector operations: The case of the South Carolina DMV

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Abstract

One relatively unanswered question regarding operational efficiency and effectiveness is whether and how *public sector* or *government* operations can employ service strategy and design concepts to deal with the conflicting objectives of minimizing expenditures while providing for an increasing number of "causes" [Haywood-Farmer, J., Nollet, J., 1991. Service Plus: Effective Service Management, G. Morin Publisher, Quebec]. In this paper, we argue that the mechanism that permits or enables simultaneous success on these dimensions in public sector operations is information technology applied in conjunction with a unified set of service operations concepts. To demonstrate this contention, we employ an adaptation of the Goldstein et al. [Goldstein, S.M., Johnston, R., Duffy, J., Rao, J., 2002. The service concept: the missing link in service design research? Journal of Operations Management 20 (2), 121–134] service planning design framework, taking issue with some interpretative aspects of their strategic model. The modified planning framework was applied to an initiative in South Carolina state government to improve operations and technology deployment at the Department of Motor Vehicles (DMV). The detailed and ongoing case study illustrates the utility of a broad service-based, IT-enabled approach to designing a government service, while simultaneously demonstrating that operational service alignment is the key to avoiding results that have long been labeled a dilemma in the public sector.

Keywords: Service design; Public sector operations; Information technology; Case study

1. Introduction

Torn by a variety of stakeholders and changing missions, public agencies have typically been unable to achieve enduring efficiency in their operations (Corrigan and Joyce, 2000). Coupled with a need to provide socially equitable outcomes, the inconsistent definition of, and concern for, accountability leaves organizations with a 'productivity paradox' and a service dilemma wherein years of spending on structure and infrastructure do not seem to have led to long-term gains in either productivity or effectiveness.

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Despite these well-known and historical difficulties, recent pressures on public expenditures have made it essential that public administrators continue to search for ways to increase productivity while simultaneously enhancing responsiveness to citizens' needs (Lee and Perry, 2002; Lenk, 2002). Interestingly, the debate about how to best accomplish these things has increasingly been couched in terms of business and process management terminology and has focused upon information technology (IT) as the principal enabler. Despite intense criticism from many authors in the public administration realm (e.g., Fountain, 2001), attention continues to be focused upon the citizen as customer, with federal and state agencies attempting to develop service or quality-based models that wisely employ current information technologies and simultaneously guarantee ''effective, efficient, and responsive government'' (Danziger and Andersen, 2002).

At the same time, the problems of government services and public service operations have historically been understudied in the operations management literature. In a comparison of modern OM research and practice, Slack et al. (2004) recently noted that there are gaps between research and practice in terms of both sectoral and content priorities. Their discussion is focused more broadly on the relative paucity of research oriented more generally toward services, while their data demonstrate that government services typically account for a substantial portion of GDP (in 2001, approximately 12.7 and 24.0% of GDP in the US and UK, respectively). Yet very few studies in the OM journals report on the application of theories to government services and virtually none have developed specific theories to help guide public administrators. On the other hand, the service operations literature would seem like a logical place to find and refine theories and concepts that can help to structure and improve public sector operations through the effective use of information technology.

In this paper, we illustrate, using a detailed case study, how service operations concepts and information technology can be synergistically employed to attain the operational goals of public sector organizations. In particular, we review the relevant literatures in the services area and explain how we adapted and tested a framework for designing an approach to strategic planning and service delivery for the South Carolina Department of Motor Vehicles (SC DMV). Using the detailed case, we highlight how government operations may be able to leverage existing service management models in combination with information technology solutions. We conclude the paper with a proposed framework to classify government services and a discussion of insights into directions for future OM research to understand and improve public service operations.

2. Productivity, effectiveness and IT

In this section, we describe the public sector performance dilemma, and elaborate on the purported role of and difficulties associated with IT in providing a solution. We also describe the limited research in operations that currently applies to this issue.

2.1. The productivity and performance imperatives in public services

Though routinely characterized as inefficient, government agencies have been under siege in recent years to cut costs. Some entities that are very heavily transaction-based (e.g., the IRS) have had considerable success, though most have wallowed in mediocre performance and with a poor public image. A number of authors have acknowledged the ongoing problem, but prefer to accept it as an important aspect of dealing with multiple constituencies and objectives (see, e.g., the arguments of Fountain, 2001 or Roy and Seguin, 2000), arguing de facto that productivity will need to remain a step-child to ''serving the public'' or meeting customer-service goals.

As implied above, the issue is not only one of productivity, but also of effectiveness. Services need to be effective in delivering a level of performance that meets customer needs or expectations (Sasser et al., 1978). While sometimes intertwined with productivity, effectiveness or customer service typically refers to ''doing the right things'' and measures constructs like customer satisfaction on dimensions, such as service quality, speed, timing, and human interaction. A service is effective whenever its outcomes or accomplishments are of value to its customers, and the ''constituent as customer'' is a rapidly evolving tenet of public sector management.

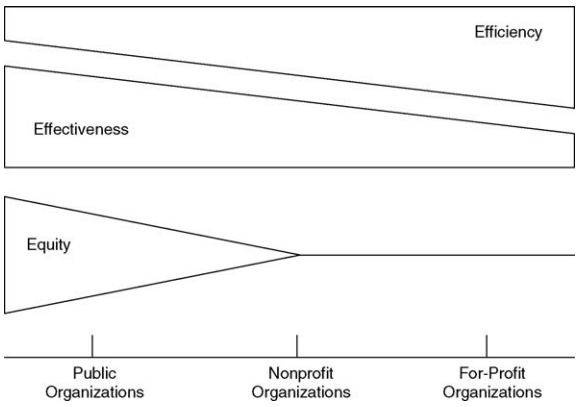

Fig. 1. The relative importance of outcome measures (Berman, 1998).

Berman (1998) makes the distinction among three goals that are important to public organizations: efficiency, effectiveness, and equity (see Fig. 1). Equity refers to the need to provide services to all citizens or equal access to those who require the specific services provided. In general, public organizations focus more on equity and effectiveness and less on efficiency; and for-profit organizations focus more on efficiency, less on effectiveness, and not at all on equity. While the details are certainly arguable, it is perhaps more important to recognize that all services may vary, with some providing a greater challenge to productivity and performance enhancement efforts.

Two recent studies of public sector organizations argue to the contrary that the problem, when placed in its proper perspective, can be resolved with leadership and appropriate structural choices (Lee and Perry, 2002; Danziger and Andersen, 2002). This perspective is attractive from an operations standpoint, since it implies that operations may well have much to say about how the performance dilemma might be resolved. Enduring efficiency may not be impossible to achieve, even in the public sector.

2.2. The promise of IT

The renewed interest in service productivity and service performance over recent years is primarily the result of the proliferation of new information technologies and the ability to conduct commerce electronically. Since this revolution is so recent, the literature in service operations has only begun to tackle some of the difficult issues that now confront service managers. Dabholkar (2000) summarized a number of studies which, at times, show seemingly contradictory results. Some describe how basing self-service options on technology has helped organizations maximize efficiency (Dabholkar, 2000; Lovelock, 1995). Others argue that this efficiency is unlikely to be realized without a clear understanding of how it will affect processes and other operational considerations. Even the use of the Internet seems fraught with roadblocks. Boyer et al. (2002), for example, highlight how most "e-services" have failed to live up to their billing and discuss, in the context of a case study, how operational improvements are sometimes garnered while at other times a service business actually incurs disadvantages by adhering to an e-business strategy.

From an investment perspective, much can be said about the difficulty in realizing the operational benefits of information technology. In studies oriented primarily toward private sector service organizations, various authors have identified reasons to explain why both casual observation and empirical studies have struggled to identify the productivity benefits of IT investments (Ives, 1994; Quinn and Baily, 1994; Brynjolfsson, 1993; Brynjolfsson and Hitt, 1998; Triplett, 1999). These include: (1) IT investment has a lagged effect on productivity; (2) investment in IT may be inadequate to show measurable returns; (3) low productivity may simply be due to an inability to measure output correctly; (4) it's a 'service problem', since virtually everything about services is difficult to measure; (5) poor productivity is due to 'mismanagement'; and (6) budget constraints and changing strategy and/or constituents make productivity an elusive goal.

The 'mismanagement' explanation has many versions and is the one that is most consistent with various operations paradigms of organizations, including the strategic fit and process-management views. Time and time again, organizations in both the private and public sector choose to graft technologies onto existing processes and infrastructure and are then surprised by a lack of results.

Although technology offers competitive strategic advantage in an increasing number of industries within

the private sector, it may well offer the *only* solution to operational issues and citizens' complaints in some public sector applications. While the number and types of stakeholders for government activities may be larger and more varied, the service delivery solutions remain the same as those available to most information intensive service companies. Perhaps the most important difference is simply the increased difficulty in translating strategic or stakeholder objectives into operational terms since the constraints may be more varied and unforgiving.

2.3. Limited contributions from operations

Although service researchers have long described the need for and benefits of productive service provision (Levitt, 1972; Quinn and Baily, 1994), much of the literature continues to emphasize the difficulties in measuring and even defining productivity in services (see, e.g., Gronroos and Ojasalo, 2004). The area of service productivity warrants much more research at both a broad and detailed level, and particularly from an operations perspective (Johnston, 1999).

Schmenner's work has perhaps best articulated the significance of service productivity in terms of a theory of swift, even flow (Schmenner and Swink, 1998; Schmenner, 2004), pointing out how service organizations that survive and thrive over long periods of time seem to be concerned with minimizing throughput time (swift flow) and decreasing the effects of variation that result from customization for and interaction with customers (even flow). Observations of organizations over the past quarter century have led Schmenner to update his service process matrix (Schmenner, 1986) and to conclude that productivity is the key issue in explaining the problems that confront different types of service organizations. The long-term pressures for a service organization to perform like a 'service factory' are more prevalent than Schmenner had originally thought and would seem to have clear implications for government services.

The interface between technology and service operations has also been under-studied by operations management researchers, but appears to be garnering attention. While a number of issues in service technology were first defined a number of years ago (see, e.g., Mills and Moberg, 1982; Collier, 1983), and even though it was (as Chase, 1996 noted) a marketer who really articulated productivity challenges and benefits of technology in service delivery, there appears to be a revival of interest in the relationships among technology in general, service strategy, and service system design. At long last it would appear that Levitt's call for systematic thinking in services is beginning to be realized, with a potential for service performance akin to what is expected of manufacturing organizations (Levitt, 1972; Bowen and Youngdahl, 1998). Although IT is not the focus of their papers, discussions of the service concept make it clear that any strategic services planning approach will need to carefully incorporate technology (e.g., Roth and Menor, 2003; Goldstein et al., 2002, as discussed below). As Hill et al. (2002) note in their paper about service design research, this entire area is defined by its interdisciplinary nature and new frameworks will be needed to adequately address its inherent complexity. These authors point to four major areas for research into service process design, with clear implications that technology is the key to at least two of these.

3. Strategy, the service concept, and service system design

Since strategic alignment is most often cited as the key to the performance dilemma, this section will focus upon the aspects and components of services that are part of the alignment process. To some extent, the terminology in this arena is still being developed in studies of the service concept and service system design.

Sasser et al. (1978) first described the notion of a ''service concept'' as 'the bundle of goods and services sold to the customer and the relative importance of each component to the consumer' (p. 14). Recently, Goldstein et al. (2002), in detailing the aspects of a service planning model, noted that what has typically been missing from most research in the service design area is some notion of the ''service concept''. These authors, however, suggested that the notion of a service concept is much broader than the Sasser view and includes the way in which the service is delivered, the customer's direct experience of the

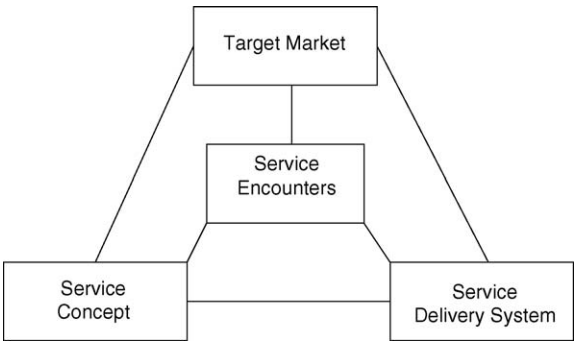

Fig. 2. The service strategy triad: Roth and Menor, 2003.

service, and both the benefits and value of the service to the customers. Roth and Menor (2003), while agreeing that the service concept has not been adequately detailed in frameworks that address service design, argue persuasively that Goldstein et al.'s (2002) model is not consistent with Sasser's original intent and suggest that the issues of concept, market assessment, service encounter, and service delivery system should be kept separate (see Fig. 2). Instead, these authors suggest that Sasser et al.'s (as well as Fitzsimmons and Fitzsimmons', 2004; Lovelock and Wright's, 1999) idea of defining the service concept as a set of elements is more consistent with the extant literature.

Although we agree with Roth and Menor's assessment, Goldstein et al.'s approach to the overall *planning* issue is consistent with the process approach so widely ascribed in quality management and operations thinking today. As such it is easily understood by service managers and may be useful when the design problem is being addressed at a broad and/or strategic level. (On the other hand, for certain research purposes, we would generally concur that it does not provide adequate detail.)

In studying public and non-profit organizations over more than 20 years, Popovich (1998) summarizes high performance organizations as those which clarify their mission, define outcomes and focus on results, empower employees, motivate and inspire people, are flexible and adjust to new conditions, are competitive in terms of performance, restructure work processes to meet needs, and maintain communications with stakeholders. At a broad level, these are very much the same characteristics of any high performing service organization implied by Goldstein et al. (2002), Roth and Menor (2003), and others who have written about strategic service alignment.

Although taxonomies are much less developed for government services than for private sector enterprises, Roth and Bozinoff (1989) provide one means of understanding why public agencies may benefit from application of strategic service concepts. These authors provide empirical support that government services vary along two key dimensions: (1) homogeneity of needs (similar to customization), and (2) experience with the service. The second dimension has two aspects, frequency and directness, where directness refers to customer or citizen contact in the same sense that Chase (1978, 1981) first described. In other words, public sector organizations that need to deal with a range of needs and direct contact with citizens may well benefit from the productivity-enhancing mechanisms known to service researchers.

4. Enhancing the framework for government services

Our adaptation of the Goldstein et al. planning framework is illustrated in Fig. 3. In the private sector "version", this model takes into account strategic intent, inputs and outputs, service delivery system design (including all process considerations), and performance measurement. In the public sector design model shown in Fig. 3, performance is more commonly assessed in relation to *standards* that are set by constituent groups rather than by (sometimes) more unambiguous measures of product or service performance. These types of measures are still significant (e.g., fast turnaround of requests, accuracy, etc.), but acceptable standards may frequently be changed for reasons that conflict with standard productivity goals, and social goals such as equity may be included.

Given the above discussions, there are two aspects of the adapted Goldstein et al. model that warrant more attention in regard to public sector operations: (1) a better definition of strategy so as to capture the needs of citizen-users (the target market) and the service being offered (the service concept) and (2) more details on characteristics of the service delivery system. In terms of focus and "market strategy", government services that require greater emphasis on

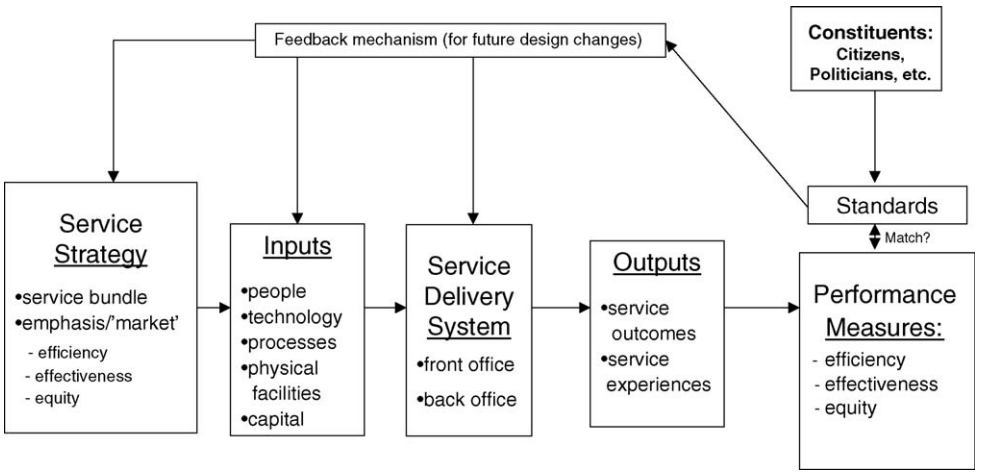

Fig. 3. Government services design planning model adapted from Goldstein et al. (2002).

efficiency and less on equity might best conform operationally to service factories as described by Schmenner (1986, 2004). Those that emphasize equity (and possibly some dimensions of effectiveness) over efficiency might correspond more to what Schmenner labels professional or mass services or even service shops. These types of agencies might benefit from service operations strategies employed by other organizations that compete more on flexibility than on efficiency.

Our second adaptation of the model hinges on the need to make appropriate design choices for the delivery system. Roth and Menor (2003) indicate, correctly, that a large number of variables that involve aspects of structure, infrastructure, and integration need to be considered. While in agreement for the purposes of more detailed system design, since we are examining an area where little has been understood, we will limit our discussion to a small number of broad-based and well-understood concepts.

Specifically, government agencies provide different levels of contact and interaction for citizens. In the case of 'interfacing' or contact-oriented government services, it is particularly helpful to take a renewed look at the customer contact model (Chase, 1978, 1981; Chase and Tansik, 1983; Chase et al., 1984) and a well-accepted but minimally researched concept implied by this model, articulated in Shostack, 1982; Shostack, 1984; Shostack's "line-of visibility" papers (1982, 1984, 1987). Like many research settings in private sector service organizations, public agencies often provide a mixed service that has both front and back office operations. Customer (citizen) impressions of government services are then formed by interactions with both service offices as well as the electronic services provided by the agency. Service design in these agencies would then require a separate accounting of the front and back offices and then an integrated look at how these could be simultaneously improved via enhancements to technology.

As Chase (1981) noted, since "most service systems are really a mixture of high and low contact" (p. 703), key issues for analysis include contact reduction, contact enhancement, and efficiency improvement and these can only be best carried out with a "contact view" of the world. In elaborating on the (many) key differences between low and high contact operations, Chase and Tansik (1983) then emphasized the divergence of goals and operating objectives. In other words, high and low contact operating strategies should logically correspond to very different types of strategic and operational objectives, and this would be sensible for public as well as private service organizations.

In her many papers regarding service blueprinting, Shostack (1982, 1984, 1985, 1987) made reference to the line of visibility between front office and back office operations. Although this concept of a 'line' seems so innocuous on the surface, from a design (i.e., planning) standpoint it is the key to service system success whenever there are real options to consider. And, in the case of government services, these choices

should be made in a manner consistent with the productivity needs and equity and effectiveness objectives of the organization. When and how to ''move the line of visibility'' would seem to be a crucial issue in regaining the confidences of citizens who are critical of government service provision.

Since the back office is not visible to customers, the primary focus of technology adoption efforts has been on this part of the typical service organization. Banks and other financial institutions have long been the testing ground for technologies that can increase productivity and provide new competitive advantages from the back room (see, e.g., Matteis, 1979; Gupta et al., 2001; Batiz-Lazo and Wood, 2002). Bank customers are most interested in low cost (price), high quality in the form of accuracy, and accessibility. These goals are similar to those demanded by citizens when asked about the back offices of government agencies that serve them.

Technology can serve a similar purpose when employed in the front office, with efficiency the focus and front office personnel being replaced by less costly automation. Service employee variability and errors (effectiveness) may also be reduced and availability of the service may be increased to as much as 24 h per day. Of course, the loss of ''personal service'' may be a disadvantage to automating the front office (Walley and Amin, 1994) and this is routinely a concern in high equity-seeking government services. Principles of human behavior and interaction will still need to be incorporated and adapted appropriately (Cook et al., 2002).

To summarize, a service-based approach to structuring delivery systems for public organizations to deal with the efficiency–effectiveness–equity question needs to examine the application of information technology while simultaneously paying close attention to design considerations that can accommodate both productivity and 'customer service' or citizen goals. While straightforward technological application may quickly address the productivity problems of low contact government services, effective application of the well-developed customer contact theory would seem like a practical solution to improving the performance and image of many experience or contact-oriented government services.

5. Using the integrated approach: a case study of the South Carolina DMV

Much has been written recently regarding the use of detailed case studies to provide insight, understanding, and theory enhancement in operations management (see, e.g., the summaries in Meredith, 1998; Handfield and Melnyk, 1998; Stuart et al., 2002; Voss et al., 2002). Given the exploratory nature of the issues in this paper, i.e., since so little is known empirically about service system design frameworks, the role of IT in these, and their applicability to government settings, a case approach would seem to be appropriate. Using the categorization neatly presented in Stuart et al. (2002), the research reported here has the primary purpose of discovering, describing, and providing for a preliminary understanding of the efficiency and equity of government service delivery. As discussed in Section 6, more targeted research questions can only be generated after assessment of in-depth cases and common situations that confront citizen-customers.

While focusing on the South Carolina DMV, we are effectively asking a series of simple questions:

(1) Why is the service delivery process for a government service such as the DMV so inefficient, despite large investments in technology?
(2) Which service design considerations can best help to improve the situation?
(3) Can we enhance our understanding of service delivery processes in public sector operations by examining the DMV in detail?

5.1. The case setting

The South Carolina Department of Motor Vehicles serves approximately 75% of the state's population in one form or another each year. In late 2003, the DMV had approximately 925 full time employees and operated 68 branch offices as well as a call center that handled over 3000 customer inquiries per day. In addition, like other similar state agencies across the United States, the DMV serves financial and lending institutions, insurance companies, automobile dealers, statewide law enforcement agencies, and other state and federal agencies. In the most recent fiscal year, the

South Carolina DMV processed over 11.5 million transactions for its various customers. In terms of categorization, the DMV is an agency that satisfies a low-to-moderate range of needs (informational and transactional) and whose customers have a relatively high degree of experience.

As is common in many other states, the DMV is one of two agencies that serve as the ''face of state government'' to the majority of the residents of South Carolina. The other is the Department of Revenue that deals with taxation at the state level. For better or worse, state residents (in and out of South Carolina) tend to form their opinions about state government from their interactions with agencies such as these, and DMV horror stories seem to be abundant regarding organizational inefficiencies and a lack of attention to customer service. See, e.g., the stereotypical situation reported by Allerton (2002) regarding the department of motor vehicles in Washington, DC.

A statewide government performance audit in 1997 indicated that the South Carolina DMV lacked a strategic plan, was basing too many of its operations on manual processes, was relying heavily on paper forms, and often failed to provide satisfactory customer service via any measure. In response, the DMV launched ''Project Phoenix''—a five-year plan designed to upgrade information technology infrastructure, re-engineer business processes, and move the agency toward a more customer-focused, team-oriented work environment. The overall plan, shown in Fig. 4, was developed in conjunction with a well-known international consulting organization which had been involved in the basic design, re-engineering, and upgrade of a number of similar offices in other states. From the beginning of Project Phoenix it was clear that information technology would play the key role in improving operations at the South Carolina DMV. Unfortunately, after five years and tens of millions of dollars, service and image had not yet improved.

5.2. Motivational basis for the case study

When South Carolina elected a new governor in 2002, he put in place a number of policy task forces to study various issues regarding the current 'state' of state government. The authors were invited to serve on a task force to evaluate the current status of DMV operations, with the intent that operations could be made more efficient and responsive to customer needs. The committee consisted of a wide array of DMV stakeholders or constituents, ranging from elected legislators to customers and including field employees, academics, consultants, a state patrol officer, and the owner of an automobile dealership. The entire committee served for about an eight-week period to make recommendations that could serve as guidelines for improving operations at the agency and put the best possible 'face' on this aspect of state government. During this period, the committee paid particular attention to the earlier design and reported results of the ongoing Project Phoenix. With the assistance of several DMV staff members, the group also intensively gathered computerized data regarding the workloads and performance measures at each of the state's offices, assessed customer surveys that had been conducted over the previous three years, and visited most of the state's larger offices and a few representative smaller ones.

Like almost all states in the US, South Carolina has been through a very difficult time in balancing its budget and meeting the needs of residents. At the beginning of the task force's deliberations, it was made readily clear that dramatic funding increases would not be a viable solution to the problem. Recurring costs would need to be kept to a minimum and the existing technology platform (set forth in Project Phoenix and Fig. 4) would need to serve as a base for the foreseeable future. With this mandate, the task force set out to define a 'framework' that would guide the design process.

In some DMV documents, there had been an earlier recognition of an approach that explicitly recognized a need to integrate technology within its service system. This construct had been part of a very simple three-faceted planning model emphasizing technology, the workforce, and facilities. Unfortunately, this framework did not appear to have provided adequate detail for guidance and improvement.

5.3. Proposed strategic service design model

After consideration of the ideas described in the previous sections and at the end of several working

System Component	"Old" – Legacy Technology	"New" – Phoenix Technology
Database	"Flat files" only; no central repository for DMV customer information	Database with inter-related, interconnected records
Servers	Mainframe computer stores all application code & customer data	Application code and database runs on Intel based Servers & a Microsoft Windows 2000 platform
PCs	Mainframe "dumb" terminals	1,525 PCs in 68 field offices & headquarters
Printers	Obsolete – replacement parts & printer ribbons can no longer be purchased	656 new laser printers
Driver license testing system	Paper tests	PC based testing system
Document management	Microfilm	Optical disk storage
Driver license issuance system	System owned by vendor; DMV pays a fee of $1.31 per credential issued from this system	DMV-owned system provides image capture, signature capture, and illumination in a safe, secure & portable configuration
Statewide network	9.6 KB data circuits & communications hardware that allow field offices to communicate with the mainframe host. Data circuits are shared among 4 to 5 different offices that compete with each other for usage of the circuit	Each office has direct link (T1 circuit) to centralized resources
WEB/IVR systems	No ability to execute transactions online	The WEB & Interactive Voice Response System (IVR) will allow DMV customers to obtain information & forms as well as execute select online transactions
Debit card/ Credit card	No ability to use a method of payment	Debit card/Credit card will be used as a method of payment in the field offices & through WEB system

Fig. 4. Comparison of old (''Legacy'') and new (''Phoenix'') technologies at the DMV.

sessions, the task force adopted the service design model shown in Fig. 3 as a means for developing a detailed set of recommendations. With the budgetary and resource constraints imposed by the governor-elect and representatives of the state legislature, it was agreed that the model would accommodate the de-coupling of services and resources with an increased cost emphasis. Definition and design of the delivery system would result from explicit recognition of the linking of service delivery activities and components with both the front and back office (i.e., clearly delineating the line of visibility), and transactions would systematically be moved on-line. The specific implementation strategy and recommendations, which were then adopted, are described briefly below and depicted in Fig. 5.

5.4. Specific recommendations using the model

1. *Service strategy*: When Project Phoenix was initiated, the DMV had developed a set of goals or 'drivers' including: (1) improved customer service/ effectiveness measured in terms of accuracy and timeliness; (2) improved delivery of DMV products and services through new technology and new channels; (3) improved delivery of data to public safety agencies and private sector stakeholders, such as insurance companies, financial institutions, etc.;

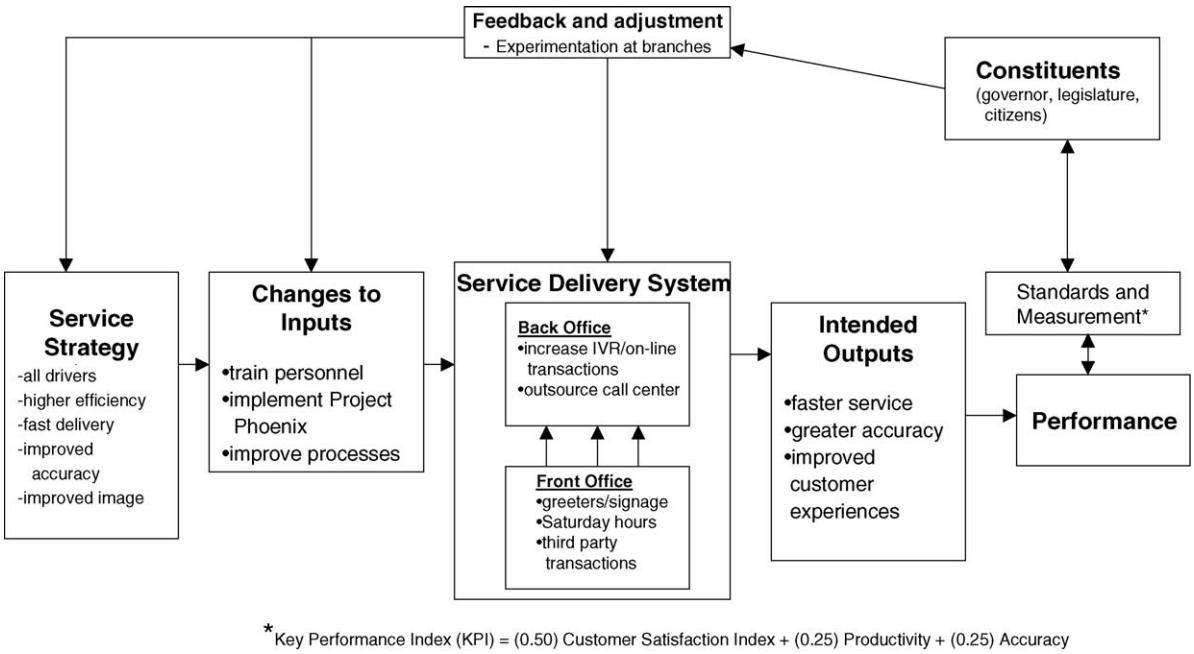

Fig. 5. Implementation of DMV strategic service design model.

(4) improved security of DMV documents; (5) cooperation with other government agencies to reduce redundancies associated with record keeping; and (6) reduction of costs through better and more coordinated processes. These goals were accepted as strategic mandates by the task force, and goals 1, 2 and 6 were emphasized since they were deemed to relate directly to productivity and individual citizens.

2. *Inputs*: Since funding constraints made it clear that the agency would not receive an increase in personnel levels or improvements in physical facilities, a focus was placed on how to attain improvements through upgrading (i.e., training) of personnel, enhancements in and more clever use of information technology, and changes in processes. Specific recommendations in this area included the marshalling of all available resources to correct existing data integrity problems and provide for remediation of potential future problems. Other input recommendations included: simplification of the current system architecture where possible, outsourcing of certain critical IT skills to third parties, and provision of customer service and computer system training to all employees.
3. *Service delivery system*: Recommendations were made to plan for and automate transaction types wherever possible, progressively 'moving the line of visibility' by using on-line processing. Other process changes to enhance operations included the following (note that the first three are all oriented toward preserving front-office efficiency):
   a. Provide greeters and improved signage in all facilities, with a particular emphasis on high volume ones.
   b. Remove telephones from counters in field offices where customer service representatives are dealing with the public.
   c. Provide computers in high activity offices for customers to complete some transactions via the Internet (and to encourage later usage).
   d. Open high volume DMV offices on Saturdays at strategic locations. (Six of these were opened in June 2003 and hours and locations adjusted at least two times since then.)
   e. Allow some transactions to be completed by other agencies in the service chain (e.g., by county treasurers who receive tax payments).
   f. Allow certain transactions to be completed by third parties. For example, with proper precau-

tions, dealerships could issue license plates directly to customers without directly involving personnel at the DMV.

g. Outsource the DMV call center to the Department of Corrections. (Although this may seem like an unusual recommendation, such systems are already in place in at least four states.)

4. *Outputs*: Although the task force did not focus on changing the products and services delivered (most of the specifics in the service bundle), it was clear that efficiency might be improved if some of the required services could be changed. For example, it was recommended that the state extend driver's license renewal periods for most drivers, with most renewals being transacted on-line and/or without the customer coming to one of the DMV offices.
5. *Performance and measurement*: The performance goals of the DMV were stated in terms of customer service. Surveys over the years had indicated that the public demands rapid and accurate service (i.e., speed and quality), with agency image also being affected by the competency and attitudes of front office employees. Since the agency did not perform regular customer satisfaction surveys, very little systematic information had been accumulated over the years to validate or argue against the apparent poor image of the agency. A measurement tool was recommended and, after more study, is now being implemented. This new 'satisfaction' index will be calculated monthly for each branch office and includes aspects of overall service, performance of front office staff members, performed service, assessment of the facilities, and experiences with call center and web site transactions.

5.5. Implementation of recommendations and results

Details of the specific implementation plan to automate transactions are shown in Fig. 6. Simple transactions that have been moved on-line in other states were the focus of the first ''move'', with more detailed and complex transactions automated in

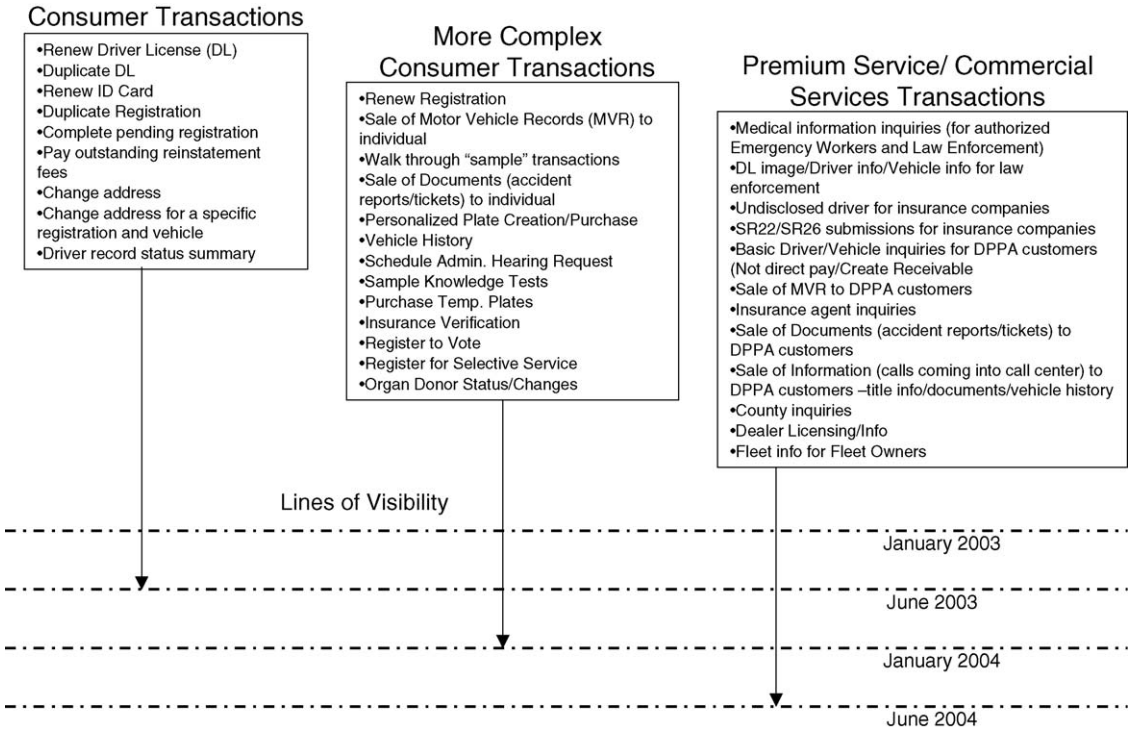

Fig. 6. SC department of motor vehicles-moving the ''Line of Visibility''.

sequence. Transactions that involved other parties (auto dealers, etc.) will be moved on-line as soon as the internal transaction systems have been adequately installed.

To facilitate front office operations, several-day long training sessions for all DMV employees have also been undertaken since the summer of 2003.

At the present time, signs are already evident of an overwhelmingly positive response to system changes. Some of these are anecdotal but a number of objective measures have also seen dramatic improvement. (Furthermore, and importantly, the only changes to the entire DMV system that have been made since the start of the study have been those in the recommendation set described here. The across-the-board results that have been seen are clearly the result of the changes made from this study.) Specifically,

1. Lines have quickly grown shorter, alleviating one of the most common complaints about DMV offices. While monthly transaction volumes at DMV branch offices across the state had increased approximately 6.9% over the year preceding this study, average wait times have now declined 87.9%! To facilitate individual needs, the new 'system' also reports the most recent wait times on the web so that customers may make an assessment of what to expect.
2. The percentage of citizens completing their transactions on the web has increased each month since the system changes were implemented. The largest DMV branch in the state completed 16,096 transactions in face-to-face contact with citizens during September of 2003. During the same period, 18,434 were successfully completed on the web (statewide) without personal contact with DMV personnel. This would indicate that the workload of one large office has already been eliminated.
3. Overall, a high percentage (62.9%) of web transactions is being successfully completed without intervention. This 'percentage completed' will increase as the DMV web site is continually improved and citizens are able to navigate the site more efficiently.
4. The top four web transaction types to date have been driver status inquiries, address changes, driver's license modifications, and driver's license renewals, all items that have historically required significant labor time.
5. Customers have regularly commented on better process flows and the availability of ''greeters'' and better signage to direct them upon arrival. These data will be better captured as the performance measurement system is installed.
6. Positive articles have been written (and have continually appeared) in various newspapers across the state as changes have been implemented.
7. The number of complaints (via telephone, by letter, and in person) has decreased by more than 50%.

Publicly, the DMV has recently adopted the following statement to explain what is happening: ''Our goal is to provide (citizens) with quality services and information in the most efficient, effective and professional manner possible.'' While the intent is clearly laudable, success will be determined only after the system changes have been in place for some time and procedures have been internalized.

6. Discussion and directions for future study

We conclude the paper with a discussion of what the case indicates about the current theories of service design, the generalizability of our results, and potential avenues for further research.

6.1. The DMV, service design, and service delivery

For the DMV, it is apparent that a comprehensive application of IT and service operations concepts has been helpful in improving productivity, faster delivery, and service (measured in terms of fewer complaints, positive anecdotes regarding competency, and accuracy of records). These are the dimensions that have mattered most to citizens, and improvements in these areas have made it possible for the agency to begin to shed its age-old image problem.

Although productivity and various notions of strategic service alignment were seemingly straightforward ideas, they served as the key factors that were integrated to frame a solution for this particular public agency. Improved performance was made possible by recognizing that technological solutions should be

constructed or re-aligned in light of a coherent agency service strategy. What is absolutely clear is the answer to our second research question, i.e., that strategic alignment, effective IT deployment, and clear separation of front and back office tasks offer the best means for improving the situation at the DMV. (As an aside, the answer to our first research question had been made clear during the task force deliberations: there really had never been a coherent strategy to integrate IT with DMV operations! Inefficiency was almost guaranteed.)

Following a broad yet comprehensive service design planning model, such as those proposed by Goldstein et al. (2002) or Roth and Menor (2003) would appear to be strongly validated by the success of the DMV case study. Admittedly, any argument regarding the relative efficacies of these and other planning approaches will require a much broader empirical test.

6.2. Generalizability of the case study findings

As noted, and for contact-oriented government services, in general, distinguishing among front and back office issues is paramount to effective service system design and delivery. With the help of available e-technology, the line of visibility can be pushed back to the point where existing (human) resources may be able to adequately deal with front office issues.

In fact, one great challenge that will need to be confronted by highly visible and experience-providing government agencies, such as the DMV is the movement of front line personnel away from making simple transactions to serving as complex problem solvers. As most transactions are moved to the back office or, at least, below the current line of visibility, face-to-face confrontations will require greater knowledge and skills on the part of employees. Delene and Lyth (1989) labeled this an 'interactive service operation' and noted several issues that are relevant to contact or experience providing government services. These include: (1) combinations of customer contact personnel, customers, and technologies will form the basis of operations; (2) customization will be more data directed (with implications for the nature of front office personnel that will be needed); (3) the performance results of services will be reported much faster; (4) customer expectations will increase as their understanding of the technology increases; and (5) transactional performance of front office employees will constitute the central measure of quality and success. The last point is particularly important from what we first set forth as one of the long-term objectives of the DMV, i.e., to improve its image. In that there is some evidence to support the argument that services can enhance their reputations through technology (Sohal et al., 2001), government services may well benefit in ways that need to be better understood. Although we have not focused the discussion in this paper on this issue, image will no doubt continue to be influenced by productivity and efficiency improvements.

Service organizations of various types have been experimenting with similar buffering strategies, with financial institutions leading the way over recent years first through technologies, such as ATMs and now with e-services. Increasingly sealing off the technical core is perhaps the best strategy available to many similar service types, and especially to both informational and 'interactional' agencies in government. Other types of services, e.g., restaurants and retail stores, have a somewhat different challenge where, at times, opening up the technical core may well offer a better approach. For government services similar to the DMV, image and citizen satisfaction would seem to be tied to citizen experience (Roth and Bozinoff, 1989), and thus the customer contact approach needs to be employed whenever appropriate. More research concerning the efficacy of moving the line of visibility in other public service organizations is warranted.

Since much of the function of government is to "provide information", the concepts discussed in this paper are even more widely applicable in public sector applications where labor costs need to be pared. Clear positive impacts would be anticipated in terms of the efficiency of government performance. In fact, Danziger and Andersen (2002) suggest that this is exactly where almost all of the benefits are likely to come in most public organizations. These authors also claim that most empirical studies seem to show a negative impact of IT in other areas, such as employee work environments, power relationships, and citizens' interactions with governments. This last issue is a point of contention among some researchers and should be an important area of future study for operations management researchers in the public sector arena.

6.3. A limitation leading to possible insights and future research

Although the use of the strategic service design model would appear to be validated for a setting such as the DMV, this case study also highlights that the DMV may be representative of only one type of government service operation. Referring back to Fig. 1, this particular government service would appear to be one where both efficiency and equity can be provided for simultaneously. DMV offices, since they are distributed across the state, are highly accessible to all citizens and, when aligned and supported properly, seem to be able to operate like one of Schmenner's (1986) service factories. Swift, even flow would appear to be a reasonable and obtainable objective for the DMV. Similar services that may benefit from further use of information technologies would likely also perform well in terms of both efficiency and equity. Agencies that deal with revenue and taxation come to mind as these become increasingly web-based.

Unfortunately, just as the service process matrix (Schmenner, 1986) would suggest for private organizations, government organizations are not all likely to benefit so quickly from automation and further buffering of core services. Legislative offices, although theoretically designed for public access, tend to deal most directly with lobbyists and vocal, powerful citizens' groups. This type of government service would seem to be characterized by relatively low performance on both efficiency and equity. Others such as public transportation, health care, and public retirement systems (with many options) may rank high on one of these dimensions, yet low on the other, with the clear implications that pressures will be continually exerted to provide these services in a much more efficient or equitable way. Strategic operations insights gained from research into different government services such as these might well provide an avenue for operations management researchers to have an impact on very important public policy issues. One possible framework for future research is presented in Fig. 7.

As in Schmenner's and other service matrices (see Fitzsimmons and Fitzsimmons, 2004 for an overview), equity may be tied in some sense to customization, a factor that introduces variation into requirements and processes. In this sense, other service management theories may be relevant in analyzing different types

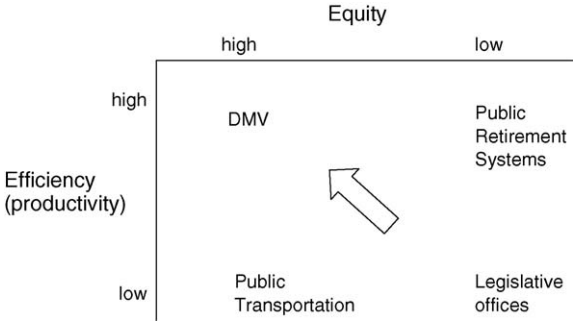

Fig. 7. A proposed government services matrix.

of government services. Haywood-Farmer and Nollet (1991) noted that Peter Drucker has always claimed that the real issue in government service performance is related to how they are funded, i.e., generally in a way unrelated to desired outcomes. Variables relating to budget-based organizations may help in categorizing government services for the purposes of developing service strategies to improve performance.

Our experience with the DMV has also led to some speculation and concern regarding Berman's (1998) observation about effectiveness. Measures of effectiveness vary widely and are absolutely essential to the satisfaction that citizens have with government services at all levels. On the other hand, this can be said about private sector service organizations as well. What may be of interest are the types of effectiveness measures that may matter most for different types of government services. To our knowledge, this is another unstudied area.

For example, the DMV has been able to make tremendous strides in achieving faster delivery and higher accuracy in its records. This seems to have come as a direct result of the effort to improve productivity. In other words, just as in JIT or lean systems, productivity, service delivery, and certain aspects of quality would seem to go hand-in-hand in environments where swift, even flow is possible. Certain measures of effectiveness may be difficult to improve when equity or other factors influence the setting, and interesting relationships may exist. In professional services, for example, Boone and Ganeshan (2001) found that organizational experience is an important factor in determining productivity. The developing OM literature in flexibility may also offer insights for these government services.

6.4. Potential research issues

Although we have tried to be careful in generalizing our results, the case study does give rise to a set of more detailed questions or issues that may be of interest to OM researchers.

1. Will the use of IT to ''move the line of visibility'' in service organizations generally lead to increased efficiency? Can the line be moved too far, resulting in a detrimental loss of personal service or inadequate contact?
2. Does an increased reliance on IT in public sector service organizations have a negative impact on areas such as employee work environments, power relationships, or citizens' interactions with government?
3. Can research involving different government services allow for the definition of a general service design strategy for such organizations?
4. What are the possible measures of service efficiency, effectiveness, and/or equity that can be applied across a range of government services?

Although it may be too early to formulate specific research propositions from our experience with this case study, these questions may provide a starting point for other, related efforts.

6.5. Summary

Operations management interest in the provision of public or government services is longstanding (see, e.g., Rosenthal, 1982), although to this point it is clear that the underlying issues have been understudied. OM and service researchers seem to have focused exclusively on for-profit organizations, perhaps due to the variety of objectives that seem to apply to public sector settings. When each setting is viewed as unique, as they often are in the public domain, it is difficult to generalize. On the other hand, approaches that examine the similarities among different types of government services would clearly be valuable.

While public sector research often rejects business approaches and objectives as too simplistic (e.g., Fountain, 2001), the operations literature and DMV case study do not support this contention. Appropriate design models can certainly account for a variety of objectives and they would appear to be valuable to public managers. Regardless of the reason for limited research efforts to date, more case studies of public sector operations are warranted and comparative research such as that reported about business process reengineering by MacIntosh (2003) should be particularly beneficial.

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