

Birkbeck, University of London

School of Computer Science & Information Systems

MSc Computer Science
Full-time Class 2015/2016
Project Proposal

Activity Based Costing Application

Supervisor: Dr. Peter Wood
Author: Yasser Alejandro Palacios

This proposal is the result of my own work, expressed in my own words, except where explicitly indicated in text. I give my permission for it to be submitted to the JISC Plagiarism Detection Service. The report may be freely copied and distributed provided the resource is explicitly acknowledged.

11 of April 2016

Table of Contents

Abstract.....	2
Introduction	3
Discussion on Activity Based Costing (ABC)	4
ABC history?	4
How does ABC differ from conventional cost accounting approaches?.....	4
How does it work? ABC steps	5
Benefits of Activity Based Costing and Risks of not using ABC	12
Challenges in the implementation of Activity Based Costing	13
Existing implementation of ABC solutions.....	14
Taxonomy of current set of solutions implementing ABC.....	14
Socio-technical evaluation of current set of solutions	15
Strengths and weaknesses of each approach.....	16
Spreadsheet	16
Enhanced Spreadsheet	16
ERP Module.....	16
Performance Management Module	16
Proposed Solution.....	17
Formulation of project aims and objectives	17
Project Solution top level MoSCoW Analysis.....	17
M - Must Have.....	17
S- Should Have	18
C- Could Have	18
W- Want to Have but Won't Have	18
Development methodology and software platform to use.....	19
Development timeline	20
Bibliography	21

Abstract

Activity Based Costing (ABC) was conceived almost 30 years ago, its procedures and benefits have been taught and recognized across numerous universities and Accounting Professional bodies training programs around the world. However, its adoption, implementation, and maintenance still represent a major challenge for most organizations. This is mainly driven by the dichotomy in balancing technical vs. social requirements and the approach used by the existing set of solutions in meeting these needs. Currently, systems that optimize technical attributes like scalability, processing speed, testability, etc., have a very poor performance in the optimization of social factors like cost and implementation time; and vice-versa. There is a strong appetite for a new approach that can properly consider both set of constraints. A cross-platform stand-alone application with the concentrated focus of only being an Activity Based Costing provider is the answer for the solution of this dilemma. The Master Thesis project that I intend to complete will deliver a basic and extendable system that will follow this new way of delivering an ABC solution.

Introduction

The term socio-technical systems was first introduced by the joint research done at the Tavistock Institute in London by Ken Bamforth, Eric Trist, and Fred Emery (Sawyer & Jarrahi). In their studies of the English coal mines during WWII period, they sought to analyze and highlight the interaction between technical systems and the people utilizing them. In particular, they started to notice and study paradoxical situations in which organizations that had invested in new technologies and business methodologies experienced a degradation in their productivity. They concluded that in order to improve the overall performance of any systems, any new solution needs to address the joint optimization of technical and social factors.

More than 60 years after the publication of this research, still many current day organizations fail to acknowledge the importance of the social factors in the successful implementation of any technical system. In particular, through my 15 years of experience as a finance manager across different industry sectors and world geographies, I became a living testimony on how a more accurate and sound costing methodology has failed to take solid roots across many organizations.

The costing methodology under consideration is known as Activity Based Costing (ABC). It is an innovative cost accounting methodology specialized in providing an analytically sound and fair allocation of indirect costs to a product or a client. "It is based on the principle that efforts required to produce a product or deliver a service to a client can be quantified and, therefore, assigned to that particular product or client. Similar to a bill of materials, products have a bill of activities required to deliver them" (Bahnub).

As part of this research project, I reflected and researched on the overall context in which ABC operates and the main challenges that it faces during its implementation. Furthermore, I studied the different set of solutions that have been used so far to deliver this methodology, and analyzed the factors behind their poor widespread adoption and lack of stickiness.

In the later section of this document, I am proposing an innovative way of delivering this costing methodology that will facilitate its absorption and extend its life-cycle within an organization. This is achieved by setting the vision on the joint-optimization of technical and socio needs, as opposed to seeking the maximization of only technical or only socio needs.

For purpose of this project, I intend to deliver a desktop software application that will perform all the procedures needed to run an Activity Based Costing model. It will allow the user to configure the application based on the business activity processes and financial/operational data inputs of the organization and will generate a report with the outcome of the ABC model.

Discussion on Activity Based Costing (ABC)

ABC history?

Activity Based Costing (ABC) early origins trace back to the Consortium for Advanced Management-International and their documentation and formalization of a set of innovative costing practices observed in the manufacturing sector of the United States in the late 1970's and 1980's (Cardos & Pete).

From an academic standpoint, Activity Based Costing gained popularity and credibility after a series of articles and a book published by Harvard University Professor Robert Kaplan and Claremont University Professor Robin Cooper in the early 1990's. This innovative costing methodology became a valuable costs analysis tool to support the Business Process Re-engineering (BPR) revolution that was taking place at that moment in time. For those unfamiliar with BPR, it was a philosophy with a set of principles and techniques with the ultimate objective of eliminating non-value added activities and offerings in an organization.

In the present time, ABC is widely known and taught by many training programs at Business Management university academic departments and Accounting Professional bodies. Regardless of this widespread dissemination; its usage, implementation, and maintenance still represents a major challenge for many organizations. On a later section of this document, it will be described in detail the major challenges faced in the implementation of an ABC system.

How does ABC differ from conventional cost accounting approaches?

Direct material costs are treated the same on conventional accounting approaches and ABC, the key difference between both methodologies lies on the treatment of indirect costs (Sohal & Chung). In particular;

- ABC drills down through the indirect costs of an organization and tries to segment it in different buckets based on the business process activities behind those indirect costs. Conventional accounting treats all indirect costs as a single pool of cost. In other words, ABC tries to segment indirect costs into individual distinctive entities, while conventional accounting tries to aggregate indirect costs into one single common entity.
- ABC makes every possible effort to find an operational factor to assign indirect costs to a set of products/clients based on a driver that accurately reflects their consumption of each activity effort. Conventional accounting tries to find a single and simple allocation driver for all indirect costs in an organization, regardless of each product's/client's activity effort consumption pattern.
- ABC is a process oriented technique where processes are costed and their costs are allocated to each product/client based on operational data and product/process mappings. Conventional accounting is an organization hierarchy centric methodology, where indirect costs are allocated based on an organization structure.

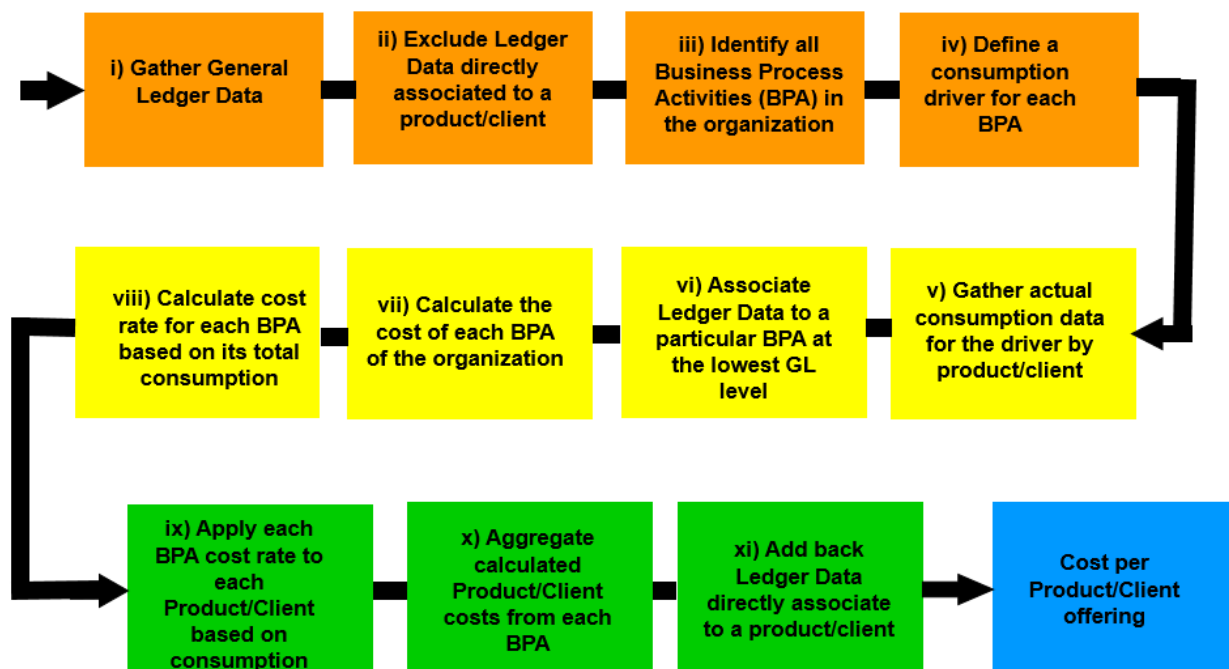
- ABC aims for accuracy and transparency on the calculation of the indirect cost of each product/client, while conventional accounting approaches aim for simplicity and speed in providing indirect cost information.
- Conventional accounting practices are sufficiently serviced by the departmental/cost center hierarchy of most Enterprise Resource Planning (ERP) financial ledger systems. ABC leverages information from an ERP financial ledger, but it also creates its own view of the cost structure of an organization based on the business processes that make an organization run.

How does it work? ABC steps

In order to document the different procedures involved in performing an Activity Based Costing exercise, I have defined a series of step-procedures that are graphically presented below and explained in further detail in this section of the document. These series of steps are based on the original work published by (Kaplan & Cooper) , partially aided by the work of (D.V. Ramana), (Hayes), and (Tariq). Nevertheless, the number of steps and their scope is the result of my reflection on the topic and my work experience with the ABC methodology.

To facilitate the explanation of each step, a fictional example of an ABC implementation is also included in this section. The example is an oversimplified version of an Activity Based Costing exercise of a miniature size, limited scope, and without the level of detail and depth that a real situation will encounter. However, it will greatly help the reader in the comprehension of the essence of each step-procedure.

The ABC methodology can be summarized in the following sequence of major steps:



- i) Gather General Ledger Data: This first step in an ABC analysis is the gathering of general ledger cost information. For those unfamiliar with the general ledger concept, this is the set of manual or electronic records that summarize the financial position of an organization in a particular period. For the purpose of ABC, only the expense module of the general ledger is needed. This expense module has a number of attributes to categorize any expense. Typical attributes are organization, legal entity, department, cost center, expense account, and period. For a powerful implementation of an ABC methodology, information at the lowest level of detail, the expense account, is needed.

An oversimplified sample view of a general ledger for a particular period would look like this;

Dept	Cost Center	Expense Category	Expense Amount
Purchasing	Product A Center	Raw Materials	£1,000,000
Purchasing	Product B Center	Raw Materials	£1,500,000
Production	Mixing	Labor	£350,000
Production	Mixing	Equipment Depreciation	£600,000
Production	Oven Operations	Labor	£200,000
Production	Oven Operations	Equipment Depreciation	£250,000
Production	Packaging	Labor	£200,000
Production	Packaging	Equipment Depreciation	£300,000
Quality	Quality	Labor	£200,000
Quality	Quality	Temp Workers	£20,000
Quality	Quality	Capital Equipment Depreciation	£175,000
Quality	Quality	Misc Testing Supplies	£35,000
Storage	Storage	Labor	£45,000
Storage	Storage	Equipment Depreciation	£40,000
Storage	Storage	Facilities	£500,000
Total			£5,415,000

- ii) Exclude Ledger Data directly associated to a product/client: ABC objective is to come up with a sound procedure to allocate costs that can't be traced directly thru the general ledger to a particular product/client. Depending on the industry sector, products/service offerings, and the accounting/organization hierarchy; there will be certain cost centers within the general ledger that can traced directly to a particular product/client. In this case, it is important to temporarily exclude them from the cost allocation methodology to be described in the subsequent steps.

From the sample table presented earlier, we will exclude the purchasing department cost centers, since those costs can be directly related to each product.

Dept	Cost Center	Expense Category	Expense Amount
Purchasing	Product A Center	Raw Materials	£1,000,000
Purchasing	Product B Center	Raw Materials	£1,500,000
Production	Mixing	Labor	£350,000
Production	Mixing	Equipment Depreciation	£600,000
Production	Oven Operations	Labor	£200,000
Production	Oven Operations	Equipment Depreciation	£250,000
Production	Packaging	Labor	£200,000
Production	Packaging	Equipment Depreciation	£300,000
Quality	Quality	Labor	£200,000
Quality	Quality	Temp Workers	£20,000
Quality	Quality	Capital Equipment Depreciation	£175,000
Quality	Quality	Misc Testing Supplies	£35,000
Storage	Storage	Labor	£45,000
Storage	Storage	Equipment Depreciation	£40,000
Storage	Storage	Facilities	£500,000

<-- Exclude

Direct	£2,500,000
Indirect	£2,915,000
Total	£5,415,000

- iii) Identify all Business Process Activities (BPA) in an organization: As mentioned earlier in this document, ABC has a process centric view of an organization. It considers an organization not as a collection of cost centers, but as a collection of business activities utilized by products or clients. The output of this step will be a comprehensive list of all the business process activities in a company.

For the example under illustration, below is the list of the business process activities that constitute that organization (*Note: The list has been made very short and simple to facilitate the explanation*).

Business Process Activities (BPA)	
#	Description
A-1	Loading/Unloading of Material into/from Mixing Machines
A-2	Mixing
A-3	Quality Testing of Mixed Material
A-4	Loading/Unloading of Material into/from Oven
A-5	Baking
A-6	Quality Testing of Baked Material
A-7	Packaging of Product
A-8	Quality Testing of Packed Material
A-9	Transportation of Product into/out Storage
A-10	Storage

- iv) Define a consumption driver for each BPA: This is a critical step in the methodology, and is where the multi-functional approach to ABC comes to life. A successful execution of this step requires the input and expertise of the personnel directly responsible for each of the activities of the

organization. This means that all business functions; manufacturing, service, sales, marketing, finance, IT, etc..., need to be actively involved in the determination of these drivers.

For the example under illustration, to the right side of the below table, you will find the consumption driver for each activity.

Business Process Activities (BPA)		
#	Description	Driver
A-1	Loading/Unloading of Material into/from Mixing Machines	Mixing Machine Loading/Unloading Time of each product
A-2	Mixing	Mixing Time of each product
A-3	Quality Testing of Mixed Material	# Batches
A-4	Loading/Unloading of Material into/from Oven	Oven Loading/Unloading Time of each product
A-5	Baking	Baking Time of each product
A-6	Quality Testing of Baked Material	# Batches
A-7	Packaging of Product	Packing Time of each product
A-8	Quality Testing of Packed Material	# Batches
A-9	Transportation of Product into/out Storage	Transport Time of each product
A-10	Storage	# Units Stored of each Product Adjusted for Volume

- v) Gather actual consumption data for the driver by product/client: In this step, actual utilization data is gathered for each one of the business activities. Typically, initial implementations of ABC will leverage existing data sources, while consequent implementations can allow time for new data collection processes to be put in place.

For the sake of simplicity, the below sample data has been aggregated by month. In reality, operational data is not expected to have been aggregated. Instead, each activity will have its own database with an hourly list on the consumption of each driver by the different products/clients. This data will need to be aggregated by the ABC system.

Business Process Activities (BPA)		Product		Total
Act #	Driver	A	B	
A-1	Mixing Machine Loading/Unloading Time of each product	288.0 hours	576.0 hours	864.0 hours
A-2	Mixing Time of each product	144.0 hours	336.0 hours	480.0 hours
A-3	# Batches	576 batches	576 batches	1152 batches
A-4	Oven Loading/Unloading Time of each product	48.0 hours	115.2 hours	163.2 hours
A-5	Baking Time of each product	115.2 hours	192.0 hours	307.2 hours
A-6	# Batches	576 batches	576 batches	1152 batches
A-7	Packing Time of each product	96.0 hours	144.0 hours	240.0 hours
A-8	# Batches	576 batches	576 batches	1152 batches
A-9	Transport Time of each product	57.6 hours	115.2 hours	172.8 hours
A-10	# Units Stored of each Product Adjusted for Volume	748.8 sq-ft	864.0 sq-ft	1612.8 sq-ft

In addition, at this point, we also need to know how many units of the product were produced in the month. This is not a calculation, this is an actual unit count.

Units Product for the Period	Product	
	A	B
Production Volume in Units for the period	172,800 Units	144,000 Units

- vi) Associate Ledger Data to a particular BPA at the lowest GL level: This step combines the results of steps ii and iii. For each particular cost center and each particular account within a cost center a mapping to a single activity needs to be done. In certain occasions a whole cost center will be mapped to the same activity, in other occasions an activity can span across several cost centers and even across several departments, and in others a single cost center can be mapped to multiple activities.

Dept	Cost Center	Expense Category	Expense Amount	Associated Activity
Production	Mixing	Labor	£350,000	A-1
Production	Mixing	Equipment Depreciation	£600,000	A-2
Production	Oven Operations	Labor	£200,000	A-4
Production	Oven Operations	Equipment Depreciation	£250,000	A-5
Production	Packaging	Labor	£200,000	A-7
Production	Packaging	Equipment Depreciation	£300,000	A-7
Quality	Quality	Labor	£200,000	A-6
Quality	Quality	Temp Workers	£20,000	A-8
Quality	Quality	Capital Equipment Depreciation	£175,000	A-3
Quality	Quality	Misc Testing Supplies	£35,000	A-8
Storage	Storage	Labor	£45,000	A-9
Storage	Storage	Equipment Depreciation	£40,000	A-9
Storage	Storage	Facilities	£500,000	A-10

Total Indirect	£2,915,000
-----------------------	-------------------

- vii) Calculate the cost of each BPA in the organization: This step takes the mapping done in the prior step and applies it to the general ledger data from step ii, in order to arrive at the total cost of each business process in the organization. This is an extremely valuable piece of information that is not only used later in the ABC methodology but it is also greatly leveraged to complementary approaches to ABC, like Activity Based Management and Value-Added-Analysis.

Cost Center	Expense Category	Expense Amount	Associated Activity	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10
Mixing	Labor	£350,000	A-1	£350,000									
Mixing	Equipment Depn	£600,000	A-2		£600,000								
Oven Operations	Labor	£200,000	A-4				£200,000						
Oven Operations	Equipment Depn	£250,000	A-5					£250,000					
Packaging	Labor	£200,000	A-7							£200,000			
Packaging	Equipment Depn	£300,000	A-7							£300,000			
Quality	Labor	£200,000	A-6						£200,000				
Quality	Temp Workers	£20,000	A-8								£20,000		
Quality	Capital Equipment	£175,000	A-3			£175,000							
Quality	Misc Testing Suppl	£35,000	A-8								£35,000		
Storage	Labor	£45,000	A-9									£45,000	
Storage	Equipment Depn	£40,000	A-9									£40,000	
Storage	Facilities	£500,000	A-10										£500,000

Total Cost for each Activity	£350,000	£600,000	£175,000	£200,000	£250,000	£200,000	£500,000	£55,000	£85,000	£500,000
-------------------------------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	-----------------	----------------	----------------	-----------------

Total Indirect	£2,915,000
-----------------------	-------------------

viii) Calculate the cost rate for each BPA based on its total consumption: This step combines the output of step vii, and divides it by the aggregate of each consumption driver from step v. The output of this step will be an actual cost rate for each activity for that particular period.

	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10
Total Cost for each Activity	£350,000	£600,000	£175,000	£200,000	£250,000	£200,000	£500,000	£55,000	£85,000	£500,000
Total Consumption	864.0 hours	480.0 hours	1152 batches	163.2 hours	307.2 hours	1152 batches	240.0 hours	1152 batches	172.8 hours	1612.8 hours
Actual Cost Rate per Activity	£405	£1,250	£152	£1,225	£814	£174	£2,083	£48	£492	£310

ix) Apply each BPA cost rate to each Product/Client based on consumption: This step combines the output of steps v and viii. Its output should be the cost that each product/client incurred in each of the activities.

Business Process Activities (BPA)		Product		Total	Actual Rate per Unit	Product		Total
Act #	Driver	A	B			A	B	
		Consumed Units				Activity Cost Allocation		
		A-1	Loading/Unloading Time of each product	288.0 hours		576.0 hours	864.0 hours	£405
A-2	Mixing Time of each product	144.0 hours	336.0 hours	480.0 hours	£1,250	£180,000	£420,000	£600,000
A-3	# Batches	576 batches	576 batches	1152 batches	£152	£87,500	£87,500	£175,000
A-4	Loading/Unloading Time of each product	48.0 hours	115.2 hours	163.2 hours	£1,225	£58,824	£141,176	£200,000
A-5	Baking Time of each product	115.2 hours	192.0 hours	307.2 hours	£814	£93,750	£156,250	£250,000
A-6	# Batches	576 batches	576 batches	1152 batches	£174	£100,000	£100,000	£200,000
A-7	Packing Time of each product	96.0 hours	144.0 hours	240.0 hours	£2,083	£200,000	£300,000	£500,000
A-8	# Batches	576 batches	576 batches	1152 batches	£48	£27,500	£27,500	£55,000
A-9	Time of each product	57.6 hours	115.2 hours	172.8 hours	£492	£28,333	£56,667	£85,000
A-10	# Units Stored of each Product Adjusted for Volume	748.8 sq-ft	864.0 sq-ft	1612.8 sq-ft	£310	£232,143	£267,857	£500,000
				Total Indirect by Product		£1,124,716	£1,790,284	£2,915,000

x) Aggregate the calculated Product/Client costs from each BPA: This is an aggregation step as indicated by its label. The output of this step should be the total indirect costs of each Product/Client produced and serviced during that time period.

To illustrate the difference between ABC and conventional accounting, in the below table you will also find the indirect cost per unit that a conventional accounting method would have used.

Method	Dimension	Product		Total
		A	B	
ABC Method	Total Indirect by Product	£1,124,716	£1,790,284	£2,915,000
All Methods	Total Units Produced	172,800 Units	144,000 Units	316,800 Units
ABC Method	Total Indirect by Product per Unit	£6.5	£12.4	£9.2
Conventional Accounting Method	Total Indirect by Product per Unit	£9.2	£9.2	£9.2

* Conventional accounting doesn't drill down into any activities, it allocates the total indirect cost to each product based on the units produced of each product. It assumes that same Indirect cost per unit for all products.

- xi) Add back Ledger Data directly associated to a product client: This step incorporates back the general ledger costs excluded in step ii. This step will generate the final output of the ABC methodology which is the total direct and indirect costs per Product/Client offering in a particular period.

Method	Dimension	Product		Total
		A	B	
Both Methods	Total Units Produced	172,800 Units	144,000 Units	316,800 Units
ABC Method	Total Indirect by Product	£1,124,716	£1,790,284	£2,915,000
	Total Indirect by Product per Unit	£6.5	£12.4	£9.2
Conventional Accounting Method	Total Indirect by Product per Unit	£9.2	£9.2	£9.2
Both Methods	Total Direct by Product	£1,000,000	£1,500,000	£2,500,000
	Total Direct by Product per Unit	£5.8	£10.4	£7.9
ABC Method	Total Cost by Product	£2,124,716	£3,290,284	£5,415,000
	Total Cost by Product per Unit	£12.3	£22.8	£17.1
Conventional Accounting Method	Total Cost by Product per Unit	£15.0	£19.6	£17.1
Total Cost % Difference between Methods		18%	-16%	0%
Both Methods	Selling Price per Unit	£16.5	£21.6	£18.8
ABC Method	Net Profit per Unit	£4.2	-£1.3	£1.7
	Net Profit % per Unit	25%	-6%	9%
	Total Contribution of each Product (Profit per Unit * Units)	£724,284	-£182,784	£541,500
Conventional Accounting Method	Net Profit per Unit	£1.5	£2.0	£1.7
	Net Profit % per Unit	9%	9%	9%
	Total Contribution of each	£259,000	£282,500	£541,500

* Based on the example provided it can be concluded that by using a more sound cost allocation method (ABC), we have discovered that based on the current price of Product B, the organization is losing -£1.3 for each unit it sells of that product. Conventional accounting misallocation of indirect costs would have wrongly concluded that the company was generating a profit of £2 for each unit sold of product B. Moreover, Product B is generating an overall loss of -£182,784 for the period.

Benefits of Activity Based Costing and Risks of not using ABC

The key value that an ABC system provides is accuracy and transparency in understanding the true cost of a product/client and its drivers. This incremental accuracy and transparency can be leveraged across an organization in order to (Maingi) :

- Understanding of market trends and optimization of pricing strategies

By properly calculating the true costs of its different products and services, an organization can adequately assess the true profitability of its offerings. Furthermore, it can better estimate the potential profitability of its competitor's products. An organization with multiple product lines using a conventional cost accounting system will experience a level of distortion on the cost structure of its different products that will fail to understand the pricing strategy of a competitor with a single product offering.

- Product Portfolio Management strategy

ABC helps an organization understand not only their overall costs, but the true differential costs of each product and service configuration. Armed with this deeper knowledge, sound portfolio management decisions can be made, by knowing which set of products and product families are contributors and which are detractors to the profitability of the organization.

- Deep understanding of the cost structure of a product.

Not only ABC delivers an accurate cost basis for each of the offerings of a company, but it also provides an incremental level of detail on the cost structure of each product/client. A particular offering can be broken down on many layers of details on its direct and indirect components.

- Identification and exposure of value added and non-value added activities

By defining activities and costing these activities, an organization will have a business process activity oriented view of its cost structure. This will facilitate the understanding of the amount of resources that each activity consumes and facilitate a cost/benefit analysis on each of them.

- Facilitates benchmarking across organizations with different process configurations

ABC enables a multi-divisional organization to properly benchmark the cost of its products and services across different operations that manufactures the same product, but with a different product mix and process configuration.

- Improves Managerial Accounting decision making models and processes

By properly tracing the direct and indirect costs of an organization's products/services, the accuracy and confidence of any managerial accounting models that uses product profitability and costs as inputs is greatly increased. For example, Cost-Volume-Profit-Analysis, which is a fundamental analysis framework supporting decision making, is greatly improved due to the higher accuracy of its inputs.

Challenges in the implementation of Activity Based Costing

- Time and costs

Depending on the platform selected to implement an ABC system, the efforts required for its initial deployment can range from a couple of weeks to up to a year. As a consequence of this decision, implementation costs can go from a couple of thousands of pounds to figures close to a million

- Data existence, collection, and integration

As an organization goes through the mapping of its different business processes, it will realize that in multiple situations it lacks any form of data collection and analysis process to control these activities. To properly implement an ABC solution, it will need to define and maintain a sound data driven management process across most of the key activities that it performs. This change on process control and monitoring takes time to implement and become effective, and if not properly managed it can face strong resistance inside an organization.

ABC makes heavy use of not only accounting data, but also the operational data that is used to manage and control the different processes of an organization. Operational data is typically disseminated across the whole organization and hosted in wide set of unrelated and multi-format databases. Its collection practices might be quite varied; some of it might be kept in offline records, some might be online but entered manually to a non-integrated application, some might be generated by a non-integrated processing equipment, and other might be produced by an ERP system. The integration of this multiple format databases into a single platform for processing is a major challenge for most organizations. In essence, there exist an Iron Triangle between data heterogeneity, implementation costs, and processing speed.

- Non GAAP and non-IFRS

ABC is part of the accounting practices supporting the decision making process of an organization (Managerial Accounting) as opposed to being part of external reporting practices (Financial

Accounting). As a result of that, it falls outside the scope of any set of accounting principles, standards, and requirements set up by the General Accepted Accounting Principles (GAAP), the International Financial Reporting Standards (IFRS), and any Accounting Government Body. Consequently, regardless of the value that ABC provides to an organization, it is still viewed as a nice to have business practice as opposed to a must have solution. The combination of this optional nature combined with the cost and efforts required to implement an ABC system, greatly explains the low level of adoption and stickiness of this methodology across most organizations even if its benefits are widely understood and accepted.

Existing implementation of ABC solutions

Taxonomy of current set of solutions implementing ABC

The first step in understanding the landscape of existing ABC solutions is figuring out a way to categorize the array of solutions in the market into clusters that share similar characteristics. For the purpose of this project proposal, two key factors have been used for the categorization process. These factors are the level of automation and the scope of the solution. A formal definition for each of them is:

- Level of automation: This factor relates to the extent in which the ABC procedure is executed with minimal user involvement, besides the user-involvement needed in the initial implementation/configuration phase.
- Scope of the solution: This factor categorizes the solutions based on being either a stand-alone application or being part of a larger multi-purpose solution.

Based on the above two criteria; the majority of the solutions in the market are placed into 4 major clusters. A listing of each category, its scope, automation, detailed description, and a sample of existing vendors/products of each segment are presented in the below table.

Category	Scope	Automation	Description	Example of Products/Vendors
Spreadsheet	Narrow	Very Low	This category embraces an ABC solution built exclusively on a Spreadsheet without any add-ons or third-party libraries.	Excel, GoogleSpreadSheets, ZohoSheets.
Enhanced Spreadsheet	Narrow	Medium	This category embraces an ABC solution that is built by leveraging a Spreadsheet Add-Ons or a Spreadsheet compatible Library. The model is still a Spreadsheet model, but the execution of major ABC calculations is done by the Add-On instead of the default Spreadsheet functions.	Mr.Dashboard, Strategy2Act.
ERP Module	Very Wide	High	This category embraces an ABC solution that is a module within a major ERP System.	Oracle PeopleSoft, SAP, SAS, Microsoft Dynamics
Performance Management Module	Wide	High	This category embraces an ABC solution that is a module of a Performance Management System.	3CSSoftware, Ignite's Acorn, proDacapo, Tagetik, Prodacapo ABM, Enlighten, CostPerform.

Socio-technical evaluation of current set of solutions

In order to evaluate the different categories of ABC solution providers, an assessment matrix based on 10 criteria was developed. The first three evaluation criteria are based on social factors, while the last seven are based on technical factors. Each one of the solution categories was ranked from 0 to 10 for each factor. A high score in a criteria reflects a strong delivery of that factor, while a low score highlights a major issue on the delivery of that particular attribute. This evaluation framework was designed specifically for this research, however it was inspired by the work done by (Jackson, Crouch, & Baxter) and (Chen).

The results of the evaluation for each category, along with a description of each criteria are presented in the below table.

Criteria-ID	Type	Criteria	Definition	Scores by Category			
				Spreadsheet	Enhanced Spreadsheet	ERP Module	Performance Management Module
C1	Social	Implementation Time	This criteria relates to how long it takes to implement the solution.	9	8	1	3
C2	Social	Cost	This criteria considers the acquisition and ongoing financial direct costs of the solution.	9	9	1	3
C3	Social	Selection & Procurement Bureaucraticness	This criteria measures the amount of bureaucracy involved in the selection and procuring of this solution.	9	8	1	3
C4	Technical	Changeability	This criteria measures how easy it is to modify the solution in order to reflect a changing business need.	1	9	6	6
C5	Technical	Interoperability	This criteria measures the degree into which the solution can by default interoperate with other financial applications.	9	6	3	3
C6	Technical	Processing Speed	This criteria measures how quickly the solution can run an ABC valuation scenario.	1	3	9	9
C7	Technical	Scalability	This criteria measures how easily the solution can support managing larger amount of inputs.	1	3	9	9
C8	Technical	Testability	This criteria measures how easily the solution can be tested to see if its calculations are correct.	1	3	9	9
C9	Technical	Accessibility	This criteria measure how easily the solution can be accessed by users from different machines and locations.	3	3	8	8
C10	Technical	Supportability & Documentation	This criteria measures the amount of support and documentation that exist regarding the particular solution.	1	3	8	8
Average Score				4.4	5.5	5.5	6.1
% Criteria with Scores below 5				60%	50%	40%	40%
Standard Deviation				3.8	2.6	3.4	2.7

Strengths and weaknesses of each approach

Spreadsheet: The delivery of an ABC system via a Spreadsheet approach, had an overall score of 4.4 out of 10; in 6 out of the 10 factors it received a score below 5. Its low acquisition cost, fast implementation, and bureaucracy free procurement process are the drivers of its high scores in the socio criteria. It scored extremely low in all technical factors, this is due to its limited scalability, low processing power, non-existing testability, and its manual change management process. Overall, it had the lowest score and the highest standard deviation of all the categories under consideration. Regardless of this poor evaluation, it is still the most widely used approach for delivering an Activity Based Costing solution. This is due to its optimization of socio factors.

Enhanced Spreadsheet: This approach achieved an overall score of 5.5 out of 10, in 5 out of the 10 factors it received a score below 5. This solution ranks similar to the Spreadsheet solution on the socio factors, but slightly better on the technical factors. This is expected, since all the input/output data still needs to be stored, set up, and modeled in a spreadsheet, its capabilities are just partially enhanced by the use of an Add-in to perform the ABC costing calculations. Overall, the number of vendors providing this type of solution is very small. This research was only able to identify two of such vendors; Mr.Dashboard and Strategy2Act.

ERP Module: It achieved an overall score of 5.5 out of 10, in 4 out of the 10 factors it received a score below 5. Due to its long implementation time, high cost, and complex procurement process, it ranked very low on the socio factors. From a technical perspective it ranked very high, with the exception of the system interoperability criteria. From an interoperability perspective, integrating a data source that lies outside the ERP system requires significant efforts in configuration and specialized knowledge in the solution architecture. Overall, from a user-base perspective, this is the second most widely used ABC delivery method, after the Spreadsheet solution. This is due to its strong optimization of technical factors and its integration with any other modules (e.g. accounting, project costing) already implemented in the same ERP framework.

Performance Management Module: This approach achieved the highest ranking with a score of 6.1 out of 10; yet, it still ranked below 5 in 4 out of the 10 criteria under evaluation. It exhibits a similar high performance on the technical side as the ERP solution, with a slightly better evaluation on the socio criteria, due to its slightly lower operating cost. Regardless of this slight improvement, it still fails to properly meet any of the socio requirements, its scores on those three criteria were below 5. Vendors in this sector are constantly emerging due to technological advancements (e.g. web-based solutions), and are either acquired & integrated by a major ERP provider; or expand the scope of their products to morph themselves into an ERP solution.

Proposed Solution

Formulation of project aims and objectives

One of the most important conclusions that can be derived from the prior evaluation process, is how none of the solutions families is able to provide an overall satisfactory answer to the different criteria under evaluation. More interestingly, there seems to be a dichotomy between the optimization of technical vs. social needs. Solutions that deliver a strong performance from a technical standpoint, are extremely costly, lengthy to implement, and have a very long and politically intensive procurement process. These socio hurdles coupled with the fact that an ABC system is not viewed as a must have solution, but just as a nice to have tool, helps to explain why after almost 30 years after the conception of the ABC methodology, still the most common approach for addressing it is through a spreadsheet. This is regardless of a spreadsheet's very poor performance as a solution, as described in the prior section of this document.

The aim of this project will be to come up with a solution that will balance the technical and socio needs of an organization aiming to implement an ABC system. In particular, the solution will address the following requisites:

- It will be cost effective and easy to configure.
- It will be scalable and have processing power (speed and capacity).
- It will have a single scope, to perform an ABC analysis. However, it will be designed and built to facilitate its extensibility and interconnectivity with other applications.
- It will be interoperable, by not locking itself into a particular platform in order to import or export data.

It is important to highlight, that as part of this research phase, a nascent and small group of providers was identified who are following a similar strategy as the one being pursued by this research project. The two companies identified are; myABCM and CostPerform. Both of these emergent and rapidly growing organizations started as third-party implementation consultants of ERP systems. However, they became aware of the major issues with the incumbent set of ABC solutions and decided to build a product to satisfy these underserved needs.

Project Solution top level MoSCoW Analysis

In order to facilitate the scope of this project, the MoSCoW prioritization technique has been applied to provide a very high level prioritization of the functionalities that the project solution will have (Coley-Consulting, n.d.).

M - Must Have

- Will provide an interactive interface that will allow the user to set up the different business process activities and define the operational driver for each activity.

- Will provide the functionality for the user to be able to import and store operational data for each activity based on the most commonly used import/export format for financial applications (csv).
- Will provide the functionality for the user to be able to import and store general ledger data at the department, cost center, expense category, and period level based on the most commonly used import/export format for financial applications (csv).
- Will provide an interactive interface that will allow the user to map each department, cost center, and expense category within that cost center to a particular activity.
- Will calculate and store the cost of each business process activity.
- Will calculate and store the cost that each product/client incurred in a particular activity based on the driver driven usage of the activity and its costs.
- Will aggregate the cost that each product/client incurred in all the business process activities in the organization.
- Will generate a csv report with the unit cost (direct/indirect) of all products/clients of the organization for a particular period.
- All the user interfaces should be simple, friendly, and easy to follow.
- Once the initial configuration is done, it should be re-usable for other time periods. The user will only need to reference a different set of input files.
- It should be able to handle large amounts of data (exact size limits to be specified later).
- It needs to provide an interface where the accuracy of its functionality can be proven and tested.

S- Should Have

- Will generate a csv report with the cost of each activity, the cost incurred by each product/client within that activity, and the usage of that activity by each product/client.
- Will generate a csv report with a detailed breakdown of the direct/indirect cost of the product/client by activity.

C- Could Have

- Will be able to import/export data in more specialized input/output formats.
- Will be able to store multiple periods of accounting and operational data and generate a report comparing the cost for different periods for each activity, product/client, and detailed information of the composition of that cost by business process and their utilization.

W- Want to Have but Won't Have

- A Graphical User Interface.
- A seamless integration with ERP/Excel applications.

The Must and Should Have requirements will constitute the deliverables for this project thesis. The Could Have requirements will be considered a second priority, due to the short-time available for this project; they are not expected to be attempted, unless the project experiences an extraordinary positive

outcome on the execution of the first two set of requirements. The Won't Have requirements, are completely beyond the scope of this project thesis, but the application will be built in a way to facilitate the eventual implementation of those requirements.

Development methodology and software platform to use

A mix of a Rapid Application Phased (RAD) and Agile Development methodology will be used for the analysis, design, implementation, and testing of the system targeted by this project. The solution being developed will be Object-Oriented centric, and the appropriate set of Unified Modeling Language (UML) techniques will be deployed through the different phases of the project to facilitate analysis and design decisions.

Each major category of the MoSCoW analysis will constitute a system release. The phase-based nature of the development methodology selected will ensure a balanced risk taking approach to the different prioritized functionalities being identified in this project. As mentioned earlier in this document, only Must Have and Should Have set of requirements will be attempted as part of this research. Each of them will constitute release phases 1 and 2 of this endeavor.

The Object Oriented nature of the development will ensure a careful design and architecture of each system release, as well as guarantee an easy integration of functionality delivered in the later releases.

Each system release will go through its own analysis, design, implementation, and testing phases. An overall analysis phase will be done before the start of the first release effort, this is to ensure that there is an overarching strategy on the integration of each of the subsequent releases.

Java SE8 has been selected as the programming language to be used for the development of this application. The main reasons behind its selection are:

- Its object oriented nature.
- Its powerful and wide range of cross-platform libraries and third-party APIs, which can facilitate the integration and extension of this solution with other systems in the future.
- The programmer level of expertise and familiarity with this programming language.
- The amount of literature and online resources available that can become useful in order to overcome technical hurdles.

The Eclipse 4.5.2 (Mars.2) will be used as an integrated development environment (IDE) to facilitate the resource management, build, compilation, and debugging efforts.

The GitHub web-based repository will be leveraged in order to facilitate version control and provide back-up storage services during the course of this project.

Development timeline

There will be two releases related to this project. Release 1 will provide all the functionality described in the “M - Must Have” section of the MoSCoW Analysis. Release 2 will provide all the functionality described in the “S – Should Have” section of that analysis, plus any functionality from release 1 that wasn’t able to meet the deadline set up for the first release date.

Project Timeline - Must Have + Should Have requirements

Task #	Phase	Task	Start	End	Duration
R1-T1	Requirement	Release 1 - Requirements Determination	8-Jun	10-Jun	2 day
R1-T2	Analysis & Design	Release 1 - Identification of Objects and their attributes	11-Jun	14-Jun	3 day
R1-T3		Release 1 - Identification of Operations performed or suffered by each Object	15-Jun	18-Jun	3 day
R1-T4		Release 1 - Defined the Visibility of each Object in relation to other Objects	19-Jun	20-Jun	1 day
R1-T5		Release 1 - Establish the Interface of each Object	21-Jun	26-Jun	5 day
R1-T6	Implementation &	Release 1 - Provide a Sequential Implementation of each Interface and Test Methods	27-Jun	18-Jul	21 day
R1-T7	Testing	Release 1 - Perform a system wide Testing & Optimization of the solution	19-Jul	28-Jul	9 day
R2-T1	Requirement	Release 2 - Requirement Determination	29-Jul	31-Jul	2 day
R2-T2	Analysis & Design	Release 2 - Identification of Objects and their attributes	1-Aug	4-Aug	3 day
R2-T3		Release 2 - Identification of Operations performed or suffered by each Object	5-Aug	8-Aug	3 day
R2-T4		Release 2 - Defined the Visibility of each Object in relation to other Objects	9-Aug	10-Aug	1 day
R2-T5		Release 2 - Establish the Interface of each Object	11-Aug	16-Aug	5 day
R2-T6	Implementation &	Release 2 - Provide a Sequential Implementation of each Interface and Test Methods	17-Aug	28-Aug	11 day
R2-T7	Testing	Release 2 - Perform a system-wide Testing & Optimization of the solution	29-Aug	3-Sep	5 day
R2-T8	Documentation	Release 1 & 2 - Write a detailed documentation of all Interfaces and methods	4-Sep	9-Sep	5 day
R2-T9		Release 1 & 2 - Write a detailed documentation of project	10-Sep	15-Sep	5 day

Bibliography

- Bahnub, B. (2010). *Activity-Based Management for Financial Institutions*. Wiley.
- CARDOȘ, I. R., & PETE, Ș. (2011). Activity-based Costing (ABC) and Activity-based-Management - Implementation – Is This the Solution for. *Romanian Journal of Economics*.
- Chen, S. (2012). *Sociotechnical Systems*. Syracuse, New York.
- Coley-Consulting. (n.d.). <http://www.coleyconsulting.co.uk/moscow.htm>. Retrieved from <http://www.coleyconsulting.co.uk/>: <http://www.coleyconsulting.co.uk/moscow.htm>
- D.V. Ramana. (n.d.). *Activity Based Costing - What? Why? How?* Retrieved from <http://www.ximr.ac.in/index.html>: <http://www.ximr.ac.in/index.html>
- Hayes, R. (n.d.). <http://www.calstatela.edu/faculty/rick-hayes>. Retrieved from <https://www.scribd.com/doc/288025284/Activity-Based-Costing-ppt>
- Jackson, M., Crouch, S., & Baxter, R. (November 2001). *Software Evaluation: Criteria-based Assessment*.
- Kaplan, R. S., & Cooper, R. (n.d.). Activity-Based Systems: Measuring the Costs of Resource Usage. *Accounting Horizons* - September 1992.
- Maingi, J. (2011). *Advantages & Disadvantages of activity based costing with reference to economic value addition*. Munich: GRIN Verlag.
- Sawyer, S., & Jarrahi, M. H. (n.d.). The Sociotechnical Perspective. In S. Sawyer, & M. H. Jarrahi, *Forthcoming*.
- Sohal, A., & Chung, W. (1998). Activity based costing in manufacturing: two case studies on implementation. *Integrated Manufacturing Systems*, 137-147.
- Tariq, A. (2012, January). Activity-Based Costing System. Dubai, United Arab Emirates.