Bringing E-Government into the Classroom: A Case of E-Commerce Education

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ABSTRACT

The paper discusses a novel educational initiative in e-commerce pedagogy where students work on an e-government project. The paper describes a two-semester joint e-government project conducted by the town of Amherst, NY, and the State University of New York at Buffalo. During the first semester, students in a graduate e-commerce course in the School of Management were instructed to identify and analyze management issues valuable for small or middle size local government. In the second semester graduate students from the Department of Computer Science and Engineering designed and implemented prototypes of three e-government portals: an on-line action site for governmental procurement (E-Procurement), a portal for reservation of community recreation facilities (E-Recreation), and a portal for online dog registration (E-DogRegistration) combining a central registry of dog owners with distributed veterinarian databases. The objective of this initiative is twofold. First, it saves the local government resources by eliminating duplication of services and by using students as developers. Second, it provides students with real life hands-on experience. The paper discusses both the technical issues involved in the implementation of the project, and the management issues that need to be taken into account to enhance the e-commerce experience for the ordinary citizen and local governments.

Keywords: e-government, e-commerce education, andragogy, adult learning, e-government portals

1. INTRODUCTION

With the rapid development of the Internet and digital technologies, E-Government is going to play a constantly increasing role as a major component in our social, economic and political life. The adoption of the Internet by governments has been a subject of continuous research interest (E-Communities Task Force, 2001; Fountain, 2001; Gant & Johnson, 2002; Heeks, 2000). The term E-Government usually refers to the use of digital technologies to facilitate governmental services and operations, information sharing, and maintaining public relationships. Developing successful E-Government portals presents significant financial, technological, and administrative problems even to the federal and state governments. Some state governments are outsourcing to public or private

ventures some activities such as design, implementation, deployment, hosting, and maintenance of their web portals. The problems become more challenging for local governments due to lack of funding, and the inability to capitalize on economies of scale. Outsourcing is usually not economically efficient for local governments and many of them do not have the resources to utilize the best commercial practices.

In this paper, we present a novel initiative to help a local government in its transition towards E-Government. The main idea was to create and develop a strategic partnership between a public university, a local government, and local IT companies aimed at developing a series of E-Government web portals. The initiative was realized by the State University of New York at Buffalo (UB), the local government of the Town of Amherst, and Electronic Data Systems, Inc. (EDS). The objective was to combine the research resources of UB with the proprietary expertise of EDS in an effort to improve the current web portal of the Town of Amherst. What makes the partnership unusual is the fact the prototypes of the web portals were implemented in classrooms by the students of UB. This extends the E-Government initiative beyond the perimeter of governance and brings it into classrooms and research laboratories.

To develop the e-government portals, we utilized an adult-learning framework, better known as 'andragogy' framework, promoted by Knowles (Knowles, 1970; Knowles, 1980) as "the art and science of helping adults learn". This framework emphasizes learner-participation and collaboration and is suitable for ill-defined, participant-centered learning environment. The framework provides a proper setting for this study because we did not have a well-defined set of problems, nor did we have a workable model for e-government portals In the following sections, we first define three-stage andragogy framework for the development of e-government portals and then explain the application process in detail.

2. ANDRAGOGY APPROACH TO E-GOVERNMENT PORTAL DEVELOPMENT

2.1 E-Government
By changing the connection between people, businesses and their governments, e-government offers several benefits.

First, it connects people and businesses with federal, state, local and international governments by new channels and new media of communications. E-Government significantly increases the response time and decreases the cycle time, thereby improving access to governmental services and customer satisfaction. According to a survey conducted by Hart-Teeter in 2001 (Council, 2000), E-Government improves public confidence in the Government. 36% of Americans find E-Government more accountable to citizens.

Second, E-Government provides constant availability and increased coverage by enabling access to governmental

services from home, work, schools, etc. With the rapid growth of mobile networks, it will not take long to access governmental services via handheld devices and web-enabled cellular phones.

Third, E-Government provides several cost-effective solutions. Automating services and moving away from human intervention frees up manpower from low-value activities and enables better utilization of human resources. In addition, E-Government offers an increase in productivity as well as an internal cost efficiency by sharing infrastructure costs with service delivery costs. For example, the cost of creating, processing, distributing, storing, and retrieving paper-based documentation could be offset by the much lower costs of producing and dispensing digital content.

Fourth, E-Government offers collaborative solutions that allow people to form electronic communities, exchange ideas and compare experiences. Digital alliances are created among public, non-profit, and research partners on the basis of their expertise and experience.

Fifth, E-Government allows for anonymous, private and secure solutions based on appropriate authentication, security, privacy, and trust policies.

Sixth, E-Government not only atomizes previously existing public services, but also creates new services and changes the way existing services are conducted. Mass personalization and mass customization technologies, for example, allow E-Government to provide citizen-centered services that meet the needs and preferences of every individual.

Despite the promising potential of E-Government it has not yet achieved the productivity growth that has been captured by the private sector. According to some recent estimates (Council, 2000), only one percent of current interactions between the government and its customers are online. A possible reason for this is the huge amount of information that the government has to transform and the strict information security policies. Another reason is the fact that most government systems have been designed and developed independently, making their integration time consuming and costly. Finally, for many years, the government IT investments have usually supported legacy agency operations organized around agencies and departments. Online services, on the other hand, require a customer-centric approach i.e., service delivery around events, such as vehicle registration, business permits, animal control, recreational services reservation, etc.

2.2 Andragogy Framework
In discussing adult education, Knowles (Knowles, 1970; Knowles, 1980) distinguished between teacher-centered and learner-centered instruction. He promoted the latter because it viewed learners as mutual partners in the learning endeavor (Sharan & Phyllis, 1989). Known as the andragogical model, the use of learner-centered instruction-

-which supports addressing the needs and interests of learners--is regularly championed in the literature as the most effective way to teach adults. The following assumptions underlie Knowles' andragogical model (Knowles, 1980; Zmeyov, 1998; Bim-Bad et al., 1992):

- Self-directed learning: Adults tend to be self-directing.

- Experiential learning: Adults have a rich reservoir of experience that can serve as a resource for learning.

- Contextual and systemic learning: Since adults' readiness to learn is frequently affected by their need to know or do something, they tend to have a life-, task-, or problem-centered orientation to learning as opposed to a subject-matter orientation.

- Influence of intrinsic factors: Adults are generally motivated to learn due to internal or intrinsic factors (such as helping their child with homework) as opposed to external or extrinsic forces (such as a raise in salary).

A logical outcome of these assumptions is the use of a collaborative teaching model that involves the learners as partners (Knowles, 1980; Boot & Hodgson 1991). According to Brookfield andragogy principles, adult learners produce best outcomes when they were encouraged to have voluntary participation, respect for participants self worth, collaboration, praxis, critical reflection, and nurture of self directed, empowered adults (Imel, 1994, Bim-Bad et al., 1992).

These are important principles in developing an information system, especially when the problems are not well defined and the project is at the initial stage. We applied the andragogical principles in the development process of Amherst e-government portals. As explained in the following sections in detail, students with different backgrounds and expertise were grouped together and asked to (i) identify the problems and needs in Amherst government operations, (ii) come up with a list of possible solutions (e-government solutions), (iii) identify the technologies and social and cultural conditions for implementations, and (iv) develop the e-government portals. Basic building blocks of andragogy frameworks such as collaboration, praxis, and critical reflection are fruitfully applied to each stage of the developmental process. Each group was assigned a leader, an EDS personnel for the MBA groups (1st semester) and a graduate assistant for CS students (2nd semester). Collaborative interaction is the primary mode of development in the process.

The process of development staged into three phases: Stage 1 involves a process of identifying the e-government needs and requirements. In this stage, our focus is on the changing needs for government and corresponding requirements that are to be implemented in e-government portals. Stage 2 involves a pooling of IS skills and roles, which represents in

fact the joint project among UB, EDS, and Amherst government. The final stage, stage 3, is the actual creation of Amherst government portals, for which students from CS department of UB were involved. The following diagram summarizes the stages of development in andragogy framework.
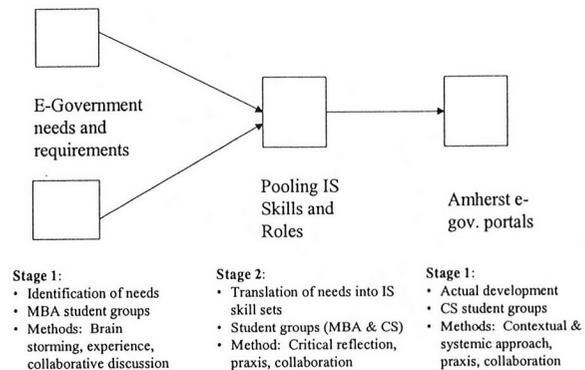

Stage 1:	Stage 2:	Stage 1:
• Identification of needs	• Translation of needs into IS skill sets	• Actual development
• MBA student groups	• Student groups (MBA & CS)	• CS student groups
• Methods: Brain storming, experience, collaborative discussion	• Method: Critical reflection, praxis, collaboration	• Methods: Contextual & systemic approach, praxis, collaboration

Figure 1: Stages of Amherst Government Portals Development

2.3 Environmental Setting
The town of Amherst has a population of 116,510 and is located in Western New York. Although the town's website offers online tax-assessment and provides information about its services and programs, the current functionality is very limited and the average citizen almost always has to travel to the town office for various services. The town realizes that it needs to be more flexible in providing services to the citizenry. In its attempt to provide better quality online services the town faces several problems, the main problem being the lack of adequate funding. Another problem is that the town does not budget for their web portal as a capital project. Developing a successful web portal usually requires substantial upfront investment the payoffs of which will be consumed in the long run. Web development is considered by the State government as operating expenditure and is funded as ordinary office equipment and personnel. Another problem is the lack of interoperability among information systems of different government departments. This creates avoidable duplication of resources and inefficiencies. In addition, the town has many legacy systems that need to be upgraded and connected to one another.

2.4 Developmental Process: Application of Andragogy Framework
Andragogy theory encourages the preponderance of self-directed learning, co-operative activities, experiential and systemic activities, and the actualization of the results (Zmeyov, 1998). Based on these principles and the developmental stages described in figure 1, we developed a process model of e-government portal development as shown in figure 2.
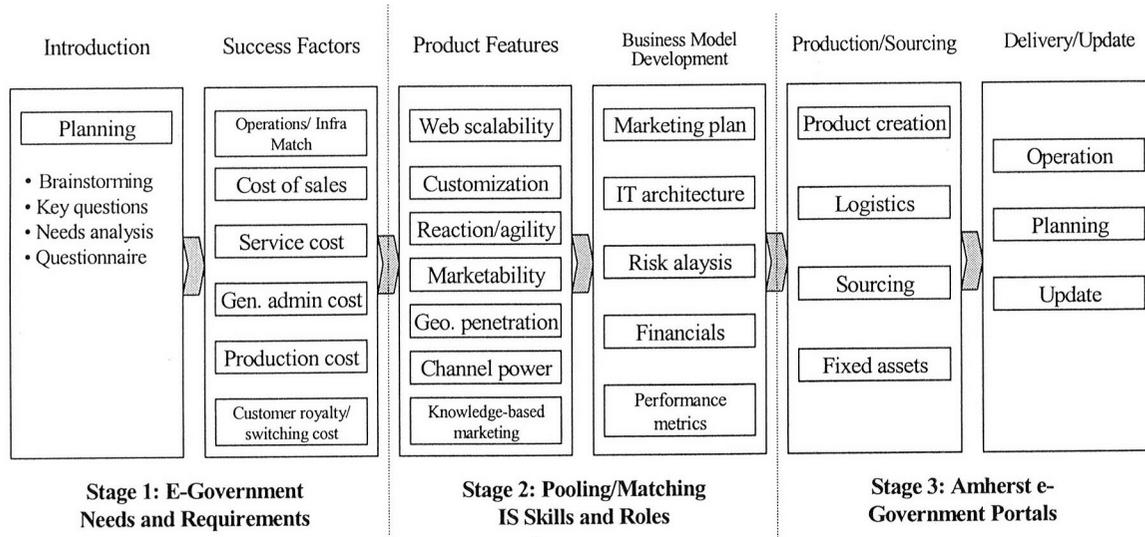
Figure 2: A Process Model of E-Government Portal Development

2.4.1 Stage 1: Identification of Needs and Requirements
Following the theoretical guidelines, in the first stage of the development, we formed 5 developmental teams, each of which was composed of four to five UB MBA-program students. The students had diverse backgrounds and there was an attempt to balance the teams - for example there would be one from marketing, one from law, one from engineering, and so forth. In the first stage, the teams were asked to identify the problems and the needs with respect to current practices of Amherst government. Task-oriented, experience-based andragogical principles were applied in the process, including brainstorming, open discussions, in-depth on-site research, etc. After the initial investigations and the first round of the discussions, a long list of ideas was generated. Each group was encouraged to generate multiple ideas from which possible candidates were later selected in accordance with the guidelines given in Table 1.

Table 1. Portal Development Guidelines

Task: Briefly document the current model of doing business; identify the needs and requirements; document the future model using brainstorming

No.	Model Ideas	Benefits to Amherst Government
1	Improving major online procurement systems at the Amherst ** 5 other submissions with the same idea	• Fairer, more open and efficient procurement process • Applicable at any federal, state and local government body, as well as all levels of educational institutions
2	Using Internet Technology to Facilitate Code Enforce- ment	• Making all negotiations regarding code enforcement transparent and viewable by the public
3	Development of the	• Saving manpower and

	PGA (Personal Government Assistant)	hours spent telling residents where to go and how to file for licenses, permits, or services • Simplifying the application processes
4	Development of Web-casting and video contents	• Live access to town council meetings and other public proceedings • Sharing of existing and new information to a broader audience
5	Building a E-Purchasing portal for all the purchase of office supplies	• Money and time savings for Amherst Government. • Reduction of paperwork
6	Development of a system for controlling the new purchase card program being implemented by the Town of Amherst.	• Making purchasing easier as well as eliminate the need for finding information to generate reports • Elimination of possible penalties for overcharging the account
7	Creation of a web-enabled, on-line, real-time system for conducting government-related auctions, contracting, and bidding for "for-sale" items	• Realizing savings in per-son hours and rent money • Providing a single "meeting" area for all aspects of sale and contracting of items and services
8	Development of a web-based dog registration system ** 1 other submission with the same idea	• Easy to implement • Simpler process for the consumers

9	Building an efficient way to check out best deals in foods & groceries in Amherst	• Broader choices among the supermarket chains and grocery stores to the consumers • Saving time on procurement and finding out the location and direc- tions
10	Facilitating the renewing of business and animal licenses granted by the Town of Amherst	• Increased renewals because it is more convenient • Less staff time spent at the customer service window
11	Recreation and traffic information service	• Better reputation of Amherst Government • More income from service providing
12	Library on-line media search/reservations/ requests	• Increased use of the library as an information resource • Better use of librarians' time
13	Use of department Card (EFT) for credit card purchase	• Simpler than issuing card to individual • Using the card to purchase items as well as spending on general expenses
14	Creating online bids/ proposals system for local contractors	• Saving money on projects that need to be completed • A more equitable way of awarding a project
15	Moving everything (appli- cation process) that is currently done in the recreation department to the Web	• Time saving for application process • Staff & manpower released as a result of this web-enablement

After the development of the ideas, each team was asked to evaluate the ideas using the key success factors broadly given by the EDS and later refined by each team. In order to select the projects, each team utilized different evaluation techniques such as balanced scorecard method and function point analysis.

2.4.2 Stage 2: Pooling and Matching IS Skills and Roles
Andragogy framework (Chaudhury & Rao, 2000) encourages task-oriented learning process, based on the life experiences of the participants. Following this principle, each development team was assigned specific tasks in the development process. In order to ensure the seamless development process, EDS assigned one mentor to each project. The mentor would meet the team periodically and give the students feedback, or give them an insight into EDS methodology. Success factors were translated into a set of product features, which was in turn reflected in the business model directly or indirectly.

In the process of identifying and pooling the resources, we utilized the principles of self-motivation and task-orientation. MBA and CS students were encouraged to participate in the production process based on their technology skill set and task-orientation.

2.4.3 Stage 3: Amherst e-Government portal development
In stage 3, six groups from Computer Science department were formed in the second semester of the project. Two groups were assigned to each project. We tried to balance the number of graduate and undergraduate students in every team and make graduate students help undergraduates with programming. Every team had a graduate student as a team leader. Team leaders were responsible for organizing team meetings, the division of labor, and performance control. Every team leader was required to keep a record of meetings, team members' participation, and allocation of tasks.

The actual implementation process was organized in several steps with deliverables. The first deliverable was the Database design. Students were requested to describe their database schema, provide entity-relationship diagram, and list all functional dependencies. The second deliverable was the Component design. Students described the components of their web application and specified their logic and interface (collection of methods, data types of arguments of methods, exceptions thrown by methods, etc). Students were requested to provide class diagrams whenever possible and describe how they were going to maintain application state and the servlet context. The third deliverable was the final implementation of the product.

Throughout the development process, students were encouraged to cooperate, to approach the problems systematically, considering all the requirements and tools simultaneously. Team leaders acted as moderators, rather than actual developers. The most difficult problem faced by students was the real time coordination and collaboration. By fruitfully utilizing the andragogy framework, students learned how to develop program specifications in a team, how to develop a peace of software that is supposed to work in a larger system, and how to test it. They also learned how to help each other, and how to jointly solve emerging problems in real time.

3. IDENTIFYING E-GOVERNMENT NEEDS AND REQUIREMENTS (STAGE 1)

3.1 E-Recreation
We first identified the needs and the requirements of the Amherst e-government portals. Our first concern was the reservation process for the Recreation Department.

The town of Amherst provides various recreation services during summertime to its residents, such as hockey lessons, golf sessions, badminton, aquatics, and tennis. In addition, the town has several parks with picnic areas, baseball diamonds, swimming pools, etc. for its citizens to use.

These public facilities can be reserved for specific groups of people. Many times, such as during the Memorial Day weekend, different groups will want to use the same facility at the same time, so the town usually adopts a reservations process. If the group wishing to use the facility is a private organization or individual, it is customary to charge a rental fee for the use of the public facility. The income from the recreational department facility rentals represents a significant source of income for the town.

Depending upon the anticipated size of the group, additional town employees may need to be notified of the planned event. For example, a regional Boy Scout camporee (several hundred youth campers and chaperones who reserve all the campsites in a park) would need to notify the police, the fire department, and the division of public works so that adequate safety, emergency response crews, and sanitation workers are available to make the experience an enjoyable and safe one for the participants. The facility reservations and notification process can get quite cumbersome, and take up extensive town employee time. In addition, the reservation must be transacted during normal business hours, which may be inconvenient for the renter. Also, there is no information about a facility, which would allow a renter to make an informed decision.

The existing process is quite cumbersome, paper-based, and involves a lot of time and effort. A resident wishing to make a reservation has to obtain an application, complete it, and mail it to the Recreation department, along with a check/money order. The process can take up to two weeks. After the application is acted upon, a decision is conveyed to the resident by mail, which can take as much as 17 days. The total cycle from sending an application to receiving an approval is shown in Figure 3. If this process can be migrated to the web, the approval time could be considerably reduced. A web-enabled application may be completed in less than seven minutes, thus achieving a reduction of more than 99% reduction in lead-time.

The primary issue in the current process is the lack of flexibility and the huge lead-time involved. This could hinder residents in planning their recreation activities. In addition, providing online services can easily dispense with the paperwork. Another drawback of the paper-based process is the lack of real-time communication/feedback between the town and the residents.

The only way by which an applicant can know whether his application is accepted/denied is thorough the final letter that he receives, which is 15 days after the application was initially made. In addition, due to the huge lead-time, the ability to change/schedule changes by the resident is greatly limited.

3.2 E-Procurement
The second project, which was developed for the town of Amherst, was an E-Procurement auction site.
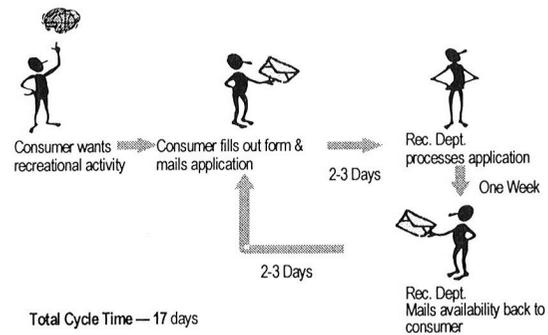

Figure 3. The Existing Process for Recreation Department Reservations

The town of Amherst needs various goods and services for its day-to-day functioning. The procurement of these supplies is time consuming, error-prone, paper-based, and requires a high level of human intervention. The current process also involves long approval cycles, a lot of red tape and high administrative costs.

Significant savings can be achieved by taking advantage of large volume purchasing, and by centralizing the purchasing function. There are many different departments and organizational units within the town of Amherst that require commonly used commodity items. Each department handles the purchases of these items on their own. Since combined purchases are not performed, the town could not take advantage of bulk purchases and discounts. The purchase of commodities can be facilitated by first aggregating all the orders relating to the same item and then allowing vendors to quote for this combined order. This could allow for substantial savings. In addition, further savings are possible if the vendors participate in an auction instead of offering price quotes individually. An online procurement auction could also significantly speed up government purchasing cycles and provide further cost reductions.

Moreover, the town does not have the resources to justify hiring purchasing agents solely for the purchasing process. At the same time, the existing accounting system lacks the ability to generate management decision-making data such as purchasing patterns trends identification, hidden costs warning signals, etc. By combining and aggregating all purchasing orders, the towns can access the potential savings without drastically altering the way in which they do business and consume materials.

3.3 E-Dog Registration
The third part of the project was a web site for online dog registration developed by the students of UB. The State of New York requires that all dogs be registered and licensed. The State maintains a central registry of dog owners at the State Department of Agriculture and Markets. However, the State delegates to the cities and towns all responsibility to issue dog licenses and keep track of the dogs living within their jurisdiction. Each dog must have a rabies vaccination before it can be licensed. The first shot is good for one year.

132

After the second rabies shot, at the end of the first year, the dog must receive booster rabies shot every three years. However, the dog license needs to be renewed once a year.

The town's experience shows that it is very difficult to track all of the dogs and their owners. While most owners do vaccinate their dogs, they won't always license the dogs. The current estimates of the town of Amherst show that there is a large number of unregistered dogs for which no license fees have been paid. An online system for dog registration, which combines a central registry of dog owners with distributed veterinarian databases, can identify unregistered dogs, and help the town collect additional revenue.

Currently, a dog owner who wishes to have his dog registered with the town should fill out an application, obtain proof of rabies vaccine, and send them along with a registration fee to the town. This can be done either through the mail or directly by visiting the town office. The process is time consuming and it can be improved upon by employing an online system for dog registration.

4. POOLING OF IS RESOURCES AND SKILL SETS (STAGE 2)

By teaming up with the University at Buffalo, the town of Amherst obtained access to the best technologies and practices in web development and e-commerce such as on-line procurement and on-line auctions. At the same time the town used the technological infrastructure of the university for web development and testing. The web prototypes were implemented in Java 2 Enterprise Edition working on Oracle 9i Application server. This created significant savings for the town in terms of equipment, training, software license fees, consultation fees, etc.

The partnership between UB and the town of Amherst started as a two-semester project. The project was funded by an Educational technology grant from the Vice Provost of UB. During the first semester, students in a graduate e-commerce course in the School of Management at UB identified and analyzed management issues valuable for the town of Amherst. In the second year, graduate students from the Department of Computer Science and Engineering designed and implemented prototypes of three e-government portals: an on-line action site for governmental procurement (E-Procurement), a portal for reservation of community recreation facilities (E-Recreation), and a portal for online dog registration (E-DogRegistration) combining a central registry of dog owners with distributed veterinarian databases.

The E-Government initiative of UB and the town of Amherst offer several advantages. First, it saves the local government resources by using the research potential of UB and the expertise of EDS. In addition, students were used as software developers. Second, the town of Amherst could become the first municipality in Western New York to offer innovative government services online. Third, it provides students with real life hands-on experience. The students obtained the chance to translate abstract theory and classroom lectures into real-world implementation projects that involve real data, real systems and real problems. Such kind of training better corresponds to the workforce needs of the digital economy. Fourth, it presented many research problems and opened several directions for future research. Fifth, as a result of the project an integrated educational environment for studying and teaching E-Commerce was developed. The environment runs on two e-commerce servers using software provided by Microsoft Academic Alliance, such as Commerce Server 2000,. The environment provides a uniform infrastructure for both research and teaching.

The joint project between UB and the town of Amherst consists of three parts: a system for Recreation Department reservations (E-Recreation), an E- Procurement auction site (E-Procurement), and a web site for online dog registration (E-Dog registration). The rest of the paper describes each of these parts in detail.

5. AMHERST E-GOVERNMENT PORTALS (STAGE 3)

5.1 E-Recreation Reservation

The proposed system for Recreation Department reservations (RDR) aims to overcome these limitations by allowing online reservations. The proposed process takes up to 6 minutes and is shown in Figure 5. The system is built using Java Server Pages and Java Servlets (Allamaraju et al., 2001, Allamaraju et al., 2000) and consists of two parts: a renter module and a government module. The renter module displays information (driving directions, capacity, etc), images, or short video clips of various recreational facilities. The user selects one of the available facilities. He is then given a choice to enter 3 possible dates and 3 possible time slots to reserve. If the facility is available for any of the entered dates then the user is asked to enter his renter code. After the user has identified himself, he enters information about the number of people involved in the function being organized (total number of people, number of children below age 5, number of senior citizens, special services required by the town such as police, ambulance, etc.). After all the relevant information has been entered the facility is blocked and an online application is sent to the town official for approval.
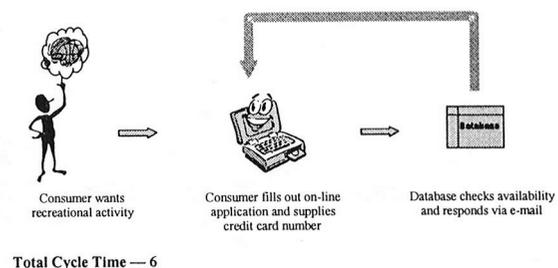

Consumer wants recreational activity → Consumer fills out on-line application and supplies credit card number → Database checks availability and responds via e-mail

Total Cycle Time — 6

Figure 4. The Proposed Process

133

The town official has a console that lists all the applications with a "Tentative Confirmation Code". The console allows the official to choose a set of prerequisites to be satisfied by the renter before the final approval is made. This also includes any payments to be made towards the rent of the facility. The official chooses all departments that need to be notified about the upcoming use of that facility (police, ambulance, etc.). If all prerequisites are satisfied, the official changes the application code to "Final Confirmation." Upon approval the system automatically sends an email to the renter and to all corresponding departments describing the details of the application. A sample reservation is shown in Figure 5.

The system for recreation department reservations provides three basic types of functionality: (1) information publishing and searching; (2) reservation of recreational facilities; (3) notification of multiple departments about upcoming reservations. All the communication between the system and the user is secured by means of SSL and appropriate session management (Ford, 2000). The system offers the following major benefits:

- It reduces the processing time from about 17 days to less than a day.
- It provides convenience, increased quality of services, and time and cost saving for users.

For the town of Amherst, it provides increased internal coordination, better flow of information, better accountability, and better resource management between departments.
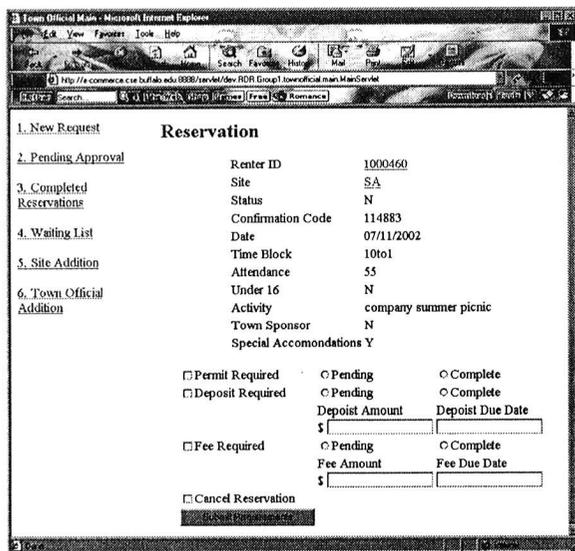

Figure 5. A Reservation Displayed on the Town Official Console

5.2 E-Procurement
In order to solve all these problems a prototype of online procurement auction was developed. The system was developed using J2EE (Allamaraju et al., 2001, Allamaraju et al., 2000) and Oracle 9i Database server. Every department enters, via a web site interface, a purchase order containing a list of items to be purchased. Every item in a purchase order is identified using a unique product identifier. The system automatically sets up an auction for every aggregated offer. In this way, the town can participate in multiple auctions simultaneously (one for every product that they desire to purchase). Vendors are registered with the system and they can participate in one or more auctions depending on how many products they can supply.
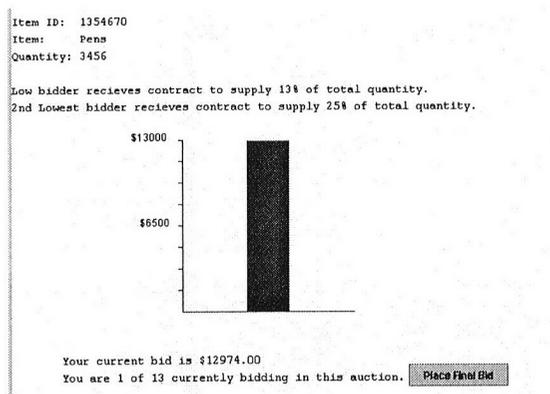

Figure 6. Vendor's Bidding Window

An auction for a particular product is held at a predefined day and time. For every auction, an email giving the auction details is automatically sent to all interested vendors. The vendors are given the URL of the web page, their vendor id and password and the product id number. Once a vendor has logged in for a particular auction, he is shown a bar graph of a continually reducing price (Figure 6). This indicates the current price of the auction. The vendor's reservation price is the price below which the vendor is no longer willing to provide his services and products. When the vendor wants to submit a bid, he clicks the halt button and is logged out of the system. The price at which the vendor logged out is accepted as his bid for that auction. The smallest bidder wins the auction and pays his own bid. Once the program has performed the bid awarding calculations, an email is automatically sent to the winner giving the details of the award.

The auction website offers the following major benefits:
- It allows the town to purchase goods and services efficiently with little action and effort required. Executing an auction is much cheaper and faster than sending paper-based requests for quotation.
- It reaches new markets, more vendors, and provides new trading opportunities, which are not available in conventional channels.
- It creates an electronic market with fast clearance and competitive dynamic pricing. If the parameters of the auction are appropriately chosen, it usually yields lower prices than conventional bilateral negotiations.

5.3 E-Dog Registration

The system for online dog registration, developed by the students of UB, consists of three parts: the User Interface, the Veterinarian's Interface, and the Town Employee's interface.

The Veterinarian's Interface is used by the local veterinarian when a dog owner takes his dog for a vaccination shot to the veterinarian. The veterinarian logs into a secure server using his user name and password. Then the veterinarian asks the dog owner for the dog's existing "State registry dog license number". If the dog has been registered before, then the veterinarian pulls up its record, prescribes further vaccination procedures and updates the record. If the dog has not been registered, then the veterinarian creates a record for the new dog and asks the dog owner to pay up the dog-licensing fee via credit card. After the payment has been made, the system issues a payment receipt and a vaccination receipt. If the owner decides not to pay at the veterinarian's office, then he is required to either go to the town office and make the payment, or log on to the town's website and makes the payment online.

The town Employee's interface is intended to help the town officials in monitoring and controlling the dog registration process. The interface gives a list of all dog registrations performed in the following categories:

- Existing dog licenses renewed online.
- New dogs that were registered with licensing payment received.
- Dogs that were vaccinated only and no licensing activity happened.

For all new dog records, the town office manually reviews all the records and either approves or rejects each dog registration application. Upon receiving a payment for license renewals or approved applications, the town official sends via post a payment receipt, a hard copy of the dog license and the metal dog tag to the dog owner. Also an email is sent automatically to the owner informing him of the approval.

The User Interface allows a user to log on to the town website and make a payment or renew a dog license without visiting the veterinarian. The user logs on to the website using his username and the dog license number, makes a credit card payment, and receives a confirmation receipt.

With the new system the process of dog registration is automated except for the approval and the delivery of the license. To register a dog, three key elements must be present and verified. The first requirement is that the registrant be a resident of Amherst town. At the current stage the test is performed manually, although it could be automated by checking the address of the dog owner against a database of known addresses. Secondly, the town needs to have a proof that the dog has been vaccinated against rabies. With the new model, the verification process will be

initiated via a network of area veterinarians. When a dog is vaccinated against rabies within the town of Amherst area, the Veterinarian will be required to report that information to the Amherst Government via a web based interface. The Veterinarian would then enter all the necessary information (the dog's name, the owner's name, address, and the date of the rabies shot) and this information will then be retained in a database linked to the town computer system. Registration is needed to be performed on an annual basis, and the residents themselves may do subsequent renewals. If a resident attempts to register a dog by himself, he may go to the town office, or perform the registration through the town website. The third requirement for issuing a dog license is the license fee payment. The system allows online payment to be performed either at the veterinarian office or on the town website.

The main advantages of the new process include a reduction in manual intervention, cost savings due to lesser time and stationery, increased convenience and customer satisfaction, greater geographic penetration, and an increase in revenue.

6. SUMMARY

The paper describes a strategic partnership initiative between the State University of New York at Buffalo, the local government of the town of Amherst, and Electronic Data Systems, Inc. The partnership aims to combine the research resources of UB with the proprietary expertise of EDS in an effort to improve the current web portal of the town of Amherst. By letting students design and implement the web portal, the E-Government initiative is extended beyond the perimeter of governance and brought into classrooms and research laboratories. The andragogical framework was fruitfully applied to the process, enabling the UB students, the town of Amherst, and EDS to define the needs and requirements of the portals, pool the resources as required, and progressively build the systems that meet the requirements. The problem of the real time coordination and collaboration in the actual development process was solved by the application of andragogy principles. Students learned how to develop program specifications in a team, how to develop software that is simply a component of a larger system, and how to implement it. A collective learning also happened in fostering the environment of mutual cooperation and jointly solving emerging problems in real time. The initiative offers benefits for the students, the town of Amherst, and the general public. Tables 2 and 3 summarize the main advantages of the initiative.

7. ACKNOWLEDGMENT

Manager, IT Services, the Town of Amherst, and Bruce Pitman, Vice Provost for Educational Technology.

Project	Existing system	Proposed system
Recreation	Resident fills out paper application; mails it along with fee, and waits for response.	Resident visits Amherst website; creates a personal profile, and enters request for desired sporting activity along with fee particulars; instant response is provided to resident about availability
Procurement	No indication of a present procurement process.	Town purchaser orders are aggregated and put up on an auction; various suppliers bid; the smallest bid wins the auction.
Dog registration	Dog owner takes dog to a Veterinarian; after the dog is vaccinated, a certificate is provided; this certificate is then mailed to town along with completed application and fee. After receipt of all required material, town mails identity tags and license certificate.	Dog owner takes dog to a Veterinarian; after dog is vaccinated, details are entered into veterinarian database which is linked to the town's database; if the town license fee is also paid to the Veterinarian, then the town is informed accordingly; the town, sends tags and license.

Table 2. A Comparison Between the Existing and the Proposed Processes

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Process	Present issues	Proposed advantages
Procurement	Error-prone; time consuming; human resources spent over low-value activities; inability to leverage purchasing power and obtain quantity discounts	Accurate; cycle time is significantly reduced; human resources spent in developing better supplier relationships; cheaper prices/ supplies
Recreation	Process takes as much as 17 days	Whole process can be achieved in less than a day
Dog registration	Manual visit/Postal communication required to Town Office – this entails time and effort	The Veterinarian may be able to perform the registration right away after vaccination; no post/physical visit required further.

Table 3. Existing Issues and Advantages of Proposed Processes

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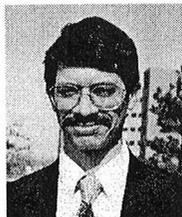
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