Moving Towards a Citizen-Centric Organisation: A Case Study of Singapore's Jurong Town Corporation

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ABSTRACT

In this paper, we describe a case study on the transformation of Jurong Town Corporation, a Singapore government agency, to a customer centric organisation. Monolithic and bureaucratic in the past, the transformation required more than the installation of an IT infrastructure to improve customer service. JTC also needed to change its decade-old business processes and IT practices to become more efficient. Such a complete overhaul was extremely challenging and pioneering in nature, and demanded wholesale changes plus the ability to work with great uncertainty. The new digital system had reaped significant savings through streamlined work processes redesign; cut down turnaround time through real-time processing; and enhanced customer service

***Keywords*:** Business process redesign, application architecture, customer portal, Web services.

1. Introduction

This paper presents a case study on the transformation of Jurong Town Corporation (JTC)-a government agency that provides tenancy and lease management services to more than 7,000 local and multinational companies in Singapore- through the implementation of a best practice enterprise resource planning system called Customer, Real Estate and Marketing System (eCREAM) that integrated customer-facing and back office applications throughout the government agency. eCREAM represented a radical step forward in the real estate industry by allowing online business transactions and immediate approvals in an industry that is characterised by high-value transactions, complex and tedious legal processes and paper-based submissions.

 JTC had achieved quantum leaps in cost savings and operational efficiencies by radically transforming internal work processes and leveraging on Information Technology (IT). It also helped JTC to win the 2004 Singapore National Infocomm Award[2] for the "Most Innovative Use of Infocomm Technology (Public Sector)." The project took 12,500 man days, 300 executives, cost S\$4.5 million, and along the way ended up mapping more than 50 separate end-to-end processes, redesigning them to make them more efficient. In fact, eCREAM was the largest IT investment ever undertaken by JTC. e-Government initiatives all over the world are moving towards adopting a customer-centric approach and moving away from more single-department services (Mahmood, 2007). Many such initiatives though fail to achieve all the desired results (Antonio, 2007), in some cases due to broader limitations of lack of national development (Kalu, 2007). Critical success determinants, shown by much research include ease of use and also trust (Horst, Kuttschreuter & Gutteling, 2007), and these are also validated by our case study.

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2. eCREAM Project Background

The genesis of eCREAM

In order to handle the large array of products, JTC developed its legacy systems in 1993 that consisted of 7 different silo systems – Land and Building Management System (LABS), Critical Fields of LABS System (CLASS), Customer Activities and Relationship Enhancement System (CARE), Customer Feedback and Recording System (CFRS), Survey Monitoring System (SMS), Pay Parking System (PPS), and Redevelopment Group Support System (RDGSS). These systems contained JTC's vital customer and marketing functions, such as product modelling and marketing, customer service, and lease management.

However, the silo systems were not perfect and had many issues that plagued JTC. For example, there was the problem of data duplication and inconsistency. This was because the 7 silo systems did not interface with each other and hence, JTC staff needed to input the same information into various systems separately. The systems also had difficulty interfacing with other systems and the only means of communications was through flat files. Flat files generated by external systems would be passed to JTC and IT staff would input those files into their own legacy systems. The legacy systems would in turn process the information and generate another flat file as output to give back to the organizations. In addition, as the legacy systems were client-server based, they were difficult to install on the PC and could not be deployed over the Internet. IT staff had to physically go down to the various users' departments to install the client applications. With a few hundred users around, the deployment was usually on a large-scale basis. Considering that these applications also needed to be maintained, a huge amount of resources were needed from support staff for installing and maintaining these systems. Furthermore, the old system architecture was inadequate to deliver e-initiatives to the customers and support the e-Government direction.

With all these problems causing inefficiencies and suboptimal use of resources, JTC decided to build a new system that would help to reinvent itself into a customer-centric organization and provide highly efficient work processes. JTC envisioned the system to be also flexible enough to be able to incorporate modifications and expansions whenever the needs arose in future. With these objectives in mind, JTC embarked on a new project – the eCREAM system.

3. eCREAM Functionality

eCream incorporated both front-end customer applications as well as back office functions. On the customer front, the customer portal, Krypton, is eCREAM's customer frontage and platform for JTC's customers to access applications hosted on eCREAM. It provided JTC customers with e-services for application, subletting and termination services from flatted factories to other JTC products. Specifically, this included:

- Applying for flatted factory unit through the Express Lane Application Programme (ELAP)
- Subletting services e.g. application for new sublet, renew of existing sublet and termination of approved sublet
- Submitting online application for seasonal parking tickets
- Updating business particulars and profile
- Accessing JTC's policies and online publications such as e-Periscope
- Making electronic payments, e.g. for subletting and seasonal parking ticket related services

On the back-end side, there were 14 internal business processes offered by eCream via Web Services as given below.

- *Dashboard Service*: It provides a one-stop shop for staff to search and view key information about customers, allocations and products based on key criteria and attributes.

- *Product Modelling Service*: It allows users to search, browse, create, update, retire, delete products data and perform marketing functions (such as grouping/ ungrouping, blocking/ unblocking and assignment of associated marketing information for products).
- *Product Launch Service:* It provides comprehensive functionalities which allow JTC to easily manage marketing launches. Specifically, it provides assistance in the assessment and ranking of applications for products with competing applications.
- *Customer Admin Service:* It creates and maintains company and contact information.
- *Customer Management:* This service captures and processes customer interactions, feedback & requests
- *Straight-Through Workflow:* This service manages workflow-driven processes that are pre-defined and repetitive in nature. It deals with the entire lifecycle of a customer, including application for space, subletting, renewal and termination of contract.
- *Car Park Admin:* It handles the administration as well as monitors the issues of car park lots to tenants/lessees as well as the public.
- *Operational Information Change:* Allows modification of certain allocation data (applications, bulk discounts & rebates, officer-in-charge) due to changes in customer request or decision/policy changes by JTC.
- *Rental Revision:* It provides a revision mechanism in which rental charges, rebates and other related charges (rental concessions) for land and ready-built factory leases paying land rent are revised according to specified intervals depending on the rental revision schemes.
- *Plan Submission:* This service monitors floor plans submitted by customers.
- *Inspection Service:* This service processes and manages inspection requests from other business services. This business service is primarily accessed by the inspection application used by the Property Executive to create, update, monitor inspection cases and generate monthly reports to schedule inspections.
- *Reminder & Notification Service:* This service sends reminders and notifications to users, internal processes or external systems for follow-up action.
- *En-Bloc Redevelopment (EBR) Service:* It creates and maintains information pertaining to each EBR programme such as EBR details, budget, etc
- *Security & Organisational Infrastructure Service:* It defines user access and manages and links information on organisational units, functional roles, users, layers, processes, process types and permissions.

4. E-Cream Implementation - Vendor Selection and Project Management

eCREAM system was implemented in two phases – study phase and the implementation phase, to effectively manage any potential risks of the system.

During the study phase of eCREAM, JTC evaluated various off-the-shelf products from Oracle, SAP and PeopleSoft that cater to the real-estate and government-related industries, to determine the solution that would best fit JTC's environment but none of these systems could meet JTC's unique requirements. JTC needed a real-estate system that must be able to comply with both complex business rules and government policies in processing transactions. Also, the system had to have customer-related management functionalities so that JTC could serve its customers better. With such unique requirements that commercial products on the market could not meet, JTC eventually decided on a turnkey solution over a packaged solution. After evaluating several proposals and based on the design, project management, and support capabilities of the companies involved, JTC finally awarded the project to a consortium of technology partners – Accenture, Avanade and Microsoft.

About 300 JTC executives and 22 consultants from Accenture-Avanade (Bhandar, 2006) were involved in the development and implementation of the eCREAM system. In order to facilitate knowledge transfer with ease from the vendor, three JTC employees were committed to work with the vendor development team. On the vendor's end, the project was sponsored by Accenture's General Manager of Government Projects, Asia Pacific. The project had full commitment from Microsoft, Accenture and Avanade as it was one of the pioneer. NET project in Singapore. When all the pieces had fallen into place, JTC moved into implementation. It took a four-phased approach whereby the entire project was delivered through a series of sub-projects that could be delivered and managed independent of each other. Small but frequent deliverables throughout the duration of the project helped to keep user interest high and lowered overall delivery risks. Internal business processes were also streamlined and re-engineered during the development of eCREAM. This required a change in mindset of all employees involved in the project. Consequently, to manage all the changes, the various components of the system were introduced in 4 phases.

With those strategies in place, JTC launched the first phase of eCREAM project in the September of 2002, one year after its study phase. In the first phase, a total 4 services were added to the new system, mainly Car Park Administrative Business Service, Customer Administrative Business Service, Infrastructure Service & Organizational, and Product Modeling Business Service. These services were relatively small and simple and hence, it only took about 3 months for this phase to be completed. Phase 2 started in December 2002 and the Product Launch Business Service was the only service added during this phase. However, this service served as an important infrastructure for more complex services which were added into the system later in phase 3. Phase 3 was carried out from June 2003 until the end of the year. During this phase, many frequently used services were added such as end-to-end Straight-Through-Workflow solution for flatted factory product type, Dashboards, and Administrative Services. This phase turned out to be the one that had the most services added and was also the longest phase in the project. The remaining services like end-to-end Straight-Through-Workflow solution for all other product types, Customer Relationship Management Business Service, Plan Submission Business Service and Rental Revision Business Service were implemented in the last phase.

5. eCREAM Technical Architecture

In order to serve business partners and the public through many electronic channels, JTC decided to connect eCREAM system to external networks. The system was, therefore, built on a solid architectural foundation that supported high availability, a secure infrastructure, and a management infrastructure. The architecture was also designed to reduce integration complexity, promote inter-operability, and increase reuse of components.

Software Platform and Standards

The application development of the eCREAM system was guided by Microsoft's .NET framework. Microsoft Visual Studio.NET was used by the development team for creating Web services as it automatically generated the necessary XML codes and SOAP interfaces. As the tool supported all modern programming languages, reusability of existing Web services was ensured. The Web Services paradigm enabled JTC to integrate and manage the services provided by its business partners over the Internet in an extensible fashion, without the need for long negotiations over formats and protocols. While the workflow was managed with Staffware Process suite 2000, Computer Associates' AION business rules engine was deployed for business rules automation. The data-driven business rule and workflow engines allowed JTC to respond quickly to policy changes and process improvements.

System Architecture

The key architectural elements in the eCREAM system architecture included the Internet clients, the devices in the perimeter network, the DMZ, the internal firewall, and an internal network that incorporated

network segments for infrastructure servers, database and management servers, and the corporate servers (Figure 1). In order to centralise storage, and to implement a high-speed backup and restore solution that would not interfere with the production network, JTC decided to use a storage area network (SAN). eCREAM system architecture was primarily centred on the Microsoft .NET Enterprise Servers (Windows 2000 Advanced Server and Microsoft SQL server) deployed on Compaq hardware base. These servers supported the goals of scalability, security, availability, manageability, and reliability.
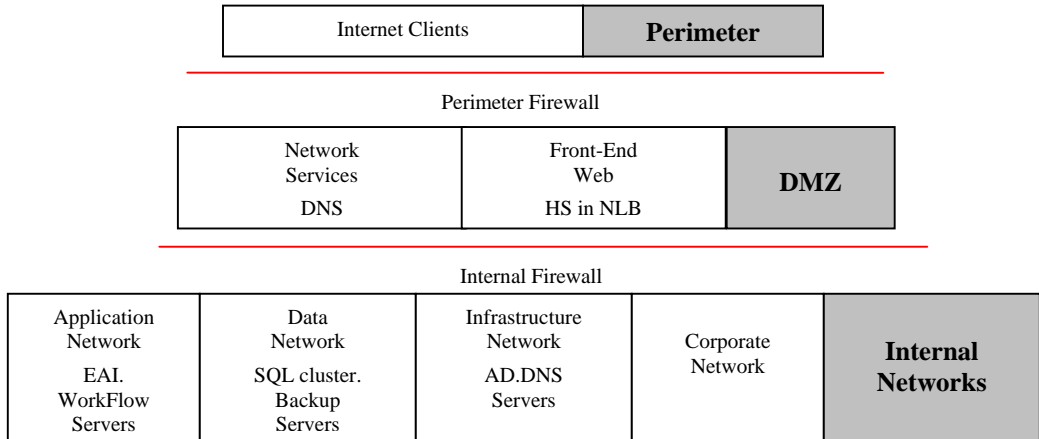
Figure 1: Logical View of System Architecture *(Source: JTC, Singapore)*

Furthermore, the team implemented best practices covering multi-tier implementation, designing for security and scalability, clustering and high availability, and everything else they needed to ensure their architecture was ready for the future.

Application Architecture

eCREAM was built on a loosely coupled set of components communicating with one another using open standards. This was to enable eCREAM to be flexible and robust enough to support JTC's future strategic business and IT requirements. There were 4 application layers in eCREAM – Data Layer, Infrastructure Services Layer, Business Services Layer and the Interface layer (see Figure 2).

Data Layer: This layer consisted of an integrated operational database to replace information that was residing in 7 legacy systems. The components within the data layer were mainly Product, Customer Database, Organizational Structure Database, Allocation Database, and Case Database (see Table 1). They were supported using servers which were running on Windows 2000 platform with MS SQL Server in a load-balanced architecture with fail-over capabilities.

Table 1: Data Layer *(Source: JTC, Singapore)*

| Components	Description
Product	Customised collection of tables, views and stored procedures. Using Microsoft SQL 2000
Customer Database	Customised collection of tables, views and stored procedures. Using Microsoft SQL 2000
Organisational Structure Database	Data store to maintain the organisation structure and user profiles. Using Microsoft Active Directory
Allocation Database	Customised collection of tables, views and stored procedures. Using Microsoft SQL 2000
Case Database	Customised collection of tables, views and stored procedures. Using Microsoft SQL 2000
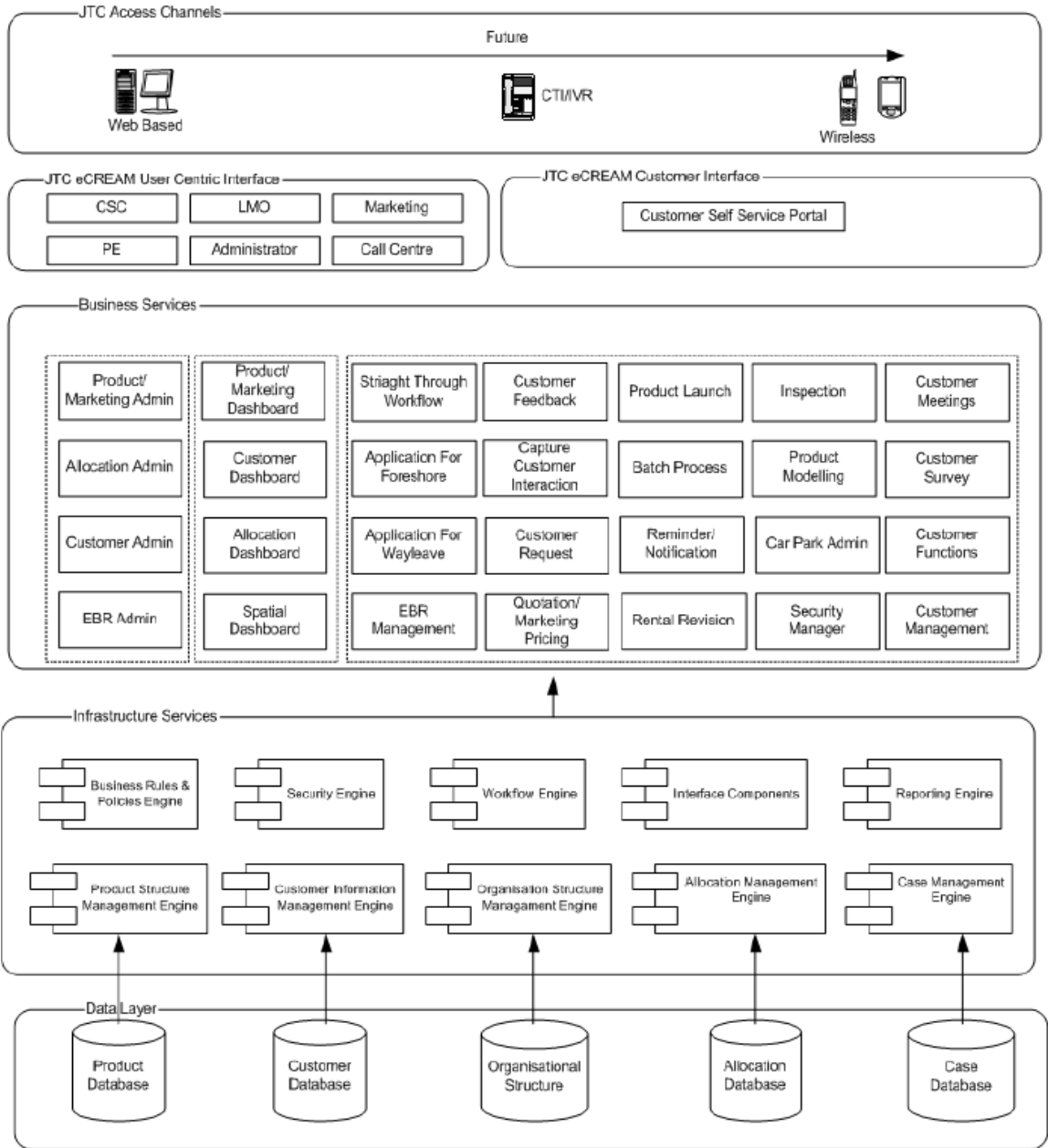
Figure 2: Logical view of application architecture *(Source: JTC, Singapore)*

Infrastructure Services Layer: The Infrastructure Services provided the fundamental building blocks for each of the subsystems. The services were used for updating and accessing customer profiles, controlling product structure and organizational structure, as well as allocating data. There were 11 components in this layer (see Table 2), which are Business Rules and Policies Engine, Security Engine, Workflow Engine, Interface Components, Reporting Engine, Product Structure Management Engine, Customer Information

Management Engine, Organization Structure Management Engine, Allocation Management Engine, and Case Management Engine.

Table 2: Infrastructure Services *(Source: JTC, Singapore)*

Components	Description
Business Rules and Policies Engine	An engine to execute the business rules which are stored in the database. This allows the business rules to be easily modified and versioned. Using CA CleverPath AION.
Security Engine	An engine that implements the security schemes identified by JTC. Leverages on Windows 2000 Security Model and Active Directory.
Workflow Engine	An engine to provide for workflow-related functions to business services including Straight Through Workflow (STW) and Non Straight Through Workflow processes. This allows workflow processes to be easily modified, enhancing flexibility of business services. Using Staffware Process Suite.
Interface Components	Provides a unified engine for integration. Various modes of interface are used for both JTC internal systems and external agencies systems: • Set of customised .NET Managed Component that utilises SOAP/XML as communication protocol • FTP file transfer • Dynamic data access • Batch programs • Text File
Reporting Engine	This engine provides a common platform to cater to reporting needs within the eCREAM system. All reporting solutions within the eCREAM system are implemented and managed with Crystal Report 9.0.
Product Structure Management Engine	Customised .NET Managed Component that provides for interfaces and methods for the management of various entities within the JTC Product database. The component utilised ADO.NET for data access.
Customer Information Management Engine	Customised .NET Managed Component that provides for interfaces and methods for the management of prospects and customers within the JTC Customer database. The component utilised ADO.NET for data access.
Organisation Structure Management Engine	Customised .NET Managed Component that provides for interfaces and methods for the management of various entities within the JTC Organisational Structure database. The component utilised Active Directory Services Interface (ADSI)
Allocation Management Engine	Customised .NET Managed Component that provides for interfaces and methods for the management of allocations within the JTC Allocation database. The component utilised ADO.NET for data access.
Case Management Engine	Customised .NET Managed Component that provides for interfaces and methods for the management of cases within the JTC Case database. The component will utilised ADO.NET for data access.

Business Services Layer: All JTC business processes were implemented as components, also known as "business services" that used the Infrastructure services to control workflow and business logic as well as to control access to data layers. There were 28 business services within eCREAM that were grouped into 7 logical areas - Business Services Dashboard, Straight-Through Workflow (STW) Business Services, Non-Straight-Through Workflow Services, Ad-Hoc Business Services, Admin Business Services, Optional Business Services, and Online Customer service Portal (see Table 3).

The business services primarily used Infrastructure Services to perform its task. For example, in a subletting application, the Straight-Through Workflow (STW) Business Service called on business rule & process engine to perform the assessment of the applicant. Once that was done, the system called on the workflow engine to route the case to the next officer. The interface engine component was also tasked to send the billing details to the SAP Financial system.

Table 3: Business Services *(Source: JTC, Singapore)*

Business Service	Description
Business Services Dashboard	The central hub linking all the various business services.
Straight-Through Workflow (STW) Business Services	JTC's pre-defined, highly repetitive, workflow-driven processes.
Non-straight Through Workflow Services	JTC's other workflow-driven processes that do not conform to STW type of workflow.
Ad-Hoc Business Services	JTC's operational processes that are not workflow driven.
Admin Business Services	Controlled service that was not available to general management and end-users for performing changes to the data record.
Optional Business Services	Business services identified as less critical to operations.
Online Customer service Portal	Transactions that are done using JTC's online customer self-service portal.

User Interface Layer: The user interface layer provided a rich graphical user interface to the users in a web browser This layer allowed the users to interact with the eCREAM system using a wide variety of access channels but consistently leveraging on the same set of business services. This design of the interface layer provided flexibility for different access channels to eCREAM system to use a combination of different business services. For example, when a customer submitted an application for termination, the workflow business service was called upon using a Web Service that routed the case to the appropriate officer-in-charge.

This layer was built using Microsoft Visual studio. Net platform and had 2 main components – User Centric Interface, and Customer Self-Service Portal (Table 4).

Table 4: User Interface Layer *(Source: JTC, Singapore)*

Components	Description
eCREAM User Centric Interface	This interface layer provides a unified access channel for JTC employees to use a combination of the different business services using Customised Web Parts with Microsoft Share Point Server as the hosting platform.
Customer Self-Service Portal	Customised .NET Web components that use web services to invoke business services to accomplish the various services within the portal.

6. Impact of eCREAM

eCREAM had impacted many facets of JTC's business most notably in the areas of customer service, business processes, internal work processes, and JTC's management decision making process.

*Customer Service***:** The implementation of eCREAM represented a fundamental shift in customer service delivery in JTC. In the past, customers had to physically commute to JTC's zone offices for transactions or payments. On the other hand, with Krypton – eCREAM's customer portal - customers were able to access the services anywhere, anytime as long as they had access to Internet. This reduced the need for customers to physically commute to JTC for transactions as services were available at the click of a mouse in the comfort of their own home or office 24 hours a day and 7 days a week. After the launch of eCREAM, JTC amalgamated its 3 zone offices across Singapore with the headquarters and reorganised its Customer Service Group to better server its various segments of customers.

Business Processes: With the implementation of eCREAM, many business processes were re-engineered with the aim of online approval via Krypton or on-the spot approval over the counter. For example, while in the past it took about 14 days to process applications for flatted factories, under eCREAM, customers could apply for flatted factories online and obtain instant approval. This efficiency and accuracy in processing online applications was achieved by automating the criteria for application evaluation as well as business rules automation.

eCREAM had also transformed internal work processes. Dashboards were created to group and organize work processes for different functions such as marketing, property management, customer service etc. These dashboards were "one-stop shops" which allowed JTC employees to search, retrieve and view key information about the cases in a single window. With these dashboards, the turnaround time was shortened as the employees had to access only one system instead of various disparate systems to scour for information.

In addition, various steps of the current workflow – application, assessment, recommendation, approval, customer acceptance – were simplified and combined into one step with customers declaring upfront that they meet the criteria and accept the terms and conditions. Besides the workflow re-engineering, various work processes were also streamlined to achieve time and effort savings. In the past, employees had to retrieve hardcopy documents from various other departments which took considerable amount of time. But with eCREAM, various documents like legal documents, map plans or floor plans were filed in the electronic document repository system that interfaced with eCREAM for easy retrieval and archiving.

Decision-making Process for Management: The standardisation of business terms and product modelling information, as well as a more structured classification of data in eCREAM facilitated business performance analysis and reporting for the JTC management. In the past, the analysis was manually performed by IT staff using SQL queries which required a much longer turnaround time. However, with the integration of product and customer information, JTC management was able to run the analysis with much less effort. This enabled JTC management to make faster and better informed strategic decisions according to the changing business environment

Time and Manpower Savings: eCREAM freed JTC staff from processing routine and standard requests, thereby allowing them to focus on higher value-added work such as engaging the customers and attending to their needs. Unlike the legacy system, eCREAM also allowed users to maintain business rules and parameters dynamically while at the same time perform self-help in data extraction and reporting.

With the system supporting over 50 processes and serving approximately 1,000 core users in their respective business areas, these improvements reaped significant time savings in operations and about $3.8 million in manpower savings per year for JTC.

7. Concluding Remarks

Transforming business processes by leveraging on Information Technology to improve services is the goal every government agency aims for. This paper has provided insights and experiences of JTC in the journey of transforming its business processes through the eCREAM system to become a customer-centric organisation. Some lessons that could be learnt by other e-government initiatives from this case study are application design, a centralised model with focused point-of-contact, but a use-friendly interface despite the back-end complexity. JTC's e-Cream system is a part of the larger Singapore Government's next-generation initiative to provide access to all government services through any device any platform. Further, all services will be integrated through a single portal, made possible through a standard operating environment (Infocomm Development Authority of Singapore, 2007) at the front-end and through the use of more uniform development tools at the back end. JTC has moved quickly towards a new, integrated infrastructure environment and this will go a long way towards seamless connectivity with every other Singapore government agency.

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