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Total Cost of Ownership Model: A Framework for Hanover

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Abstract

Financial pressures are forcing companies to focus on calculating Total Cost of Ownership (TCO) of Information Technology (IT) assets and their business value. Hanover Insurance had attempted to develop a TCO model in the past. This model was not implemented due to a limited set of defined metrics. This project proposes a TCO model that includes a larger set of metrics, which allows the company to calculate the costs derived by IT assets and the business value these assets generate.

Executive Summary

The Hanover Technology Group (HTG) needed to develop an understanding of the drivers of each line of business in order to properly spread costs across the company. Through this project, we created a Total Cost of Ownership (TCO) model to help HTG determine the value of their current IT costs while maintaining alignment. The project objectives were:

Objective 1: Understand Hanover's Business and IT Strategies

Objective 2: Analyze business processes within two lines of business: Personal Lines and Commercial Lines.

Objective 3: Determine links between IT applications and business processes analyzed in the two lines of business.

Objective 4: Develop a TCO model that takes into consideration the IT infrastructure and alignment between business processes.

We reviewed the literature to examine previous TCO models used by other companies, breakdown of cost techniques, and business drivers, which are crucial in developing an effective TCO model. We also reviewed research studies, internal documents, and Hanover's approach of achieving alignment with Information Technology Service Management (ITSM) and Information Technology Infrastructure Library (ITIL). Lastly, we explored the topic of Technology Business Management

(TBM) and analyzed packaged TBM solutions which are an alternative to calculating Total Cost of Ownership.

Initially, we researched scholarly articles on TCO models used by other companies. These models provided situational examples to help determine the most applicable TCO model for Hanover. After understanding other approaches to creating a TCO model, we scrutinized internal resources to gain a stronger perspective of Hanover's business processes. More specifically, we studied the process maps for Personal Lines and Commercial Lines to better understand how Hanover structures its business within these lines. In addition, we analyzed internal data worksheets that contained the applications and products used by the company. These internal worksheets were crucial in deciding the components of our TCO model.

To enhance our understanding from literature review and document analysis, we interviewed the CIO's from each line of business at Hanover. We used these interviews to gauge the opinions of both business and IT perspectives on the approach to the new TCO model. After accumulating outlooks on the problem, we were able to establish a stronger understanding of the specific needs in creating a successful TCO model for Hanover.

In order to determine the drivers of our TCO model, we met with the Business Process Architects to discuss the main transactions, core applications, and products for Personal Lines and Commercial lines. We limited our project scope to 16 core applications and four main transactions. These transactions were chosen because they held the highest percent of usage by the determined core applications. We determined

that having a transaction-based model provides an opportunity to better align IT applications and business processes, a theme we heard frequently in our interviews. We developed the following equation to calculate Total Cost of Ownership in our model:

$$Total\ Cost\ Per\ Application\ Per\ Transaction\ Per\ Product = Total\ Cost\ Per\ Line\ of\ Business * Percent\ Usage\ Per\ Application\ Per\ Transaction\ Per\ Product$$

This equation allows Hanover to better align the IT and Business side, because the transactions provide a link between the IT applications and business products. Along with the TCO Excel worksheet, we incorporated a visual representation of the data derived by the above equation. These two deliverables generate value for Hanover Insurance because it allows the company to benchmark across company standards, as well as, slice financials while providing cost transparency.

At the end of this project, we created a TCO model for Hanover and provided the company with the following recommendations:

Recommendation 1: The new TCO model should be employed with a three-step approach. The first two steps include the implementation of the proposed model, and the expansion of the model with minor applications, third-party services, and additional transactions. The third step recommended Hanover to consider other advanced analytic solutions such as TBM.

Recommendation 2: Hanover should update their Business Process Maps and Systems Impacts model data every six months in order to easily maintain the TCO model.

Recommendation 3: Proper training and a value-added presentation were suggested to gain the confidence of the employees and minimize resistance to change.

In summary, through this project we were able to improve our data mining abilities as well as our qualitative and analytical skills. Through our efforts, we hope this model will provide a solid framework to assist Hanover Insurance with the delineation of their current IT costs.

Authorship

Each team member has contributed equally to the writing and editing of all sections of this report.

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1. Introduction

Managing information technology (IT) investments, expenditures, costs and benefits are a challenge for most companies as tighter budget controls on IT spending are implemented commonly across industries. Executives have found that understanding the Total Cost of Ownership (TCO) within IT could allow companies to more accurately budget their future costs (Smith, 2002). In this report, we use the term Total Cost of Ownership to refer to the direct and indirect costs of applications used to support lines of business. This description of TCO provides a balanced approach to emphasizing both the operations and technology components in these models. Hanover, like many other successful businesses, understands the value of evaluating their IT services. In this project, we advise Hanover Technology Group (HTG) on the best approach in assessing current and future budget by creating a Total Cost of Ownership model for the company. This reliable model highlights the opportunity for technology standardization and allows Hanover to benchmark against industry standards.

One of the main motivations of Hanover's initiative is to create a TCO model that will inadvertently cause IT staff to think of business capabilities and the future of Hanover's budget. In doing so, Hanover strives to maintain and further improve alignment between business and IT. The Technology and business sectors are too dynamic to be easily connected. By creating strategic alignment maturity, businesses are able to identify with a successful business strategy. Furthermore, HTG needs to develop an understanding of the drivers of each line of business in order to properly spread costs across the company. HTG had attempted to come up with a TCO model for IT in 2007,

but their biggest challenge was repeatability and maintainability within the model. HTG has defined valuable metrics over the past five years that helped form a strong platform for the new TCO model. HTG asked us to approach this problem again and develop a new model that meets HTG's needs and functions well within the current environment.

In order to attain our goal, as a project team we upheld the following objectives:

Objective 1: Understand Hanover's Business and IT Strategies

Objective 2: Analyze business processes within two lines of business: Personal Lines and Commercial Lines.

Objective 3: Determine links between IT applications and business processes analyzed in the two lines of business.

Objective 4: Develop a TCO model that takes into consideration the IT infrastructure and alignment between business processes.

This report continues with a summary of the background information collected by the team followed by a brief description of the methods used in this project. We then present interview results and our TCO model. The Discussion section touches on the value gained from our model and the Recommendation section discuss what we believe is the best approach for Hanover. The Conclusion section presents a summary of the key findings from our project.

2. Background

In this section, we have articulated the literature review that was conducted in order to provide a direction for the TCO model. The literature review is made up of internal documents, case studies, and scholarly articles. The topics discussed include previous TCO models used by companies and the breakdown of cost and drivers that are crucial to developing an effective TCO model. The topic of alignment was discussed, along with Hanover's approach of achieving alignment with Information Technology Service Management (ITSM) and Information Technology Infrastructure Library (ITIL). Lastly, the topic of Technology Business Management (TBM) and an analysis of companies that currently implement TBM conclude the background section.

2.1 TCO Models proposed in Literature

There are several TCO Models that reflect what businesses can use in order to better understand their IT costs. By implementing and analyzing a TCO model, these companies will be able to reduce their overall IT expenditure. Many times, companies will overestimate the value of specific applications, which causes them to disproportionally request high IT support levels. We looked into various TCO models in literature and internal documents in order to better grasp the approach that was taken for HTG's TCO model. Below are the three most relevant TCO models to the project objectives.

According to a study (Smith, 2002), IT cost can be separated into two main sets of cost factors to create a TCO model; acquisition cost and administration costs. Figure 1 presents a detailed chart of the TCO Model breakdown inspired by the study (Smith, 2002). In this study, acquisition costs include hardware and software. On the other hand,

administration costs include control and operational costs that can be even further broken down. Control costs include implementation and maintenance of both centralization and standardization. Operational costs involve support, evaluation, installation upgrades, training, downtime, futz, auditing viruses, and power consumption. These costs were developed into an equation that derived a per-seat cost. Per-seat cost is simplified into the below equation:

$$Per\ Seat\ Cost = Acquisition\ Costs, Control\ Costs, Operational\ Costs$$

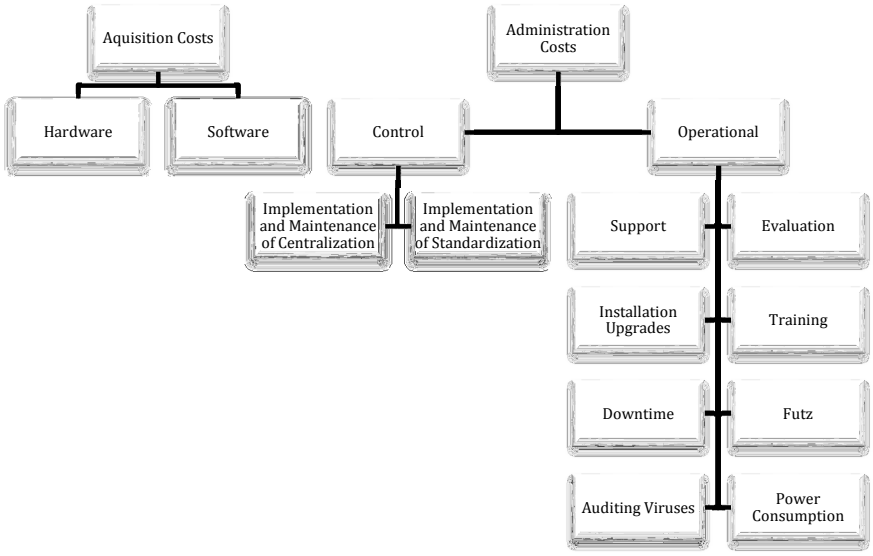

Figure 1: Inspired by Communication of the ACM TCO model layout inspired by (Smith, 2002)

In another paper (Koomey, 2007), the TCO model was split into IT hardware and software such as servers, disks, tape storage, and networking. This model had taken the energy usage and cost into consideration by comparing themselves to other company usages and costs. In turn, this model developed a relation to current technology data for

other high-performance computing program's financials. Furthermore, this TCO model, as depicted in **Error! Reference source not found.**, recommended that data center's evaluate their "architectural and engineering fees, interest during production phase, land, inert gas fire suppression costs, IT build-out costs for racks, cabling, internal routers and switches, point-of-presence connections, external networking and communications fees, electricity costs, security costs, and operations and maintenance costs for both IT and facilities." This allowed the data center to better assess their energy usage as well as their IT expenditure. See **Error! Reference source not found.** for a detailed layout of the spreadsheet used to hold this relevant information (Koomey, 2007) .

In addition to the TCO models we found in the academic literature, we investigated TCO models in Hanover's internal archives. One of the TCO models involved an innovation-driven pharmaceutical company called Lilly (Archives, 2010b) This company, like many other companies, overestimated their applications, which has caused disproportionately high IT support levels. Therefore, Lilly decided that an implementation initiative to educate business partners on value and total cost of existing applications portfolio was necessary for the improvement of the company's capital usage.

The approach of this pharmaceutical company was to correlate the costs with the benefits of applications in order to determine their importance to the company through the use of scorecarding. Scorecarding provides a way for business users to track employee performance. Through the use of key performance indicators (KPIs), a visual record of results is created. KPIs can include sales performance, margins, or amounts sold. The scorecard then makes target goals, and monitors the company's progress towards them. Scorecarding is a good way to communicate important strategies in an

effective way. These indicators can be tailored for many industries, as they assist with budget decisions and benchmarking

Creating score applications that allowed the business to weigh out business objectives demonstrated the impact of investing, or choosing to not invest, in an application. This was a zero to one based scale that looked into both qualitative and technical factors. After accumulating this data, the company was then able to reduce cost, increase value, retire and/or keep as is (Archives, 2010b).

2.2 Breakdown of Cost

Cost is an important component to developing a well-designed model. We evaluated the most frequently used costs within a TCO model. These costs included infrastructure costs, annual support costs, direct costs, and per-seat costs.

Infrastructure costs are concerned with "the portion of the shared infrastructure that a particular application utilizes" (Archives, 2012). These costs refer to the hardware and software costs associated with a process for a given line of business. For example, most processes must pass through multiple automated activities. For each activity, the software and hardware have both an initial purchase cost and continual maintenance costs. Infrastructure costs are the accumulated cost of purchase and maintenance costs for one activity.

Direct costs are important for most companies who use applications that involve technology. Direct costs "include application maintenance costs and depreciation." (Archives, 2012). For example, for any given user, they must have access to technical support, repair, and up-to-date technology in order to complete the task at hand. Annual support costs umbrella part of direct costs, but on a much larger scale.

Energy and power use/costs	Units	Servers	Disk storage	Tape storage	Networking	Totals	Notes
% of racks		80%	8%	2%	10%	100%	1
# of racks		160	16	4	20	200	2
# of U per rack		42	42	42	42	42	3
% filled	%	76%	76%	76%	76%	76%	4
# of U filled		5120	511	128	638	6397	5
Power use/filled U	W	385	200	50	150	340	6
Total power use/rack	kW/rack	12.3	6.4	1.6	4.8	10.9	7
Total Direct IT power use	kW	1971	102	6	96	2176	8
Total electricity use							
IT (UPS) load	kW	1971	102	6	96	2176	8
Cooling	kW	1281	66	4	62	1414	9
Auxiliaries	kW	690	36	2	34	761	10
Total power use	kW	3942	204	13	192	4351	11
Electric power density							
IT load	W/sf elect. Active	99	5	0	5	109	**12**
Cooling	W/sf elect. Active	64	3	0	3	71	**12**
Auxiliaries	W/sf elect. Active	35	2	0	2	38	**12**
Total power use	W/sf elect. Active	197	10	1	10	218	12
Total electricity consumption							
IT load	M kWh/year	16.4	0.9	0.1	0.8	18.1	13
Cooling	M kWh/year	10.7	0.6	0.0	0.5	11.8	13
Auxiliaries	M kWh/year	5.7	0.3	0.0	0.3	6.3	13
Total electricity use	M kWh/year	32.8	1.7	0.1	1.6	36.2	13
Total energy cost							
IT load	M $/year	1.11	0.06	0.00	0.05	1.23	14
Cooling	M $/year	0.72	0.04	0.00	0.04	0.80	14
Auxiliaries	M $/year	0.39	0.02	0.00	0.02	0.43	14
Total electricity cost	M $/year	2.23	0.12	0.01	0.11	2.46	14
Capital costs (Cap Ex)							
IT capital costs							
Watts per thousand $ of IT costs	watts/thousand $	86	30	6	100		15
Cost per filled U	k $/U	4.5	6.7	8.3	1.5		16
Cost per filled rack	k $/rack	189	280	350	63		17
Total IT costs	M $	23.0	3.4	1.1	1.0	29	18

Other capital costs	Units	Servers	Disk storage	Tape storage	Networking	Totals	Notes
Rack costs	k $/rack	3	3	3	3		19
External hardwired connections	k $/rack	5	5	5	5		20
Internal routers and switches	k $/rack	5	5	5	5		21
Rack management hardware	k $/rack	3	3	3	3		22
Rack costs total	M $	0.48	0.05	0.01	0.06	0.6	23
External hardwired connections total	M $	0.80	0.08	0.02	0.10	1.0	23
Internal routers and switches total	M $	0.80	0.08	0.02	0.10	1.0	23
Rack management hardware total	M $	0.48	0.05	0.01	0.06	0.6	23
Cabling costs (total)						1.3	24
Point of Presence (POP)	M $					3.5	25
kW related infrastructure costs	M $	46.9	2.4	0.2	2.3	51.8	26
Other facility costs (elect. active)	M $					5.2	27
Interest during construction	M $					4.0	28
Land costs	M $					0.50	29
Architectural and engineering fees	M $					2.9	30
Inert gas fire suppression	M $					1.0	31
Total installed capital costs	M $					101.8	
	$/sf elect. active					*5091*	
Capital costs with 3 year life	M $					30	32
Capital costs with 15 year life	M $					72	33
Annualized capital costs	M $/year					19.3	34
Annual operating expenses (Op Ex)							
Total electricity costs	M $/year	2.2	0.1	0.01	0.1	2.5	35
Network fees	M $/year					0.5	36
Other operating expenses							**37**
IT site management staff	M $/year					0.39	38
Facilities site management staff	M $/year					0.52	39
Maintenance	M $/year					0.42	40
Janitorial and landscaping	M $/year					0.16	41
Security	M $/year					0.70	42
Property taxes	M $/year					0.72	43
Total other operating expenses	M $/year					2.91	
Total operating expenses	M $/year					5.9	44
Total Annualized costs							
Total	M $/year					25.2	45
Per unit of electrically active floor space	$/sf/year					1260	46
Per server	$/server/year					4922	47

Figure 2: "A Simple Model for Determining True Total Cost of Ownership for Data Centers" TCO model excel spreadsheet(Koomey, 2007)

They are not determined on a daily basis, but must be calculated when determining the value of an application. These particular costs include "the ongoing costs necessary to sustain the program in the future, including maintenance, staffing, and upgrades, calculated by averaging three years of support costs after achieving scale" (Archives, 2012). When considering staffing costs, it is also very important to include the cost of training. Training can involve materials, training leaders, and employee payments. Per-seat cost combines every cost associated with one user. The formula is as such,

$$Per\ Seat\ Cost\ =\ f(Hardware, Software, Centralization, Standardization, Support, Evaluation, Upgrades, Training, Downtime, Auditing, Viruses, Power\ Consumption)$$

(Smith, 2002).

Drivers are a key factor to the overall layout of the model when considering a company's Total Cost of Ownership. Depending on the needs of the company, the drivers may change according to the model type; application-based or transaction-based. Overall the drivers will spread the cost in a presentable and maintainable manner, which is why they are crucial to the development of a TCO model.

Infrastructure drivers "[support] the enterprise IT applications via standardized interfaces," as shown in Figure 3 (Broadbent, 2002). With these drivers businesses can communicate with customers and business partners in a standardized and efficient way. The infrastructure is broken into two main parts; physical and management-oriented clusters. Within the figure, the overarching clusters have strong dependencies with each other, which is why many of the management-oriented clusters touch several different components. The physical clusters, which are the dark blue clusters, contain components

that use technology to improve business standards and efficiency. The management-oriented cluster uses education and organization to control and maintain the physical cluster.

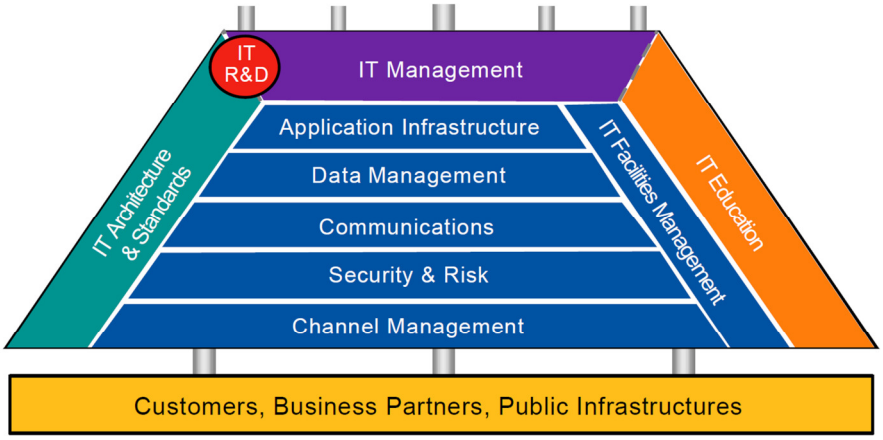

Figure 3: ITIL Service Strategy (Broadbent, 2002)

One example of how breakdown of cost can address both technical and operational issues is illustrated in the MetLife case study. MetLife, a well-known insurance company, has developed steps of best practice to define IT services from the bottom up. This approach helps to "take advantage of business capabilities defined through the formal business architecture process" (Archives, 2010a). The process outlined by the MetLife case study provides a guide on how to identify the lines of business, processes, IT infrastructure, and relevant applications. The value of this case study was its consideration of the business side of the company including who actually uses applications and in what capacity. The previous TCO models discussed in Section 2.1 primarily focused on the IT side of the business, which can lead to unaligned business sectors.

In determining a business strategy, it requires a detailed understanding of the business processes and capabilities in order to determine how to achieve the end-goal. It

is important to define the business strategy for each line of business relevant to the project. MetLife recommended discussing with each business partner their point of view on their business strategy in order to identify any inconsistencies across the company. The second step in the MetLife case study is to identify business processes. Once the business processes are clearly outlined, key business activities will be seen. These processes help to determine relevant business services, and may reveal important business drivers.

Once business processes are clearly understood, they should be linked to the company applications. Linking the two, maps the IT infrastructure. In this step, applications for each capability are identified and mapped as well. When considering the business processes and applications, one has to consider what factors drive the cost of utilizing the services involved in each process. Whether it is a financial driver or a driver of IT infrastructure, the TCO model needs to address the various aspects that can influence the Total Cost of Ownership of the company.

2.3 Importance of Aligning IT and Business Strategies

Alignment involves setting the priorities of IT with the business strategy. It is one of the most difficult tasks for a company as business strategy and technology is continually evolving. When a company commits to creating a balanced environment for both IT and the business, the company will easily be able to gain a competitive advantage among its competitors. Alignment involves six main categories: communication maturity, partnership maturity, competency and value measurement maturity, governance maturity, technology scope maturity, and skills maturity (Luftman, 2003).

Communication maturity requires individuals working in the environment to effectively exchange ideas among their coworkers in order to ensure successful strategies. By creating this exchange of information, both the business side and the IT side will be able to understand the motives and concerns of each department, making decision making a lot more effective. Often companies choose to use facilitators or liaisons in order to prevent any issues with miscommunication. Many times this approach has caused companies to struggle more with their communication issues rather than foster from the facilitators work.

Partnership maturity lies along the same lines as communication maturity because it is the expectation that both IT and business have equal say in defining business strategies. This requirement embraces the need for trust among the participants. By creating a strong vision that both the CIO and CEO share, the company will be able to easily contribute to a mature alignment.

Competency and value measurement are based on IT developing a strong enough service level agreement that assesses IT's commitments to the business needs. This agreement includes the rewards and penalties for surpassing, or missing, the business objectives. Value measurements should be created and maintained. These measurements are not meant for a company to merely assess the current standings of the business, but rather should be used to analyze the future motives and objectives for the company.

Alongside competency and value measurement lies governance maturity. This alignment strategy must be used to determine the authority for resources, risk, and conflict resolution. Governance also includes holding business partners, IT management, and service providers accountable for their part in the IT group. These individuals are

involved with project selection and prioritization among the projects in order to have a clear vision of the IT and businesses future.

The technical scope maturity of the company must also be maintained by hiring individuals within the IT department that hold several different qualifications such as:

1. Go beyond the back office and the front office of the organization
2. Assume a role supporting a flexible infrastructure that is transparent to all business partners and customers
3. Evaluate and apply all emerging technologies effectively
4. Enable and drive all business processes and strategies as a true standard
5. Provide solutions customizable to customer needs (Luftman, 2003)

Lastly, skills maturity encompasses all IT Human Resources (HR) considerations. Like the technical scope maturity, the skills maturity requires HR to hire individuals that demonstrate fire, motivation, education, training, and culture. By demonstrating all six of these alignment maturity categories, companies will be able to tremendously succeed within their business. Recently, Hanover has implemented a service management model and standard to ensure alignment between business and IT (Luftman, 2003) .

2.4 Hanover's Approach

Recently, Hanover has implemented the Information Technology Service Management model and the Information Technology Infrastructure Library standard to ensure alignment between business and IT (Luftman, 2003) . In addition to the two

models, Hanover has also previously implemented a Total Cost of Ownership model, which provided an understanding of the needs of the new TCO model.

2.4.1 Information Technology Service Management (ITSM)

In an effort to align the business strategy with the IT strategy, Hanover has implemented the Information Technology Service Management (ITSM) model. Service Management aims to maximize the value that technology brings to the business. It is composed of specialized capabilities used to provide value to customers in the form of services. Service Management also brings transparency to IT Operations and encourages IT and business partners alike to speak the same language (Archives, 2011).

A service is a means of delivering value to customers by facilitating the outcomes customers expect and want to receive. Some examples of services that apply to the HTG are e-mail, print, and system availability. ITSM shifts the way IT provides services – from providing services in "parts and pieces" to providing services seamlessly aligned to business objectives. Hanover benefits from implementing the ITSM model because this model:

- Increases customer satisfaction with IT Services
- Raises the awareness and understanding of how IT services align to business operations and success
- Eliminates rework or lost time which provides financial and capacity savings
- Improves decision-making and risk management
- Provides a foundation to adapt and scale with ease
- Fosters a collaborative approach for business discussions and decision making

- Enables change, opportunity and next generation IT

Overall, ITSM is a process that details best practices based on Information Technology Infrastructure Library (ITIL) standards to enable and optimize IT services in order to satisfy business requirements and manage IT infrastructure both tactically and strategically (Conger, 2007).In terms of the business, implementing the ITSM model increases profits and revenue by improving services and increases quality by focusing on continual measurement and improvement on services. The model also enables the business to better leverage IT and facilitate business transformation.

Hanover is now in the process of implementing the model, and hopes to build a Service Management culture within the company. Hanover also wants to implement Risk Management Governance models to ensure the right metrics are being used and that there are actionable results.

2.4.2 Information Technology Infrastructure Library (ITIL)

Information Technology Infrastructure Library (ITIL) was developed in the 1980's by the United Kingdom government and has been reconstructed since its implementation. ITIL is the structure and framework that describes best practices in IT Service Management and establishes a framework for governance. ITIL processes focus on a plan of continuous measurement and improvement, ultimately enhancing the quality of services the team provides to the business (Archives, 2011). The ITIL standards used by Hanover are shown in the Figure 4 below:

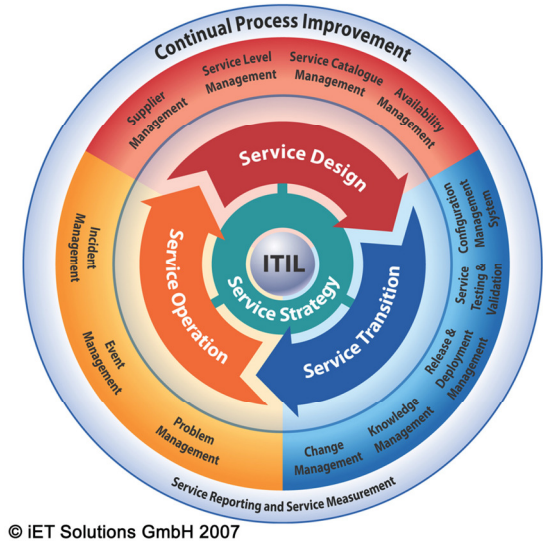

Figure 4: Hanover's ITIL Service Strategy (Archives, 2011)

The ITIL Service Strategy is made up of five main components: Service Design, Service Operation, Service Transition, Continual Process Improvement, and Service Reporting and Service Measurement. Service Design consists of Supplier Management, Service Level Management, Service Catalog Management, and Availability Management. The Service Operation components focus on Incident Management, Event Management, and Problem Management. Service transition includes Change Management, Knowledge Management, Release & Deployment Management, Service & Testing Validation, and a Configuration Management System. Continual Process improvement occurs at all times.

In regards to Hanover, their initiative scope focused on Incident and Problem Management within the Service Operation component of ITIL. They hoped to restore normal state as quickly as possible to minimize impact on business operations within Incident Management. When it came to Problem Management, Hanover wanted to

minimize the number of incidents and problems and initiate actions to prevent reoccurrences. Hanover's initial scope also included Configuration and Change Management within the component of Service Transition. Employees wanted to identify and record configuration items and the relationships that underpin services, as well as control changes to IT services to minimize impacts of change to business operations.

Overall, Hanover is in the process of developing a model that aims to change the processes of IT to better satisfy the business requirements by using the ITIL standards and implementing the ITSM model. In doing so, every business capability is aligned to a service, and therefore they can cost out each service when calculating Total Cost of Ownership. Hanover has previously attempted to calculate their Total Cost of Ownership, which will be discussed in the next section.

2.4.3 Hanover's 2007 TCO Model Attempt

In 2007, Hanover had attempted to develop a TCO model that would be periodically maintained in order to further understand their IT budgeting. The model's main shortcoming was its lack of maintainability due to the difficulty of obtaining necessary metrics. Along with this, the TCO model lacked standardization, which made it difficult for any employee to re-create the model. Now, five years later, the company has improved their current metrics and believes that they are capable of a creating a TCO model that will encompass the current lines of business.

2.5 Technology Business Management Solutions

Technology Business Management (TBM) is a concept that many companies around the world are beginning to implement. TBM uses previous tools and standards on

operational and infrastructure levels of technology to make sure the company's business strategy is recognized by the technology it utilizes. This approach is used to align the technology and business management to communicate the cost and value of IT services.

TBM is made up of core principles that allow a company to gain insight into their business strategy and Total Cost of Ownership. The first principle focuses on cost transparency, in which TBM helps to define and identify core cost drivers of IT services. The second principle focuses on managing performance and making trade-offs by benchmarking the TCO of the company's IT product and services internally between and across business units. The last principle focuses on continuous improvement and planning in which IT continually automates and manages the budget. At times, companies will use third party services to optimize their budget.

There are many Technology Business Management solutions available to companies who want to determine their cost drivers and calculate their Total Cost of Ownership. Below is a discussion of four companies that Hanover could possibly use in the future to further assess their IT strategy.

2.5.1 Apptio

Apptio is an independent provider of Technology Business Management Solutions. Clients include JPMorgan Chase, Starbucks, Boeing, Swiss Re, and Hallmark. Their solutions are Software as a Service (SaaS)-based to increase value and accelerate success through technology and proven best practices. They "enable IT leaders to manage the cost, quality, and value of IT services by providing a deep visibility into the total cost of IT services…" The product solutions are based upon five categories of technology business management: IT planning, IT service costing, Bill of IT, IT Service

Performance, and IT Benchmarking. The SaaS-based platform uses collaborative reporting and analytics, IT modeling and activity based costing, and data integration management for each category of technology business management. The comprehensive solution can be used to help improve many operations and increase transparency for a company.

2.5.2 CUBEbilling

CUBEbilling uses a cloud-based application as an internal or external billing and chargeback system. The application increases transparency across sales, delivery, account teams, and external clients. It provides accurate and up-to-date data regarding costs, while reducing potential errors that would be made from using excel spreadsheets. The internal cost allocation and chargeback system automatically uploads transactions into the system for the client at specified intervals. The application then aligns internal products and service offerings, and mirrors the organization structure of delivery and client locations. The external system sits in front of the company's existing billing system, while accomplishing all the features described from the internal system. The simplicity of this software allows for little or no training, and is capable of creating custom reports.

2.5.3 Costnomics

Costnomics is a Technology Business Management company that offers a SaaS-based solution that allows one to gain insight into their Total Cost of Ownership. It allows the company to look at their TCO through a top-down view or a bottom-up view. This SaaS-based solution enables immediate view of key information and metrics into a single view and gives an accurate understanding of service cost and capacity. This IT Financial solution helps to better communicate the value of IT to business partners.

Costnomics offers a variety of solutions including: Service Portfolio Management (SPM), Service Cost Management (SCM), IT Investment Management (IIM), IT Performance Management (IPM), and IT Charge Management (ICM). In Figure 5, depicted is an image of the software that contains their dash-boarding feature.

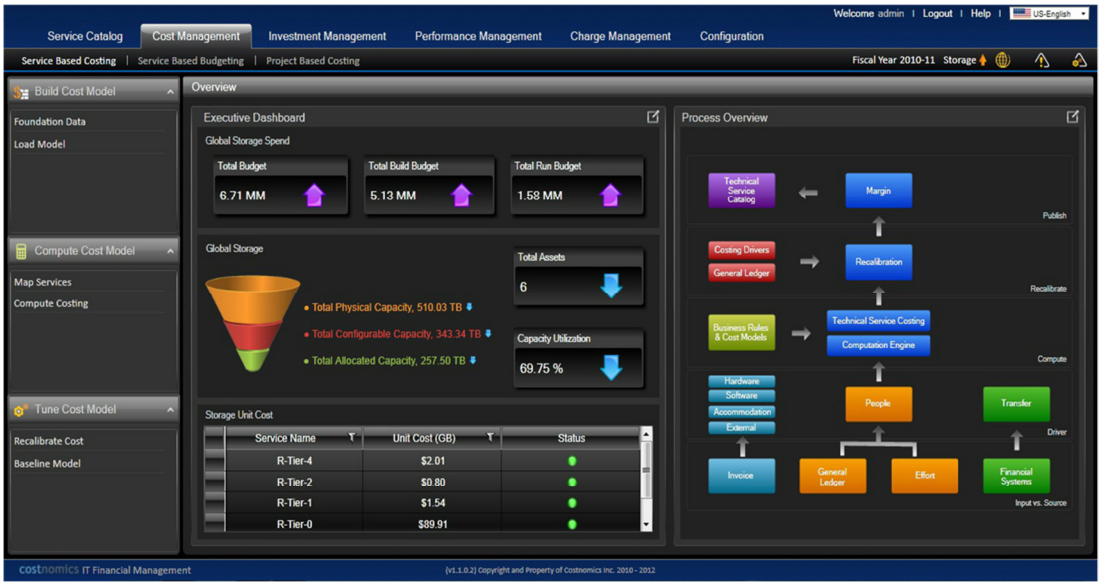

Figure 5: Costnomics Dash-boarding feature (http://costnomics.com/products/screen-shots.html)

The SaaS-based solution allows the company to gain a comprehensive understanding of their cost drivers, as well as to scrutinize their budgets and align IT with strategic objectives. The software also allows the company to identify and eliminate loss-making projects.

2.5.4 ComSci

ComSci delivers IT Financial and Business Management solutions to organizations that strive to better manage and communicate the cost, quality and value of services they deliver. ComSci has worked with various organizations such as Goldman

Sachs, Bank of America, Merrill Lynch, Pfizer, and the McGraw-Hill Companies. Their solution is a SaaS-based enterprise application that provides organizations a resource to gain visibility into unit costs of services. These unit costs include activity-based costs, IT product costs and costs of products and solutions that IT "sells" to the business. The ComSci platform consists of three core modules: Source Data Manager, ITCostFlow™ and BillBrowser™ as seen in Figure 6 found on the ComSci website. Their Source Data Manager allows for real-time consolidation of data with their fully automated and supported program. ITCostFlow™ brings organizations unit cost/rate generation, benchmarking metrics, analytics and executive dashboards. These modeling tools all assist in mapping out IT cost drivers to find a simple and efficient way to maintain the products and services provided by IT to the organization. The third ComSci module is called BillBrowser™, which is an automated program that sends Business Managers in the organization a monthly detailed invoice of the cost and value of IT services that they consume. The overall transparency provided by this IT Financial and Business Management solution is what attracts their customers to the solution.

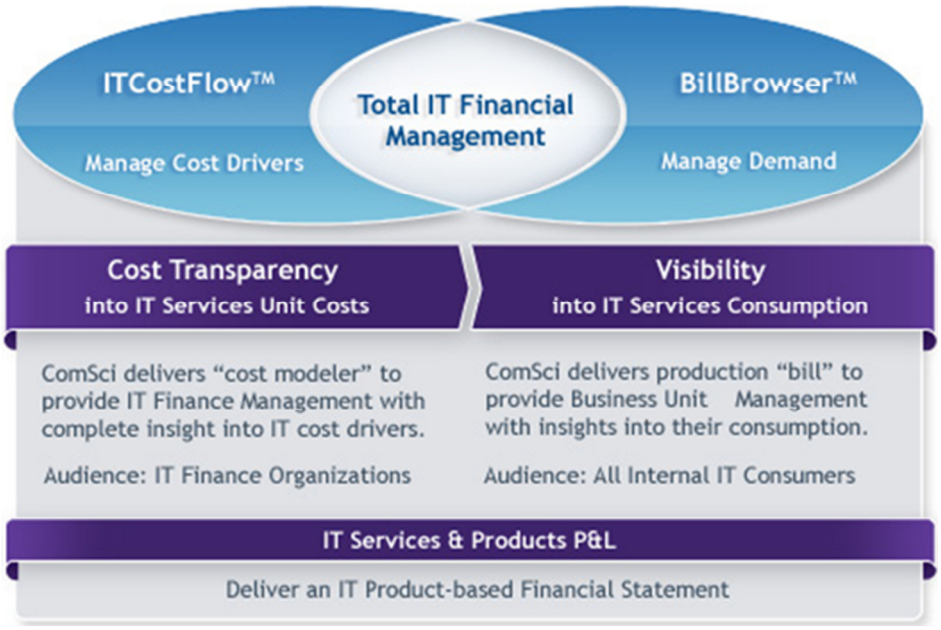

Figure 6: ComSci TBM Solution (http://www.comsci.com/)

2.6 Summary

TCO models bring value to companies because it allows for transparency and provides a clear view of how costs are spread. When considering developing a TCO model, it is crucial to breakdown costs and to determine what drivers influence the company's processes. Through the creation of a TCO model, IT and Business goals become more apparent which allows for the company to better achieve alignment. Hanover uses ITSM and ITIL to better their alignment by fostering a collaborative approach for business discussions and decision-making. Through these two alignment strategies, Hanover is able to relay the importance of IT and business integration. In the past, Hanover had attempted a TCO model but was unable define valuable metrics. Hanover asked us to redevelop the model since the metrics are more readily available, which makes it easier to maintain. The next section discusses the methodology used to analyze the previous approach and create the new TCO model.

3. Methodology

Throughout the project, we created a better understanding of the technology cost drivers in alignment to the business processes they support by developing a standardized TCO model. In order to achieve our objectives, the team used various methods, which will be described in the following subsections. These methods include document analysis, interviews, and data analysis.

3.1 Document Analysis

Initially, the team was given internal resources through Hanover that dealt with portfolio management and optimization. We received multiple resources through the CIO Executive board, which contained mostly white papers and PowerPoint presentations. After sorting through the articles, we determined which papers and presentations were relevant to the topic of TCO. From there, we created an Excel spreadsheet listing all the applicable resources based on topic and reference. We then created a detailed spreadsheet on the different types of costs that apply to TCO which were also found in the articles.

As a group, we also utilized the Google Scholar search engine in order to gain more information on various TCO models used by companies today. The research concentrated on TCO models used within Information Technology. These accumulated TCO models were used to identify the current costs that could apply to Hanover's TCO model. In total, we reviewed 7 internal whitepapers, 9 scholarly articles and case studies, and 4 internal spreadsheets. After all resources were compiled from both CIO Executive Board and Google Scholar, we created a PowerPoint presentation of all the valuable information found to be easily referenced.

3.2 Interviews

To gain a better understanding on Hanover's business and IT strategies, as well as their business processes within each line of business, we conducted interviews with pre-selected employees. Table 1 contains the names and positions of those who were chosen for interviews. These individuals, to achieve purposeful sampling (Petruccelli, 1999), were recommended by the project sponsors based on their expertise in each line of business. All interviewees were contacted through email, with a short explanation on the primary goal of our project, as well as the topics that would be discussed in the interview. The CIO's provided guidance to valuable resources along with their desired expectations of the TCO model. The business architects delivered information on business processes and the applications used within each process. Before interviews were conducted, we completed the IRB application in order to properly conduct interviews, while following WPI's code of ethics. (Appendix B)

To be prepared for the interviews, we developed a protocol of a defined set of questions to effectively gain the information needed to achieve the project objectives. These can be found in the Appendix A. While conducting interviews, two group members recorded minutes and one facilitated questions. Additionally, the session was audio recorded with the consent of the employee being interviewed.

CIO's
Cilsy Harris, Personal Lines CIO
Dave Trigo, Corporate Lines CIO
Sean Hauver, Global Software Delivery Leader
Raymond Balser, Director for Business Intelligence

Business Process Architects
Daniel Daviau, Commercial Lines
Lori Caron, Personal Lines
Matt Loehr, Corporate Lines

Business Analysts
Justin Brooks, Business Analyst

Table 1: Hanover Interviewees

3.3 Data Analysis

After the interviews were completed, we re-analyzed the voice recordings while consolidating the minutes. This allowed us to create theme-based summaries from all the interviews, which included alignment strategy, value of TCO framework, and breakdown of costs. We were able to develop the TCO model based upon the reoccurring themes throughout the interviews. The interviews provided us with a clear direction of the content that we needed to obtain from the Business Process Architects.

The data obtained included process maps of applications used per transaction from the Business Process Architects, the total cost of applications used from Mark Malkasian, Program Manager, as well as the number of transactions per application from Raymond Balser, Director of HTG Operations. Our internal data analysis also consisted of reviewing the cost and transaction worksheets provided by the Business Process Architects. Once this data was provided, we were able to combine the findings from our

literature review with the financials and process maps in order to develop the TCO model.

4. Interview Results

The MQP team interviewed the CIO's from Personal Lines, Corporate Lines, and the Business Process Architects to gain insight on how the TCO model should be designed. We assessed their opinions based on the company's business strategy. Two main conditions for the TCO model were most apparent through the interviews: an aligned and transaction-based model.

4.1 Assessment of Hanover's Current Alignment Strategy

After speaking extensively to Dave Trigo (CIO of Corporate Lines), Cilsy Harris (CIO of Personal Lines), and Sean Hauver (Enterprise Tech and Global Strategy Manager), we were able to understand the structural needs of the TCO model. All three employees strongly believed that Hanover is well aligned and the company fully understands its business needs and capabilities for the following reasons:

- Company has CIO's for each line of business
- Increased focus on their business processes throughout each line of business

In addition to the strong qualities of their current alignment, the CIO's and Sean Hauver discussed with us ways to improve alignment within Hanover. These improvements are listed below.

- Link the strategies of each line of business
- Revise Service Delivery aspect of the company because it does not highlight their processes and services very well
- Improve alignment with transparency and dash boarding which allows for more value-added activities
- Consider business processes and end-to-end services further

Considering the above opinions, we developed an understanding of the importance of alignment within the creation of a TCO model.

4.2 TCO Model's Value

When the interviewees were asked whether Hanover's TCO model should be transaction-based or application-based, all claimed that the most beneficial model would be a transaction-based design. The following reasons are listed below:

- Allows for more business-centric conversations.
- Allows employees to make technology-based decisions and, in turn, make more business process-based decisions.
- Exposes the value-added activities in the business.
- Applications often weigh too heavily on IT costs when these costs are only one component; end-to-end costs must also be considered.
- Allows the business and IT relationship to strengthen.

4.3 Breakdown of Cost at Hanover

In addition to the interviews with the CIO's and Sean Hauver, we met with a representative from the Financial Department, Alex Calvi, to discuss the breakdown of costs within Hanover.

The Information Technology Financial Department at Hanover is divided into three main components: cost-center, account, and activity code. Employees' accounts include their salary account so they can receive their pay, and the activity codes are codes that correspond with a specific task, (i.e. 3149 is Corrective Maintenance). If an employee were to work on a task, they would tag the activity code so they can be paid for their labor. All costs for each activity are then calculated and charged back. If there is no activity code, then the financial department spreads the cost throughout other parts of the business.

The three manual drivers used to produce reports according to business units for the Financial Department are networks, "move adds and changes", and IT Help desk calls. The Network is used to charge cost-centers and is divided by cost-center in which each cost-center is made up of a certain department (i.e. Business analysts, IT helpdesk.) Hanover's second IT financial driver is called "move, adds, and changes." This driver refers to the cost it takes to move employees, set up computers, set up IP addresses, and set up an account for a new employee. This cost, unlike the network driver, is charged to every part of the business. The third manual driver is the calls that come into the IT Helpdesk.

5. Proposed TCO Model

5.1 Our Approach

Understanding what types of cost apply to Hanover assisted in determining how the model will be broken down. Initially, based on the literature review the team was going to breakdown the TCO model by the four costs mentioned in Section 2.2. These costs were infrastructure costs, annual support costs, direct costs, and per-seat costs. However, after speaking with the Business Process Architects, the team found it more valuable to break down the model by transactions. We chose these four transactions because they were the most frequently conducted transactions by the company, and held the highest percent of usage. Furthermore, we found that these four transactions were a better fit because they were the most consistent with the requirements requested by the CIOs and Sean Hauver. These requirements are to focus costs specific to business activities to ensure alignment and to create a transaction-based model. Other transactions like endorsements and cancel/rewrites were not included, because Hanover did not feel a need to focus on these transactions for the initial implementation of the TCO model.

Once the transactions were decided, we integrated the business drivers by deciphering which applications perform each transaction. Not all applications are used for each transaction. Therefore, this required us to discuss with the Business Process Architects each application and its respective transactions. This provided us an understanding of how to display the drivers within the model in order to reflect the most effective framework.

In order to be consistent with the current alignment within Hanover, we chose to meet with both the business sector and the IT sector of the company. By having both perspectives assist in the creation of the TCO model, it will encourage better alignment as the model is implemented and maintained. With our approach, both sides of the business will be able to see how the business products influence IT applications through specific transactions. This approach to the model in terms of alignment provided a deliverable that can be used in the long-term of the company as it considers all factors of the business.

Prior to the model's development, we analyzed business process maps and a systems impact model; documents obtained from the Business Process Architects. This helped us to determine Hanover's core applications and the products that utilized these applications within each line of business. Within the same documents, we were able to identify which transactions are performed by each application. Additionally, we met with the Business Process Architects in order to verify whether the internal information was accurate to the current business operations. We found that the internal information was outdated, therefore, much of our decisions were based off of the meetings with the Business Process Architects. By using this data, this gave us a strong understanding the relationship between applications, transactions, and products, which was then conveyed in the TCO model by a three-layered model.

Despite our desire to create a comprehensive model, we had to limit our scope in order to deliver a working prototype TCO model. We also had to make some assumptions as we developed our model due to various reasons:

- All data used within the TCO model was based upon outdated data in order to have a working framework for Hanover. The spreadsheets from which we obtained the products and applications that use those products were outdated.
- Not all applications used by Hanover are considered; only the core applications suggested by the Business Process Architects were included in the TCO model. Systems that were not included are minor systems and third party systems.
- Only four transactions were included in the model. All other transactions were excluded due to low percent of usage.
- Transaction counts were divided evenly by the number of applications that are used within a specific product as opposed to the actual transaction count weight of usage per application.
- Personal Lines percentage of TCO is assumed at 40% and Commercial Lines percentage of TCO is assumed at 60%. This assumption was provided Mark Malkasian.
- Some total cost of core applications were estimated based on maintenance and support fees. These core applications include Bill Center, Billing IVR, MHP, and SAMs, and were also provided by Mark Malkasian.
- Total cost of Underwriting Work Station was estimated by Mark Malkasian, due to the fact that it is a newly implemented application at Hanover.

5.2 Our TCO Model

Our solution focused on two lines of business: Personal lines and Commercial lines. These two lines were chosen because they were capable of being broken down by the four transactions that Hanover wanted to focus on. Our TCO model considered all the

products for the two lines of business and the transactions conducted by each application. For example, Personal lines consists of seventeen insurance products, some of which include Personal Auto insurance and Home Owners insurance. Commercial lines is broken down into thirty-three products; two of these products are Property insurance and General Liability insurance.

Our TCO model contains seven worksheets which can be found in Appendix E – TCO Model Worksheets. These seven worksheets are Total Cost-Per Line of Business, PL-Transactions, CL-Transactions, PL-Percentages, CL-Percentages, PL-Total Cost Breakdown, and CL-Total Cost Breakdown. For the purpose of simplicity, we will focus on Personal Lines in order to describe the functionality of our TCO model.

The two Transactions worksheets, two Percentages worksheets, and two Total Cost Breakdown worksheets, are similarly structured but hold very different data. All worksheets have blue highlighted cells that indicate which applications and transactions are used for each designated product. The empty blue cells indicate missing data that we were unable to attain for that transaction and product within our time at Hanover.

The Total Cost-Per Line of Business, as seen in Figure 7, is one of the worksheets that should be updated monthly. This worksheet contains the Total Cost for each application within the first column, which was data accumulated by Mark Malkasian. The Total Cost per application is further broken down by line of business in the next two columns according to the percent of cost that pertains to that line of business. Personal Lines holds a percent of cost at 40% and Commercial Lines holds a percent of cost at 60%. Mark Malkasian determined this percentage because Commercial Lines bears

heavier costs than Personal Lines.

Core Applications	TCO	Total Cost PL	Total Cost CL				Personal Lines Percent of Usage	Commercial Lines Percent of Usage
Application 1	$858,813.00	$343,525.20	$515,287.80				40%	60%
Application 2	$35,533.00	$14,213.20	$21,319.80					
Application 3	$1,000,000.00	$400,000.00	$600,000.00					
Application 4	$100,000.00	$40,000.00	$60,000.00					
Application 5	$189,889.00	$75,955.60	$113,933.40					
Application 6	$136,629.00	$54,651.60	$81,977.40					
Application 7	$2,482,041.00	$992,816.40	$1,489,224.60					
Application 8	$277,532.00	$111,012.80	$166,519.20					
Application 9	$1,459,092.00	$583,636.80	$875,455.20					
Application 10	$250,000.00	$100,000.00	$150,000.00					
Application 11	$672,670.00	$269,068.00	$403,602.00					
Application 12	$4,709,533.00	$1,883,813.20	$2,825,719.80					
Application 13	$3,805,643.00	$1,522,257.20	$2,283,385.80					
Application 14	$250,000.00	$100,000.00	$150,000.00					
Application 15	$956,151.00	$382,460.40	$573,690.60					
Application 16	$250,000.00	$100,000.00	$150,000.00					
* Assumes PL percentage of TCO is 40% and CL percentage of TCO is 60%								
* Applications 3, 4, 10, and 14 have estimated TCO								
* Application 16 too new of application so TCO was assumed								

Figure 7: Total Cost per Line of Business Worksheet

The Transactions worksheets, as seen in Figure 8, is another worksheet that should be regularly updated as it holds the number of transactions for each of the four transactions performed by each application depending on the product. Below each application, the total number of transactions for the application is calculated. Within Figure 8, the red box signifies the number of transactions per application per product. The arrows point to a formulated calculation of the total number of transactions used by that application.

Core Applications	Transactions	Product 1	Product 2	Product 3
Application 2	Transaction 1			
	Transaction 2			
	Transaction 3			
	Transaction 4			
Total:	**2160**			
Application 3	Transaction 2			
	Transaction 3			
Total:				
Application 12	Transaction 2	68565	5294	798
	Transaction 3	872618	61760	4593
	Transaction 4	71264	13819	349
Total:	**1100792**			

Figure 8: PL Transactions Worksheet

The Percentages worksheets, as seen in Figure 9, are output worksheets that hold the percent of usage for each application per transaction per product as derived from the data found in the Transactions worksheets. The Percentages worksheet's cells contain the following formulated calculation to find the percent of usage per application per transaction per product:

$$Percent\ Usage\ Per\ Application\ Per\ Transaction\ Per\ Product$$

$$= \frac{Number\ of\ Transactions\ (i)\ per\ Application\ per\ Product}{Total\ Number\ of\ Transactions\ (for\ all\ i)\ per\ Application}$$

$$i = \{per\ quote, per\ new\ policy, per\ renewal, per\ claim\}$$

As seen in Figure 9, the red box indicates the percent of usage, which was attained through the above formula.

Core Applications	Transactions	Product 1	Product 2	Product 3
Application 2	Transaction 1			
	Transaction 2			
	Transaction 3			
	Transaction 4			
Application 3	Transaction 2			
	Transaction 3			
Application 12	Transaction 2	6.23%	0.48%	0.07%
	Transaction 3	79.27%	5.61%	0.42%
	Transaction 4	6.47%	1.26%	0.03%

Figure 9: PL Percentages Worksheet

The Total Cost Breakdown worksheets, as seen in Figure 10, are also output worksheets derived from data found within the Percentage worksheets and the Total Cost per Line of Business worksheet. This data is accumulated with the following formulated calculation to find the total cost per application per transaction per product:

$$Total\ Cost\ Per\ Application\ Per\ Transaction\ Per\ Product$$
$$= Total\ Cost\ Per\ Line\ of\ Business$$
$$* Percent\ Usage\ Per\ Application\ Per\ Transaction\ Per\ Product$$

As seen in Figure 10, the red box indicates the total cost which was attained through the above formula. The arrows point to a formulated calculation of the total cost of transactions used by that application.

Core Applications	Transactions	Product 1	Product 2	Product 3
Application 2	Transaction 1			
	Transaction 2			
	Transaction 3			
	Transaction 4			
Total:	**$14,213.20**			
Application 3	Transaction 2			
	Transaction 3			
Total:				
Application 12	Transaction 2	$117,337.02	$9,059.76	$1,365.64
	Transaction 3	$1,493,333.26	$105,691.45	$7,860.12
	Transaction 4	$121,955.89	$23,648.80	$597.25
Total:	**$1,883,813.20**			

Figure 10: PL Total Cost Breakdown Worksheet

6. Discussion

In creating this model, we intended for Hanover to use this framework in their current and future Total Cost of Ownership projects and goals. The values used in the worksheets represent annual transactions in 2012. This framework has established a strong platform that can be easily expanded and maintained to include a more comprehensive view of Hanover's IT costs. The Discussion Section focuses on how the model can be maintained in order to gain the most value. Additionally, we incorporated an Alternative Matrix in order to assist with a potential initiative to acquire a TBM solution.

6.1 Model Maintenance

The primary limitation of the 2007 TCO model was that it was in need of a defined set of metrics to allow ease of maintainability. Therefore, we created a TCO model that requires minimal effort and training. An individual chosen at the discretion of HTG will update the data and costs monthly from their financial data warehouse. Furthermore, the model content will be evaluated and updated annually. The content that is going to be evaluated includes the products within each line of business and the core applications. Updates may occur as products are added or as applications become outdated. The data, more specifically, the transaction counts and costs, should be updated monthly since these will fluctuate more frequently. As the TCO model is updated, Hanover should evaluate this model in a strategic manner that will allow the company to pull value from its contents. As an example, Hanover can use the model to compare an application's costs versus its percentage of usage and slice financials accordingly.

6.2 Value of the Model

The TCO model will be the vehicle that enables business discussions and allow for easy portfolio management and evaluation. The most valuable characteristic of implementing this TCO model is its ability to benchmark and evaluate whether or not HTG is acting in the best interest of the company in regards to reducing cost. Furthermore, the TCO model will increase cost transparency through dash-boarding, as seen within the dash-boarding graphs we had created found in Figure 11 and Figure 12. By creating these visual representations of the data formulated within the TCO model, Hanover Insurance is able to interpret the accumulated data and, therefore, make more business-centric decisions. The TCO model drives the initiative to make a more complete end-to-end model of the company's applications and transactions. If the TCO model is updated and evaluated in accordance to our recommendations, it will be a very successful tool for HTG and Hanover as a whole.

6.3 Alternative Matrix

In addition to our TCO model, we created an alternative matrix, as seen in **Error! Reference source not found.**, in order to allow Hanover to assess what their ideal solution is. The two types of solutions HTG may choose between are a TBM third-party solution or our MQP TCO model solution. At the time, Hanover was considering using a TBM solution for their Total Cost of Ownership.

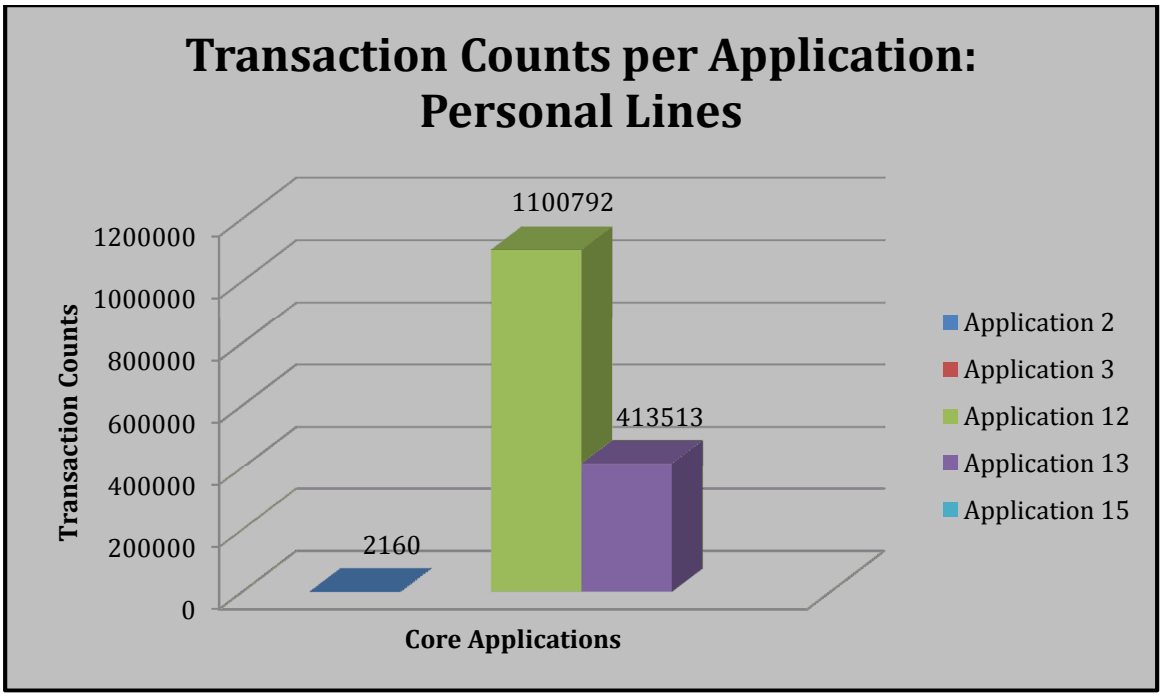

Figure 11: Transaction Counts per Application: Personal Lines Dashboard

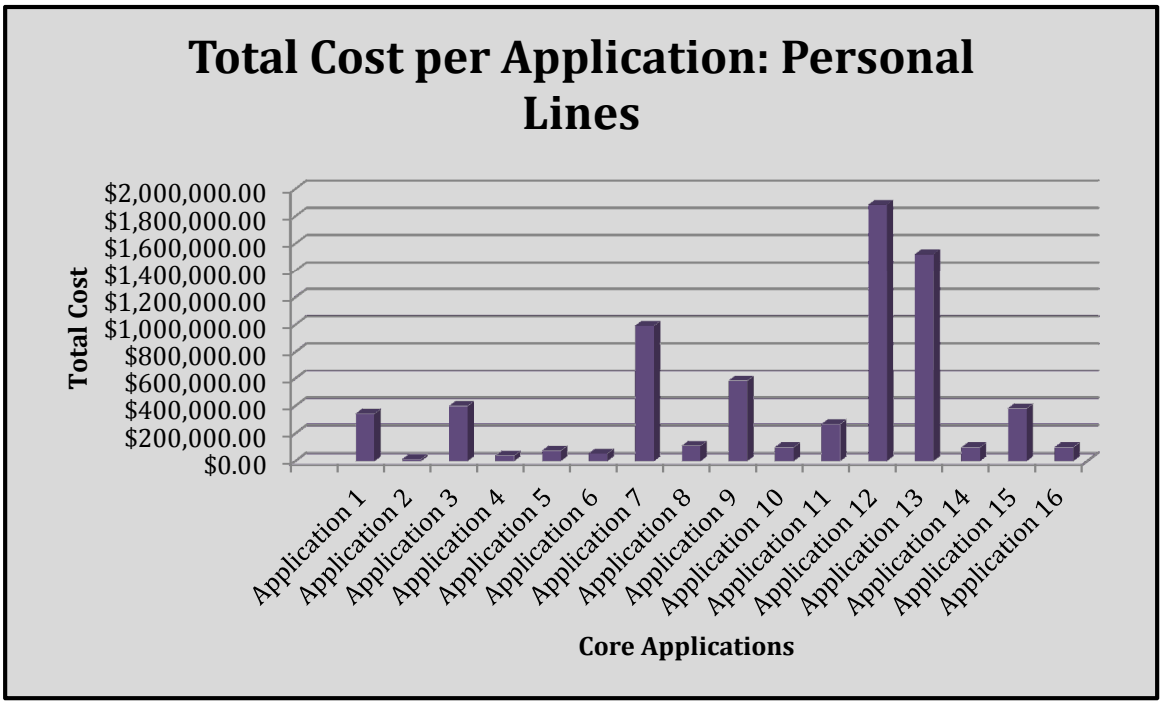

Figure 12: Total Cost per Application: Personal Lines Dashboard

The three TBM solutions that we chose to include in the matrix were Apptio, Costnomics, and ComSci. CUBEbilling was excluded as an alternative because we believe that the product did not meet the needs of Hanover. Although CUBEbilling was a TBM solution, it was only a solution for billing and chargeback which is unrelated to Total Cost of Ownership; Hanover's primary goal.

Evaluation Criteria	Relative Importance (Weight)	Alternative 1: Apptio	Score (1-5)	Weighted Score	Alternative 2: Costnomics	Score (1-5)	Weighted Score	Alternative 3: ComSci	Score (1-5)	Weighted Score	Alternative 4: MQP TCO Model	Score (1-5)	Weighted Score
Ease of Maintenance	35			0			0			0	Focus on core applications and transactions	5	175
Flexibility of Analytics	20			0			0			0	Simplistic framework but lacks dash-boarding	3	60
Front Costs	15			0			0			0	No cost for development or implementation	5	75
Ongoing Costs	20			0			0			0	Only internal cost of employee compensation	4	80
Necessary Training	10			0			0			0	Minimal training required	5	50
Total:	100			0			0			0			440

Figure 13: Alternative Matrix

The alternative matrix was based on five evaluation criteria. These criteria include: Ease of Maintenance, Flexibility of Analytics, Front Costs, Ongoing Costs, and Necessary Training. Hanover indicated that each of these were crucial in their decision on finding the best solution to developing their Total Cost of Ownership. We also based the alternative matrix on the limitations of the previous TCO model attempt to prevent any reoccurrences. Company discretion is a main concern for third-party vendors, which made it a challenge to evaluate the three TBM solutions according to Hanover's criteria. Therefore, we chose to only evaluate our MQP TCO Model. If HTG were to pursue the solutions, they would be given the information that was withheld and, in turn, will be able to fill out the alternative matrix to completion.

The criteria were weighted based on the characteristics that HTG found most important in their Total Cost of Ownership solution. Each criterion was given a Relative Importance Weighted Score with an overall total of the five criteria being 100. Ease of Maintenance was weighted at 35 since this was the biggest issue with the first TCO model attempt in 2007. Flexibility of Analytics and Ongoing Costs were both weighted at 20 since these criteria are going to most affect the success of the TCO model. Front Costs were weighted at 15 as they are a one-time cost for Hanover and it may be compensated through the use of the model. Lastly, Necessary Training was weighted at 10 because as long as it is a successful solution, training is a minor obstacle for the company.

As seen in **Error! Reference source not found.**, each solution is scored on a 1-5 scale; 1 being poor and 5 being excellent. In regards to our MQP TCO Model, the criterion Ease of Maintenance resulted in a score of 5 out of 5, since the primary focus of the TCO Model initiative were core applications and transactions, the MQP TCO model requires less maintainability since minor systems and third-party services are not included. This focus creates a simple framework, which is easy to evaluate and maintain. Its simplistic framework also provided flexibility of analytics, which is why Flexibility of Analytics received a 3 out of 5. We felt that our TCO lacked dash boarding, which was a quality that most of the other solutions offered. In terms of the criterion Front Costs, we gave it a score of 5 out of 5 because there is no cost for development or implementation of the model. Ongoing Costs are only expected for employee compensation, as compared to solutions that are automated or require membership fees. For this reason, we scored Ongoing Costs as 4 out of 5. In regards to Necessary Training, since there is minimal

training required we scored this criterion as 5 out of 5. Other solutions may include the cost of training programs or training media.

7. Recommendation and Conclusions

Our recommendation for Hanover consists of a three-step approach to launching the TCO model. Additional recommendations include data maintenance of internal information, as well as techniques to manage any resistance to change.

7.1 Recommendation 1: Launching the TCO Model

7.1.1 Step 1: Implementation of Proposed Model

This step will consist of completing the current TCO model with all necessary data. This data should be accurate and up-to-date with the current percentage of usage and financials. The model should be updated monthly to ensure accuracy with the current company standings. After a year, the model should be content evaluated to decipher if the applications, transactions, and products are still in use. The data should be analyzed to help the company decide whether or not it is necessary to reevaluate their cost distribution. If the model is not assessing their Total Cost of Ownership to the level Hanover sees beneficial, the company should assess whether or not to expand the model.

7.1.2 Step 2: Expansion of the TCO Model

If Hanover decides there is a need to expand the model, the first step to expansion is to add all applications used by the company, including core and minor applications. This will have an overarching view of all applications and possibly provide greater financial benefits for Hanover. In addition to including all applications used, HTG should expand the model to encompass all transactions for each application. For example, in the

Step 2, HTG can incorporate endorsements and cancel/rewrite transactions. Furthermore, as third-party services are a significant cost for the company, it would be beneficial to expand the TCO model to include these services as well. Hanover should continue to update the model monthly and reassess the model yearly as suggested in the Step 1. If by the end of the second year the company feels as if the TCO model still does not meet the needs and requires more analytics, such as advanced dashboards with drill down capability, Hanover should consider third-party TBM solutions.

7.1.3 Step 3: Consider Advanced Analytic Solutions

Although Hanover has already begun evaluating Apptio's TBM solution, HTG should continue its third-party service initiative by referring to the three TBM solutions mentioned in **Error! Reference source not found.**, the Alternative Matrix. By contacting the TBM solution consultants, Hanover can receive the necessary information needed to complete the alternative matrix in order to evaluate which solution would be most beneficial to the company. This information can be procured through demonstrations, trial periods, competitor research, and consumer reviews. Once the alternative matrix is complete, HTG can select the best solution based upon the weighted scores.

7.2 Recommendation 2: Data Maintenance

We recommend Hanover to update the Business Process Maps and the Systems Impact Model more frequently. This information should be regularly updated every six months. If this data is updated on a regular basis, it will make Step 2 much more plausible because the necessary data will be up to date.

7.3 Recommendation 3: Change Management

An issue that may be encountered upon implementation of the model is resistance to the model from employees who will have the responsibility of obtaining the data and updating the model. We suggest providing proper training and a value-added presentation of the model in order to gain the confidence of the employees and minimize resistance.

7.4 Conclusion

In conclusion, we created a TCO model to provide Hanover with a solid framework for cost assessment. In addition, we developed an alternative matrix template that will help the evaluation of third-party TBM solutions if dash-boarding and additional analytics are required. Overall, the model's value is its ability to drive the right conversations and initiate purposeful decisions. Furthermore, the model may identify areas of improvement and areas of cost reduction. Hanover will be able to assess their current standings among their competitors and improve their current benchmarking strategies through the use of our TCO model. We hope the MQP TCO model will establish a strong foundation in calculating Total Cost of Ownership and allow Hanover to easily expand upon the model in the future.

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Appendix A-Interview Protocol

Interviewee:

Interviewer:

Others in the room and their roles:

We are WPI students working on our Major Qualifying project, which is a Total Cost of Ownership Model for Hanover. Hanover attempted to make a TCO model in 2007, but were unable to obtain the necessary metrics. Our goal is to create a better understanding of the technology costs in alignment to the business processes within the company. We want to create a repeatable and maintainable TCO model, which will, in turn, emphasizing the alignment between IT and Business Strategy, and highlight opportunities to reduce cost.

Most of the questions we will ask you will focus on the business strategy, alignment, cost drivers, and IT applications. We are hoping to gain a better understanding on the business processes in each line of business, as well at the drivers that influence them. Before we begin, we would like to ask you if it is okay to record our session today to reference at a later time during our data analysis.

Protocol:

1. What exactly is your position and how long have you held that position?
2. How would you describe your IT strategy in your role as a CIO?
3. How do you feel about the alignment between your business strategy and your IT strategy? How can it be improved?
4. What cost metrics do you utilize in your line of business?
5. What IT applications do you utilize in your line of business? What costs are associated with those IT applications?
6. Did you know about the initiative in the past with the TCO model? If so, what do you believe were the shortcomings of this attempt?
7. If you were to develop a TCO model, what do you believe should be included in terms of your line of business?
8. Would you prefer a transaction based or application based model? What are the reasons for your choice?
a. Do you foresee being able to identify cost by application or business line? Which has greater benefit and why?
9. Who would you recommend to get in contact with for more information on IT cost metrics?
10. How do you think this TCO model will help you as the CIO of your line of business?
11. Do you have any additional thoughts on the TCO model or the project itself?

Appendix B-IRB Approval Letter

100 Institute Road
Worcester, MA 01609-2280, USA
508-831-5000, Fax: 508-831-6090
www.wpi.edu

Worcester Polytechnic Institute IRB #1
IRB 00006774

12 October 2012
File: 12-154

Worcester Polytechnic Institute
100 Institute Road
Worcester, MA 01609

Re: IRB Application for Exemption #12-154 "Hanover Insurance Total Cost of Ownership Model"

Dear Prof. Tulu,

The WPI Institutional Review Committee (IRB) has reviewed the materials submitted in regards to the above mentioned study and has determined that this research is exempt from further IRB review and supervision under 45 CFR 46.101(b)(2): "Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation."

This exemption covers any research and data collected under your protocol from 12 October 2012 until 12 October 2013, unless terminated sooner (in writing) by yourself or the WPI IRB. Amendments or changes to the research that might alter this specific exemption must be submitted to the WPI IRB for review and may require a full IRB application in order for the research to continue.

Please contact the undersigned if you have any questions about the terms of this exemption.

Thank you for your cooperation with the WPI IRB.

Sincerely,

Kent Rissmiller
WPI IRB Chair

Appendix C-Resources Spreadsheet

Keyword	Source of Paper	Name of Paper	Abstract	Date Accessed	Reference	Comments
Portfolio Management	CIO Executive Board	Boosting Portfolio Productivity: Frameworks for Extracting Business Value from the IT Portfolio	IT organization should provide business partners with visibility into the long-term costs and benefits of new investments. This study shows how exemplar companies such as Seagate, Lily, and Charles Schwab fram and communicate these cost/value tradeoffs.	8/29/12	"Boosting Portfolio Productivity: Framework for Extracting Business Value from the IT Portfolio." CIO Executive Board" 29 Aug. 2012.	-covers techinques used to break down data in order to find the TCO. For example, shared service costs, infastructure costs, and direct costs.
Portfolio Management	CIO Executive Board	Capturing and Distributing Data That Drives Decisions	N/A	8/29/12	"Capturing and Distributing Data That Drives Decisions" CIO Executive Board. 2009	too much data impairs decisions, interview stakeholders to prioritize IT metrics, use parameters like unit of measure & estimated cost measurement for effective metrics, gives a checklist for metric selection
Portfolio Management	CIO Executive Board	Portfolio Cost/Value Optimization	To maximize the value of the existing applications portfolio, Lilly's IT group regularly partners with the business to evaluateopportunities to enhance application value and reduce costs.	5-Sep-12	"Portfolio Cost/Value Optimization". CIO Executive Board. 05 September 2012.	
End-to-end IT Services	CIO Executive Board	The path to End-to-End IT Services	In the past couple of years, service management has expanded from an infastructure delivery technique to a model for end-to end services that reshapes how IT operates as a whole. Loosley defined, an end-to-end service packages toegther all the technologies, processes, information, and related IT resources required to support a specific business outcome. As	9/5/12	"The Path to End-to-End IT Services" CIO Executive Board. 5 Sept. 2012.	Discusses understanding the business as an aligned whole. Also, examples the importance of understanding revelvant businesses processes and their break down
End-to-end IT Services	CIO Executive Board	The ROI of End-to-End IT Services	For many organizations, end-to-end IT services is a new concept that needs to be explained within the IT team and to other business stakeholders. This whitepaper can be used to help estimate the costs and benefits of transitioning to an end-to-end IT services model. Use this analysis to build a business case for services that captures the cross-functional impact delivered to business partners.	9/5/12	"The ROI of End-to-End IT Services" CIO Executive Board. July 2012.	Discusses what end-to-end IT services can due to benefit a company and create alignment. Services can help reduce IT budget, and the article discusses the cost and benefits of implenting a IT service to help business perform business capabilities.
Hanover Sharepoint	AEC Executive Board	Using Unit Cost Visibility to Drive Retirement Decisions	None	5-Sep-12	"Using Unit Cost Visibility to Drive Retirement Decisions". AEC Executive Board. 05 September 2012.	Identification of Intel unit costs and value of applications to determine what should be considered for application retirement

"Total Cost of Ownership" "Information Tecnology"	Google Scholar	A Simple Model for Determining True Total Cost of Ownership for Data Centers	Data centers are mission-critical components of all large enterprises and frequently cost hundreds of millions of dollars to build, yet few high-level executives understand the true cost of building and operating such facilities. Costs are typically spread across the IT, networking, and facilities/corporate real-estate departments, which makes management of these costs and assessment of alternatives difficult. This paper presents a simple approach to enable C-suite executives to assess the true total costs of building, owning, and operating their data center physical facilities (what we are here calling the True TCO). The business case in this paper focuses on a specific type of data center facility: a high-performance computing (HPC) facility in financial services. However, the spreadsheet model (available for download at http://www.	9/6/12	Koomey, Jonathan, Kenneth Brill, Pitt Turner, John Stanley, and Bruce Taylor. "A Simple Model for Determining True Total Cost of Ownership for Data Centers." Mission Critical Magazine. Uptime Institute, 2007. Web. 6 Sept. 2012. <http://www.missioncriticalmagazine.com/ext/resources/MC/Home/Files/PDFs/(TUI3011B)SimpleModelDeterminingTrueTCO.pdf>.	Model of TCO for company. See table 1 within the PDF to fully understand how the metrics were broken up and how it can relate to the project's TCO metric system.
"Total(Cost(of(Ownership"("Information(Tecnology"	Google(Scholar	Managing(your(Total(IT(Cost(of(Ownership	N/A		9/6/12	"Managing(your(Total(IT(Cost(of(Ownership"Julie(Smith(David,(David(Schuff,(and(Robert(St.(Louis.(Communication(of(the(ACM.(January(2002.(9/6/12	
"Total(Cost(of(Ownership"("Information(Tecnology"	Google(Scholar	"Managing(total(cost(of(ownership:(Examining(costs(and(service(levels"	N/A		9/20/12	Managing(total(cost(of(ownership:(Examining(costs(and(service(levels Schuff,(David(Michael ProQuest(Dissertations(and(Theses;(2000.(9/20/12	
"Total(Cost(of(Ownership"("Information(Tecnology"	Google(Scholar	"Method(for(Determining(Total(Cost(of(Ownership	N/A		9/20/12	"United(States(Patent:(Method(for(Determining(Total(Cost(of(Ownership"(Feria,(Joaquin.(Nunn,(Stephen.(2006.(9/20/12	
"Hanover Insurance" "Information Technology"	Library website	"Redesigning SDLC for HTG"	The Hanover Technology Group (HTG) develops software applications for Hanover Insurance internally. They currently use a waterfall methodology that is very document oriented and inhibits HTG's speed to market. This project explored process redesign opportunities to increase the speed of HTG's delivery process by increasing flexibility. We collected data through staff interviews, document analysis, and research on current SDLC methodologies. We developed redesign recommendations for Scrum and hybrid methodology with guidelines to measure success after implementation.	9/10/12	Manson, Stephanie. Patel,Khushbu., Podber, Trevor.(2010) *Redesigning SDLC for HTG.* Unpublished Interactive Qualifiying Project. Worcester Polytechnic Institute.	provided informaiton on waterfall development of HTG
"Information Technology Service Management"	Internal Resource	"IT Service Management: Hanover Insurance Group"			9/15/12	"IT Service Management Presentation" The Hanover Insurance Group. 2011	provides model for ITSM and ITIL standards and allows us to see the different components within IT services

"IT(Infrastructure"	Google(Scholar	"IT(Infrastructure(for(Strategic(Agility"	Investing(in(IT(infrastructure(is(one(of(the(most(challenging(tasks(facing(senior(managers(who(often(feel(ill(equipped(to(make(these(decisions.(Investing(in(the(right(infrastructure(at(the(right(time(enables(rapid(implementation(of(future(electronically(based(business(initiatives(and(cost(reduction(of(current(business(processes.(This(paper(presents(a(framework(for(senior(executives(to(view(IT(infrastructure(in(business(terms(and(to(lead(in(making(investment(decisions.(By(studying(180(electronically(based(business(initiatives(in(89(top(performing(enterprises(we(identified(the(specific(infrastructure(capabilities(needed(for(different(types(of(business(initiatives(and(how(this(capability(is(provided(as(an(integrated(IT(infrastructure.(An(integrated(IT(infrastructure(has(ten(clusters(of(IT(infrastructure(services(fine(tuned(to(the(enterprise's(set(of(electronically(	9/24/12	Broadbent,(Marianne.(Weill,(Peter.(Subramani,(Mani((IT(Infrastructure(for(Strategic(Agililty."Center(for(Information(Systems(Research:MIT.(2002.(9/24/1(	
"Information Technology Service Management"	Google Scholar	"Information Technology Service Management: An Emerging Area for Academic Research and Pedagogical Development"	The economic landscape has changed for the industrialized nations of the world. The most mature nations on the planet have transitioned from agriculture and manufacturing economies to service-based economies. Services constitute more than 75% of industrialized nations' economies. These services are dependent on Information & Communication Technology that is supported by local and global information technology functions or the combination of both. In this paper, we review the modern methods and standards of information technology service management, such as ISO/IEC 20000; emerging pedagogical developments; and alternative approaches to ITSM research.	9/24/12	Conger, Sue. Dattero, Ronald. Galup, Stuart. Quan, Jim J. "Information Technology Service Management: An Emerging Area for Academic Research and Pedagogical Development" New York, NY, USA. 2007. 09/24/12.	provided more insight on the components of ITSM an ITIL

"IT Infrastructure"	Google Scholar	"WHAT IT INFRASTRUCTURE CAPABILITIES ARE NEEDED TO IMPLEMENT E-BUSINESS MODELS?"	As firms integrate e-business into their existing businesses, they migrate from traditional physical business models to combined physical and virtual models. This shift increases the role of the information technol- ogy (IT) infrastructure because information and online transaction processing become more important. However, the large number of in- frastructure investment options can easily overwhelm senior manage- ment teams. To help, we classify e-business initiatives by the building blocks they use (which we call atomic e-business models), and we ex- amine the main IT infrastructure services that four of our eight models need. The four models require surprisingly different IT infrastructure services, so categorization should help executives prioritize their IT infrastructure investments based on their business goals. At the heart of this prioritization process	9/25/12	Weil, Peter.,Vitale, Michael."What IT infrastructure capabilities are needed to implement E-Business Models"University of Minnesota. 2002. 9/25/12
"Alignment"	Google Scholar	"Assessing IT/Business Alignment"	Alignment is the perennial business chart-topper on top-ten lists of IT issues. What follows is a methodology developed by the author for assessing a company's alignment. Modeled after the Capability Maturity Model® developed by Carnegie Mellon's Software Engineering Institute, but focused on a more strategic set of business practices, this tool has been successfully tested at more than 50 Global 2000 companies and is currently the subject of a benchmarking study sponsored by the Society for Information Management and The Conference Board. The primary objective of the assessment is to identify specific recommendations for improving the alignment of IT and the business.	9/25/12	Jerry Luftman (2003): Assessing It/Business Alignment, Information Systems Management, 20:4, 9-15

Appendix D-Cost Drivers Spreadsheet

Name of Paper	Source of Paper	Costs	Applicable?
Boosting Portfolio Productivity: Frameworks for Extracting Business Value from the IT Portfolio	"Boosting Portfolio Productivity: Framework for Extracting Business Value from the IT Portfolio." CIO Executive Board" 29 Aug. 2012.	**Cost-to-scale** - includes start-up costs and investment necessary to reach value and user volume targets after launch	No
Boosting Portfolio Productivity: Frameworks for Extracting Business Value from the IT Portfolio	"Boosting Portfolio Productivity: Framework for Extracting Business Value from the IT Portfolio." CIO Executive Board" 29 Aug. 2012.	**Annual Support Costs** - Ongoing costs necessary to sustain the program in the future, including maintenance, staffing, and upgrades, calculated by averaging three years of support costs after achieving scale	Yes
Boosting Portfolio Productivity: Frameworks for Extracting Business Value from the IT Portfolio	"Boosting Portfolio Productivity: Framework for Extracting Business Value from the IT Portfolio." CIO Executive Board" 29 Aug. 2012.	**Time to Market** - Number of months until launch after approval	No
Boosting Portfolio Productivity: Frameworks for Extracting Business Value from the IT Portfolio	"Boosting Portfolio Productivity: Framework for Extracting Business Value from the IT Portfolio." CIO Executive Board" 29 Aug. 2012.	**Time to Volume** - Number of months to reach value/volume goal after launch	No
Boosting Portfolio Productivity: Frameworks for Extracting Business Value from the IT Portfolio	"Boosting Portfolio Productivity: Framework for Extracting Business Value from the IT Portfolio." CIO Executive Board" 29 Aug. 2012.	**Shared Service Costs** - These include the quality control and program management costs	No

Boosting Portfolio Productivity: Frameworks for Extracting Business Value from the IT Portfolio	"Boosting Portfolio Productivity: Framework for Extracting Business Value from the IT Portfolio." CIO Executive Board" 29 Aug. 2012.	**Infastructure Costs** - These are based on the portion of the shared infastructure that a particular application utilizes.	Yes
Boosting Portfolio Productivity: Frameworks for Extracting Business Value from the IT Portfolio	"Boosting Portfolio Productivity: Framework for Extracting Business Value from the IT Portfolio." CIO Executive Board" 29 Aug. 2012.	**Direct Costs** - These include application maintenance costs and depreciation.	Yes
Portfolio Cost/Value Optimization	"Portfolio Cost/Value Optimization". CIO Executive Board. 05 September 2012.	**Share Service Costs** - These include quality control and program management costs.	No
Portfolio Cost/Value Optimization	"Portfolio Cost/Value Optimization". CIO Executive Board. 05 September 2012.	**Infrastructure Costs** - These are based on the portion of the shared infrastructure that a particular application utilizes.	Yes
Portfolio Cost/Value Optimization	"Portfolio Cost/Value Optimization". CIO Executive Board. 05 September 2012.	**Direct Costs** - These include application maintenance costs and depreciation.	Yes
Using Unit Cost Visibility to Drive Retirement Decisions	"Using Unit Cost Visibility to Drive Retirement Decisions". AEC Executive Board. 05 September 2012.	**Internal Headcount Support Costs** - estimating the number or resources needed multiplied by the average burden rate (total cost of maintenance divided by total IT support staff).	Yes
Using Unit Cost Visibility to Drive Retirement Decisions	"Using Unit Cost Visibility to Drive Retirement Decisions". AEC Executive Board. 05 September 2012.	**Internal Maintenance Costs (Non-Headcount)** -such as hosting costs to servers and shared platforms	No

Portfolio Cost/Value Optimization	"Portfolio Cost/Value Optimization". CIO Executive Board. 05 September 2012.	**Direct Costs** - These include application maintenance costs and depreciation.	Yes
Using Unit Cost Visibility to Drive Retirement Decisions	"Using Unit Cost Visibility to Drive Retirement Decisions". AEC Executive Board. 05 September 2012.	**Internal Headcount Support Costs** - estimating the number or resources needed multiplied by the average burden rate (total cost of maintenance divided by total IT support staff).	Yes
Using Unit Cost Visibility to Drive Retirement Decisions	"Using Unit Cost Visibility to Drive Retirement Decisions". AEC Executive Board. 05 September 2012.	**Internal Maintenance Costs (Non-Headcount)** -such as hosting costs to servers and shared platforms	No
Using Unit Cost Visibility to Drive Retirement Decisions	"Using Unit Cost Visibility to Drive Retirement Decisions". AEC Executive Board. 05 September 2012.	**External Vendor Support Costs** - associated with hardware and software maintenance as well as consulting costs	Yes
Using Unit Cost Visibility to Drive Retirement Decisions	"Using Unit Cost Visibility to Drive Retirement Decisions". AEC Executive Board. 05 September 2012.	**Capital Costs (Sustaining)** - associated with hardware and software upgrades	Yes
Using Unit Cost Visibility to Drive Retirement Decisions	"Using Unit Cost Visibility to Drive Retirement Decisions". AEC Executive Board. 05 September 2012.	**Miscellaneous Costs** - such as administrative support	Yes
A Simple Model for Determining True Total Cost of Ownership for Data Centers	Koomey, Jonathan, Kenneth Brill, Pitt Turner, John Stanley, and Bruce Taylor. "A Simple Model for Determining True Total Cost of Ownership for Data Centers." Mission Critical Magazine. Uptime Institute, 2007. Web. 6 Sept. 2012. <http://www.missioncriticalmagazine.com/ext/resources/MC/Home/Files/PDFs/(TUI3011B)SimpleModelDeterminingTrueT	**Infrastructure Costs** - including cooling, air handling, backup power, power distribution, and power conditioning	Yes
Managing your Total IT Cost of Ownership	"Managing your Total IT Cost of Ownership"Julie Smith David, David Schuff, and Robert St. Louis. Communication of the ACM. January 2002. 9/6/12	per-seat cost = f(hardware, software, centralization, standardization, support, evaluation, upgrades, train- ing, downtime, futz, auditing, viruses, power con- sumption)	An example of how to break down costs into different component

Appendix E-TCO Model Worksheets

Total Cost Per Line of Business Worksheet

Core Applications	TCO	Total Cost PL	Total Cost CL				Personal Lines Percent of Usage	Commercial Lines Percent of Usage
Application 1	$858,813.00	$343,525.20	$515,287.80				40%	60%
Application 2	$35,533.00	$14,213.20	$21,319.80					
Application 3	$1,000,000.00	$400,000.00	$600,000.00					
Application 4	$100,000.00	$40,000.00	$60,000.00					
Application 5	$189,889.00	$75,955.60	$113,933.40					
Application 6	$136,629.00	$54,651.60	$81,977.40					
Application 7	$2,482,041.00	$992,816.40	$1,489,224.60					
Application 8	$277,532.00	$111,012.80	$166,519.20					
Application 9	$1,459,092.00	$583,636.80	$875,455.20					
Application 10	$250,000.00	$100,000.00	$150,000.00					
Application 11	$672,670.00	$269,068.00	$403,602.00					
Application 12	$4,709,533.00	$1,883,813.20	$2,825,719.80					
Application 13	$3,805,643.00	$1,522,257.20	$2,283,385.80					
Application 14	$250,000.00	$100,000.00	$150,000.00					
Application 15	$956,151.00	$382,460.40	$573,690.60					
Application 16	$250,000.00	$100,000.00	$150,000.00					
* Assumes PL percentage of TCO is 40% and CL percentage of TCO is 60%								
* Applications 3, 4, 10, and 14 have estimated TCO								
* Application 16 too new of application so TCO was assumed								

PL-Transaction Counts Worksheet

Core Applications	Transactions	Products																
		Product 1	Product 2	Product 3	Product 4	Product 5	Product 6	Product 7	Product 8	Product 9	Product 10	Product 11	Product 12	Product 13	Product 14	Product 15	Product 16	Product 17
Application 2	Transaction 1																	
	Transaction 2																63	16
	Transaction 3																1665	400
	Transaction 4																4	12
Total:	**2160**																	
Application 3	Transaction 2																	
	Transaction 3																	
Total:																		
Application 12	Transaction 2	68565	5294	798													63	
	Transaction 3	872618	61760	4593													1665	
	Transaction 4	71264	13819	349													4	
Total:	**1100792**																	
Application 13	Transaction 1	223675	115979															
	Transaction 2	68565	5294															
Total:	**413513**																	
Application 15	Transaction 1																	
	Transaction 2																	
	Transaction 3																	
	Transaction 4																	
Total:																		

CL-Transaction Counts Worksheet

Core Applications	Transactions	Products																																					
		Product 1	Product 2	Product 3	Product 4	Product 5	Product 6	Product 7	Product 8	Product 9	Product 10	Product 11	Product 12	Product 13	Product 14	Product 15	Product 16	Product 17	Product 18	Product 19	Product 20	Product 21	Product 22	Product 23	Product 24	Product 25	Product 26	Product 27	Product 28	Product 29	Product 30	Product 31	Product 32	Product 33
Application 1	Transaction 1																																	
	Transaction 2									5750	523									1022		127			200									
	Transaction 3									39084	2333									1565		374			1396									
	Transaction 4									3577	471									802		189			39									
Total:	**57452**																																	
Application 3	Transaction 2																																	
	Transaction 3																																	
Total:																																		
Application 4	Transaction 1																																	
	Transaction 2																																	
	Transaction 3																																	
	Transaction 4																																	
Total:																																		
Application 5	Transaction 2												897																87					
	Transaction 3												17																147					
Total:	**1148**																																	
Application 7	Transaction 1																																	
	Transaction 2	2119	2902		2			5138		5750	523							25		1022		127	127	82	200				87				490	0
	Transaction 3	18340	16026					27932		39084	2333							564		1565		374	374	271	1396				147				2758	81
Total:	**129839**																																	
Application 9	Transaction 4	7305	3081	19		28		4148		3577	471		291					105	2	802		189	378	262	39				15	6	5		7	
Total:	**20730**																																	
Application 12	Transaction 2	2119	2902		2			5138			523												127	82									490	0
	Transaction 3	18340	16026					27932			2333												374	271									2758	81
Total:	**79498**																																	
Application 13	Transaction 1																																	
	Transaction 2	2119	2902					5138																										0
Total:	**10159**																																	
Application 16	Transaction 1																																	
	Transaction 2																																	
	Transaction 3																																	
Total:																																		
Application 14	Transaction 1																																	
	Transaction 2																																	
	Transaction 3																																	
	Transaction 4																																	
Total:																																		
Application 15	Transaction 1																																	
	Transaction 2																																	
	Transaction 3																																	
	Transaction 4																																	
Total:																																		

PL-Percentages Worksheet

Core Applications	Transactions	Products																
		Product 1	Product 2	Product 3	Product 4	Product 5	Product 6	Product 7	Product 8	Product 9	Product 10	Product 11	Product 12	Product 13	Product 14	Product 15	Product 16	Product 17
Application 2	Transaction 1																0.00%	0.00%
	Transaction 2																2.92%	0.74%
	Transaction 3																77.08%	18.52%
	Transaction 4																0.19%	0.56%
Application 3	Transaction 2																	
	Transaction 3																	
Application 12	Transaction 2	6.23%	0.48%	0.07%	0.00%		0.00%	0.00%	0.00%			0.00%				0.00%	0.01%	0.00%
	Transaction 3	79.27%	5.61%	0.42%	0.00%		0.00%	0.00%	0.00%			0.00%				0.00%	0.15%	0.00%
	Transaction 4	6.47%	1.26%	0.03%	0.00%		0.00%	0.00%	0.00%			0.00%				0.00%	0.00%	0.00%
Application 13	Transaction 1	54.09%	28.05%				0.00%									0.00%		
	Transaction 2	16.58%	1.28%				0.00%									0.00%		
Application 15	Transaction 1																	
	Transaction 2																	
	Transaction 3																	
	Transaction 4																	

CL-Percentages Worksheet

		Products																																
Core Applications	Transactions	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6	Product 7	Product 8	Product 9	Product 10	Product 11	Product 12	Product 13	Product 14	Product 15	Product 16	Product 17	Product 18	Product 19	Product 20	Product 21	Product 22	Product 23	Product 24	Product 25	Product 26	Product 27	Product 28	Product 29	Product 30	Product 31	Product 32	Product 33
Application 1	Transaction 1						0.00%		0.00%	0.00%	0.00%				0.00%	0.00%	0.00%			0.00%		0.00%			0.00%		0.00%	0.00%						
	Transaction 2						0.00%		0.00%	10.01%	0.91%				0.00%	0.00%	0.00%			1.78%		0.22%			0.35%		0.00%	0.00%						
	Transaction 3						0.00%		0.00%	68.03%	4.06%				0.00%	0.00%	0.00%			2.72%		0.65%			2.43%		0.00%	0.00%						
	Transaction 4						0.00%		0.00%	6.23%	0.82%				0.00%	0.00%	0.00%			1.40%		0.33%			0.07%		0.00%	0.00%						
Application 3	Transaction 2																																	
	Transaction 3																																	
Application 4	Transaction 1																																	
	Transaction 2																																	
	Transaction 3																																	
	Transaction 4																																	
Application 5	Transaction 2												78.14%				0.00%												7.58%					
	Transaction 3												1.48%				0.00%												12.80%					
Application 7	Transaction 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Transaction 2	1.63%	2.24%	0.00%	0.00%	0.00%	0.00%	3.96%	0.00%	4.43%	0.40%	0.00%		0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.79%	0.00%	0.10%	0.10%	0.06%	0.15%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.38%	0.00%
	Transaction 3	14.13%	12.34%	0.00%	0.00%	0.00%	0.00%	21.51%	0.00%	30.10%	1.80%	0.00%		0.00%	0.00%	0.00%	0.00%	0.43%	0.00%	1.21%	0.00%	0.29%	0.29%	0.21%	1.08%	0.00%	0.00%	0.00%	0.11%	0.00%	0.00%	0.00%	2.12%	0.06%
Application 9	Transaction 4	35.24%	14.86%	0.09%	0.00%	0.14%	0.00%	20.01%	0.00%	17.26%	2.27%	0.00%	1.40%	0.00%	0.00%	0.00%	0.00%	0.51%	0.01%	3.87%	0.00%	0.91%	1.82%	1.26%	0.19%	0.00%	0.00%	0.00%	0.07%	0.03%	0.02%	0.00%	0.03%	0.00%
Application 12	Transaction 2	2.67%	3.65%	0.00%	0.00%	0.00%	0.00%	6.46%	0.00%		0.66%	0.00%				0.00%	0.00%						0.16%	0.10%		0.00%				0.00%			0.62%	0.00%
	Transaction 3	23.07%	20.16%	0.00%	0.00%	0.00%	0.00%	35.14%	0.00%		2.93%	0.00%				0.00%	0.00%						0.47%	0.34%		0.00%				0.00%			3.47%	0.10%
Application 13	Transaction 1	0.00%	0.00%				0.00%	0.00%																								0.00%		0.00%
	Transaction 2	20.86%	28.57%				0.00%	50.58%																								0.00%		0.00%
Application 16	Transaction 1																																	
	Transaction 2																																	
	Transaction 3																																	
Application 14	Transaction 1																																	
	Transaction 2																																	
	Transaction 3																																	
	Transaction 4																																	
Application 15	Transaction 1																																	
	Transaction 2																																	
	Transaction 3																																	
	Transaction 4																																	

PL-Total Cost Breakdown Worksheet

		Products																
Core Applications	**Transactions**	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6	Product 7	Product 8	Product 9	Product 10	Product 11	Product 12	Product 13	Product 14	Product 15	Product 16	Product 17
Application 2	Transaction 1																$0.00	$0.00
	Transaction 2																$414.55	$105.28
	Transaction 3																$10,956.01	$2,632.07
	Transaction 4																$26.32	$78.96
Total:	**$14,213.20**																	
Application 3	Transaction 2																	
	Transaction 3																	
Total:																		
Application 12	Transaction 2	$117,337.02	$9,059.76	$1,365.64	$0.00		$0.00	$0.00	$0.00			$0.00				$0.00	$107.81	$0.00
	Transaction 3	$1,493,333.26	$105,691.45	$7,860.12	$0.00		$0.00	$0.00	$0.00			$0.00				$0.00	$2,849.36	$0.00
	Transaction 4	$121,955.89	$23,648.80	$597.25	$0.00		$0.00	$0.00	$0.00			$0.00				$0.00	$6.85	$0.00
Total:	**$1,883,813.20**																	
Application 13	Transaction 1	$823,410.34	$426,951.19				$0.00									$0.00		
	Transaction 2	$252,406.97	$19,488.70				$0.00									$0.00		
Total:	**$1,522,257.20**																	
Application 15	Transaction 1																	
	Transaction 2																	
	Transaction 3																	
	Transaction 4																	
Total:																		

CL-Total Cost Breakdowns Worksheet

		Products																																
Core Applications	**Transactions**	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6	Product 7	Product 8	Product 9	Product 10	Product 11	Product 12	Product 13	Product 14	Product 15	Product 16	Product 17	Product 18	Product 19	Product 20	Product 21	Product 22	Product 23	Product 24	Product 25	Product 26	Product 27	Product 28	Product 29	Product 30	Product 31	Product 32	Product 33
Application 1	Transaction 1						$0.00		$0.00	$0.00	$0.00				$0.00	$0.00	$0.00			$0.00		$0.00			$0.00		$0.00	$0.00							
	Transaction 2						$0.00		$0.00	$51,571.83	$4,690.79				$0.00	$0.00	$0.00			$9,166.33		$1,139.06			$1,793.80		$0.00	$0.00							
	Transaction 3						$0.00		$0.00	$350,544.95	$20,924.71				$0.00	$0.00	$0.00			$14,036.51		$3,354.41			$12,520.74		$0.00	$0.00							
	Transaction 4						$0.00		$0.00	$32,082.16	$4,224.41				$0.00	$0.00	$0.00			$7,193.15		$1,695.14			$349.79		$0.00	$0.00							
Total:	**$515,287.80**																																		
Application 3	Transaction 2																																		
	Transaction 3																																		
Total:																																			
Application 4	Transaction 1																																		
	Transaction 2																																		
	Transaction 3																																		
	Transaction 4																																		
Total:																																			
Application 5	Transaction 2												$89,022.87				$0.00												$8,634.33						
	Transaction 3												$1,687.17				$0.00												$14,589.03						
Total:	**$113,933.40**																																		
Application 7	Transaction 1	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Transaction 2	$24,304.46	$33,285.30	$0.00	$22.94	$0.00	$0.00	$58,931.72	$0.00	$65,951.23	$5,998.69	$0.00		$0.00	$0.00	$0.00	$0.00	$286.74	$0.00	$11,722.11	$0.00	$1,456.66	$1,456.66	$940.52	$2,293.96	$0.00	$0.00	$0.00	$997.87	$0.00	$0.00	$0.00	$5,620.19	$0.00
	Transaction 3	$210,355.74	$183,814.67	$0.00	$0.00	$0.00	$0.00	$320,373.86	$0.00	$448,284.83	$26,758.99	$0.00		$0.00	$0.00	$0.00	$0.00	$6,468.96	$0.00	$17,950.20	$0.00	$4,289.70	$4,289.70	$3,108.31	$16,011.81	$0.00	$0.00	$0.00	$1,686.06	$0.00	$0.00	$0.00	$31,633.65	$929.05
Total:	**$1,489,224.60**																																		
Application 9	Transaction 4	$308,499.77	$130,114.69	$802.40	$0.00	$1,182.48	$0.00	$175,175.50	$0.00	$151,061.42	$19,890.95	$0.00	$12,289.31	$0.00	$0.00	$0.00	$0.00	$4,434.29	$84.46	$33,869.52	$0.00	$7,981.72	$15,963.44	$11,064.61	$1,647.02	$0.00	$0.00	$0.00	$633.47	$253.39	$211.16	$0.00	$295.62	$0.00
Total:	**$875,455.20**																																		
Application 12	Transaction 2	$75,318.88	$103,150.25	$0.00	$71.09	$0.00	$0.00	$182,627.84	$0.00		$18,589.79	$0.00				$0.00	$0.00						$4,514.16	$2,914.65		$0.00				$0.00			$17,416.82	$0.00
	Transaction 3	$651,886.85	$569,636.79	$0.00	$0.00	$0.00	$0.00	$992,830.08	$0.00		$82,925.41	$0.00				$0.00	$0.00						$13,293.66	$9,632.57		$0.00				$0.00			$98,031.84	$2,879.11
Total:	**$2,825,719.80**																																		
Application 13	Transaction 1	$0.00	$0.00				$0.00	$0.00																								$0.00		$0.00
	Transaction 2	$476,276.65	$652,267.51				$0.00	$1,154,841.64																								$0.00		$0.00
Total:	**$2,283,385.80**																																		
Application 16	Transaction 1																																		
	Transaction 2																																		
	Transaction 3																																		
Total:																																			
Application 14	Transaction 1																																		
	Transaction 2																																		
	Transaction 3																																		
	Transaction 4																																		
Total:																																			
Application 15	Transaction 1																																		
	Transaction 2																																		
	Transaction 3																																		
	Transaction 4																																		
Total:																																			