

**Proposal for Investigating and Prototyping an
ERP System for University Information Functions**

Shahriar Mullick Swapnil
Student ID: 06141002

School of Engineering and Computer Science
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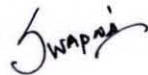


BRAC University, Dhaka, Bangladesh

DECLARATION

I hereby declare that this thesis is based on the results found by myself. Materials of work found by other researcher are mentioned by reference. This thesis, neither in whole nor in part, has been previously submitted for any degree.

Signature of
Supervisor

Signature of 
Author

ABSTRACT

Initial research has shown that a majority of BRAC University's information functions are compartmentalised and detached from one another. This information arrangement stifles visibility of information that aids the strategic decision making process. This project aims to analyse in detail BRAC university's current information management and dissemination methods and understanding whether modern Enterprise Resource Planning software can provide integration of such compartmentalised information into a 'single source of truth', as well as implement the ability for systems of different functions to interface with each other. Once an ERP system is in place, all aspects of BRAC University can work in harmony instead of every single system needing to be compatible with each other.

The analysis will involve investigating use of information that is common in nature by various faculties of the University. It will also take into account various information components from different areas that can be collaborated to produce better decision making mechanisms at a corporate or organisational level. This study will then take into account software currently in the market that can achieve seamless information integration and robust interfacing to ensure that greater visibility of University's operations.

Finally a human resource management system will be built that will demonstrate capabilities and advantages of modern ERP software. This will also involve understanding the level of customisability of selected ERP software. This research will produce a thesis for a plan to implement a full scale ERP system at BRAC University to manage its increasing information volumes. In addition Inventory Control System will be designed for the University.

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1.1 ENTERPRISE RESOURCE PLANNING: AN INTRODUCTION

Enterprise resource planning (ERP) is an enterprise-wide information system designed to coordinate all the resources, information, and activities needed to complete business processes such as order fulfillment or billing. An ERP system supports most of the business system that maintains in a single database the data needed for a variety of business functions such as Manufacturing, Supply Chain Management, Financials, Projects, Human Resources and Customer Relationship Management. An ERP system is based on a common database and a modular software design. The common database can allow every department of a business to store and retrieve information in real-time. The information should be reliable, accessible, and easily shared. The modular software design should mean a business can select the modules they need, mix and match modules from different vendors, and add new modules of their own to improve business performance. Ideally, the data for the various business functions are integrated. In practice the ERP system may comprise a set of discrete applications, each maintaining a discrete data store within one physical database.

Today's ERP systems can cover a wide range of functions and integrate them into one unified database. For instance, functions such as Human Resources, Supply Chain Management, Customer Relations Management, Financials, Manufacturing functions and Warehouse Management functions were all once stand alone software applications, usually housed with their own database and network, today, they can all fit under one umbrella – the ERP system. Enterprise resource planning is available in two states. One of them is referred to as commercial while the other is called open source ERP. Commercial ERP software is generally owned and managed by a central organization for profit purposes. The present market leaders of Commercial ERP systems are SAP, Oracle Applications, The Sage Group, Microsoft Dynamics and SSA Global Technologies. The term open source refers to software programs which are usually developed as a public collaboration, made freely available and delivered with the underlying source code so that the recipient may use, modify and redistribute the solution as he or she sees fit. Open source advocates argue that collaborative development by global communities with shared interests is a superior method to make software. Top 6 Open Source Enterprise Resource Planning (ERP) Software Systems are as follows:

- ❖ OpenBravo ERP
- ❖ Apache OFBix/opentaps
- ❖ ERP5
- ❖ ADempiere ERP business suite
- ❖ PostBooks ERP by xTuple
- ❖ Open ERP

1.2 COMMERCIAL VS. OPEN SOURCE ERP: A COMPARISON

Commercial and open source ERP has lots of differences. Study has been made on following factors while comparing commercial and open source ERP software.

- Pricing
- Flexibility
- Duration
- Dependence
- Training
- Security
- Ease of integration with current systems
- Longevity

Pricing

Most open source software is freely distributed with no up-front licensing fees. Further savings come from ease of deployment, training and integration. Companies that implement open source ERP solutions often report a 50% savings over proprietary systems. Commercial ERP is an expensive package and suitable only for bigger corporations. The prices vary significantly but according to the size of the company and volume of business. In many cases they have been found to be extremely costly irrespective of the quantum in which they are purchased. Another major allegation against the package is that they consist of lot of hidden costs.

Flexibility

Commercial systems are not flexible in nature. They let business with no other choice but to change their way of business. However when it comes to open source ERP everything is decided by the code. Therefore companies can do the necessary modifications in code and without much support from the vendor. Another advantage of open source is that it does not interfere with the regular schedule of the company during the implementation stage. This is a major difference between commercial and open source ERP applications.

Duration

The time allotted for implementing open source ERP is very less when compared with commercial ERP. The innumerable number of complexions in commercial ERP calls for longer time span. It consumes a lot of time not only during implementation but in every stage of ERP process due to the nature of work involved.

Dependence

When it comes to the question of relying on the vendor the open source ERP owners enjoys a considerable edge than the commercial ERP. Since open source is license free users have full freedom for taking care of needs by themselves. The productivity is also high in open source ERP systems and the failure rates are very low.

Training

Lots of training is required for using commercial ERP. It calls for lots of investments in terms of time and money. Validity of training sessions designed and handled exclusively by the ERP vendor is also debatable. On the other hand Open Source ERP does not require much training. The results are also bound to be effective because the user gets to learn through the process of self training. The company need not spend much on training and makes a minimal utilization of the resources.

Security

Commercial ERP systems are less secure compared to Open Source ERP Systems. They are by and large prone to the traps and pitfalls of hackers. Even though open source ERP makes everything transparent and available in the public domain it bring into the notice of user whenever something goes wrong.

Ease of integration with current systems

ERP solutions touch every aspect of a company, from warehousing to accounting. As such, a company's ERP solution should easily integrate with existing IT infrastructure components, such as application servers, directory services and storage arrays. Open source solutions are compatible via standards-based interfaces with multiple technologies, including support for lowest-cost commodity operating systems, databases, utilities and hardware.

Longevity

Virtually any ERP solution will work well when initially deployed, but time is the true test of every ERP solution and vendor. Unforeseen opportunities will likely drive changes to a business' objectives and necessitate changes to its ERP solution. An open source solution with a flexible foundation addresses today's needs and safeguards the solution's future. Because the user has the source code, a solution can never be bought or merged out of existence, meaning the investment lasts as long as needed. Independent services for ERP implementation support is also available for free with open source ERP.

2.1 OPENBRAVO

2.1.1 Overview

OpenBravo, currently the market leader in Open Source ERP solutions, is a web-based, open source ERP business solution. It is built using open standards, around a unique combination of well-proven MVC and MDD development frameworks, executed by its WAD engine and released under GNU license. OpenBravo implements standard technologies which include:

- Java and Javascript
- SQL and PL/SQL
- XML
- XHTML

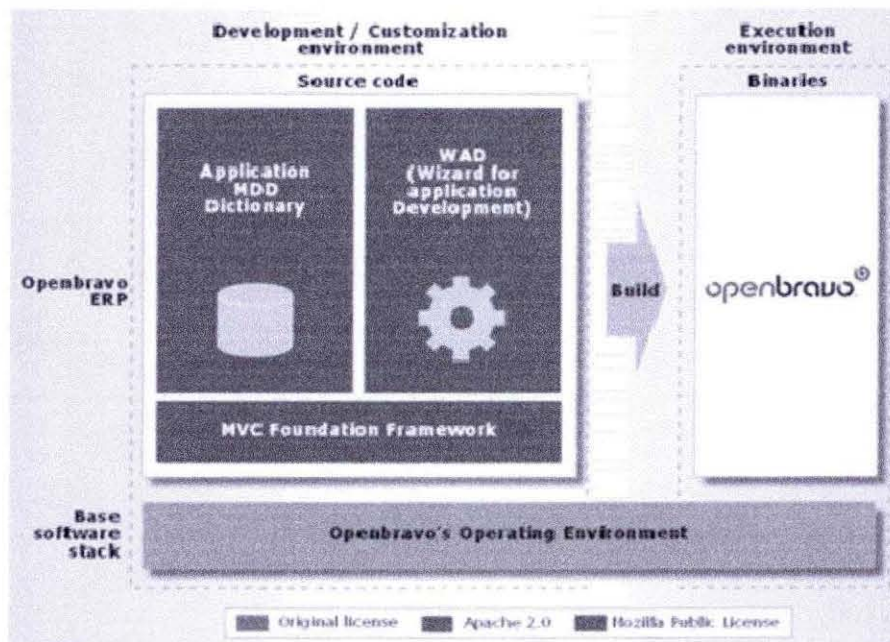


Figure 2.1: Key Architecture Components of OpenBravo System

MVC is a proven web applications development framework, which helps to decouple the database, user interface elements, and business logic. The separation of these elements into different files results in a more structured code, facilitating development and maintenance.

MDD is a software design approach that relies on metadata stored in a dictionary to model the behavior of the application. This results in a drastic reduction in manual coding and fewer bugs, allowing business experts with little coding experience to configure the application to suit the needs of each enterprise.

2.1.2 Functionality

OpenBravo ERP has been designed with broad business functionality to help businesses improve overall performance. It is based on a single, integrated database model covering all key application areas of a complete business management system, including seamless integration to Business Intelligence (BI) and Point of Sale (POS). It is implemented on top of the robust OpenBravo ERP Platform, which provides an equally strong set of cross-application functionality.

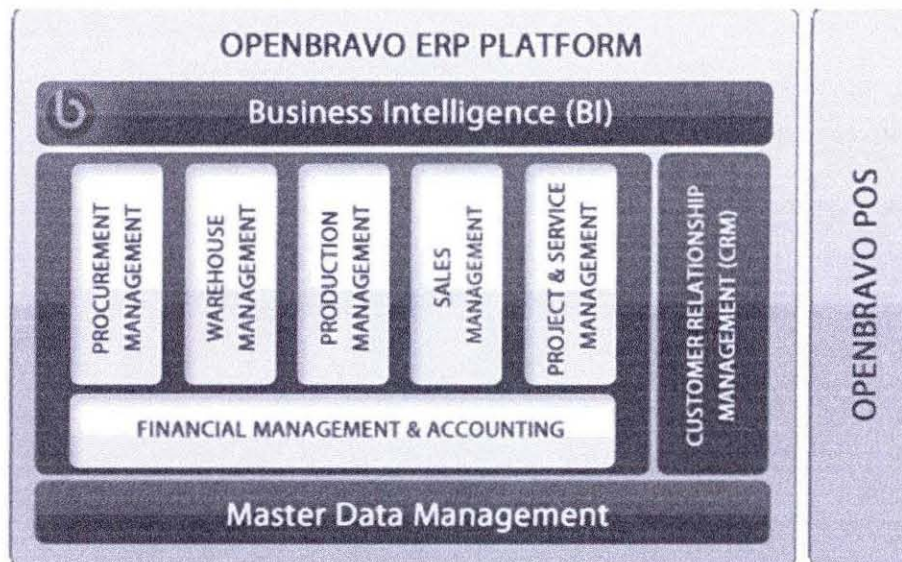


Figure 2.2: OpenBravo ERP Platform and BI Integration

2.1.3 Key Features

OpenBravo features a web-based interface, where the user can view the entire status of a company, including production information, inventory, customer information, order tracking, and workflow information. It is possible to synchronize this information with other applications through the Java-based OpenBravo API. The other key-features include:

Alerts

Notifications can be programmed to alert the user whenever a certain condition is met. These Alerts are then made clearly visible to user as soon as they log in to the application.

Linked items

Users are always empowered with a 360 degree view of all the data in the application. From any record in the application, users can access any other record in the application that is linked to it, as long as their permissions allow for it.

Dimensional Reporting

End users can easily create customized report formats based on multiple fields and categories in order to extract critical integrated company data.

Compatibility and Sharing

Lets users export a single file or a collection of files to Excel, CSV, or PDF directly from the application.

Email

Users can be assigned unique e-mail addresses which they can easily access through the ERP system to share information.

Keyboard navigation

On top of being a web-based application, OpenBravo has been designed so that it can be fully operated from the keyboard, without using the mouse.

Modular

Third-party modules or plugins can be implemented to work in harmony with the existing system. Shared third-party functionality includes additional reports, connectors, product integrations, and content packs such as tax codes and product specifications. This approach provides access to a greater number of functionalities, whilst greatly reducing implementation costs of the ERP.

Easily configurable

OpenBravo implements the model driven-development architecture, which means users can tailor existing functionality and business rules, as well as add new functionality without any programming.

Roles

Users with different profiles can access OpenBravo with roles that are tailored to their work habits and that secure the amount of information they see and change. With a role, managers can control which screens are accessible from the menu, which an organization's users can see and they can access it either in edit or read-only mode. Language and other system defaults can also be configured for each individual user.

Scalability

OpenBravo can be deployed in a single server or on a cluster of them, serving up to thousands of users. Servers can be located on-premises, on the data center, or in the cloud.

Multi

OpenBravo ERP is prepared to be deployed in multi-national and multi-client environments. It can work in multi-language, multi-currency, multi-accounting schema, multi-organization, etc.

Auditing

As a business software solution, any record in the system can be audited and traced to the user who created it, or the latest user to edit it.

2.2 OPENTAPS

2.2.1 Overview

Opentaps is a web based ERP solution that combines the power of ERP and CRM for medium and small size businesses. It enables businesses to come up with high quality and innovative solutions for business problems using open source software. Opentaps is sponsored by Open Source Strategies, Inc. and developed by full-time professional developers with the help of a global community of contributors.

Opentaps is built on Java J2EE with a Service Oriented Architecture and Model-View-Controller framework and compatible with all major databases that are in practice including MySQL, PostgreSQL, Oracle, and SQL Server. It provides support for XML RPC, SOAP, and SyncML integration protocols and incorporates the Apache Tomcat and Geronimo servers. Opentaps also provide support for Java5.

2.2.2 Functionality

Opentaps with its integrated ERP and CRM solution provides a complete solution to modern day businesses. Its functions include eCommerce, Point-of-Sales, inventory, warehouse, order, customer management and general ledger. It also offers built-in business intelligence tools and mobility integration including with Microsoft Outlook, Google Calendar, and mobile phones.

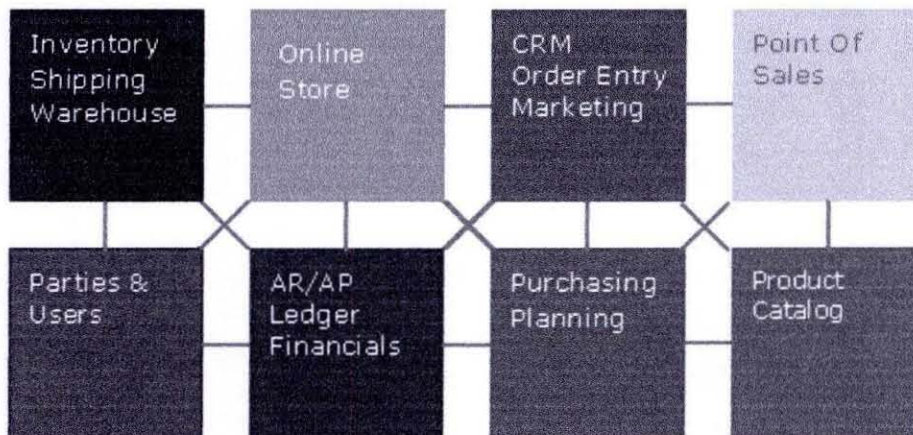


Figure 2.3: Opentaps Business Functionalities

2.2.3 Key- Features

Opentaps offers sophisticated features and modern architecture includes a full ERP and CRM solution plus mobile connectivity and built-in business intelligence tools. The following are the key strengths of Opentaps Open Source ERP and CRM:

- A complete suite that deliver a 360-degree view of the business, from customers to orders to inventory to accounting
- Opentaps is one application running on one unified data model with over 700 tables
- Compatible with all major open source and commercial relational databases, including MySQL, PostgreSQL, Oracle, Sybase, and Microsoft SQL Server
- Runs on Linux, Unix, and Windows
- Service-Oriented Architecture for easy interoperability with external or legacy applications.
- Modular and tiered architecture allows for easy modifications or additions.
- Synchronization of users' contacts and calendars with their mobile phones or Outlook Express
- Integrates with the Asterisk open source Voice Over IP (VOIP) PBX system
- Built-in business intelligence and reporting tools with JasperReports and Pentaho
- Integrate with PHP and Ruby On Rails applications, including the Joomla content management system or your custom web storefronts, or use the fully-integrated ecommerce store in Opentaps
- Workflow for adapting to unique business processes
- Dashboard to quickly access important functions
- Flexible Open Architecture
- Robust Data Model
- Scalability
- Active Development Community
- Automate sales process from lead gathering to conversion
- Manage sales opportunities
- Create sales visibility with forecasts
- Browser-based email with integration to email server
- Customer services and case management
- Quotes, order entry, and order prioritization
- Manage marketing campaigns, including outbound emails and call management
- Tracking code reporting and management

2.3 ERP5

2.3.1 Overview

ERP5 is an open source enterprise resource planning package that provides a range of organisational functions from accounting to data warehousing capabilities. It is recommended for medium sized organisations; however because of ERP5's open source customisability, the solution can be extended and customised to serve the needs of larger organisations. ERP5 is also supported by the Nexedi Corporation for training and consulting purposes.

ERP5 is mostly developed using the Python Language and hosted in a Linux environment. However the package is cross-platform compatible and so it can also be customised to be hosted in a Windows environment. The system is based on the Zope application server architecture, thus providing a web-based development and configuration environment. Because of this foundation, ERP5 can leverage the advantages of object oriented development. ERP5 is normally rolled out with a MySQL database but ERP5's platform independence allows the use of any database management system that supports ODBC. The system has also been developed to support a clustered server architecture which helps scalability and high performance of information processing. This feature allows the system to be rolled out in an organisation which is process and workflow intensive.

2.3.2 Functionality

With the wide range of functions available, ERP5 is able to provide a sound end-to-end solution that is both robust and transparent. ERP5 provides the business logic in so called Business Templates. Currently the following functionality is provided:

- ❖ **Accounting:** provides multiple accounting features such as multi-key analytical accounting, multidimensional budget accounting, activity based accounting, project accounting, provisional accounting as well as asset- and cash management, generic reports and invoicing.
- ❖ **Immobilisation:** extends the Accounting Business Template by providing support for immobilisations.
- ❖ **Payroll:** extends the Accounting Business Template to provide administration and generation of payroll sheets for employees.

- ❖ **Budget:** extends the Accounting Business Template by providing the creation, planning and administration of budgets.
- ❖ **Product Data Management:** provides a transparent overview of products and the corresponding BOMs.
- ❖ **Trade:** provides all necessary elements to support procurement and sales. This Business Template provides supplier lists, packing lists, orders, order management and tracking, shipping and transport, freight and inventory management.
- ❖ **Material Requirement Planning:** provides all elements required for the management of a production facility. This Business Template provides bills of materials, product orders, production reports, material requirement planning and complex supply chains.
- ❖ **Customer Relationship Management (CRM):** provides CRM related features. It includes features to follow customer development, management of the relations between customers and other organisations, customer related incoming and outgoing events such as phone calls and email, sales opportunities, campaign management and meetings as well as a ticket tracking system for support requests and complaints.
- ❖ **Project:** provides support for project planning as well as project based accounting and cost analysis.
- ❖ **DMS:** provides a workflow based Document Management System. It is focused on supporting open data formats but also provides support for the major proprietary formats such as ".doc" or ".xls".

2.3.3 Key- Features

The ERP5 system is designed to set up workflows and so it can be used to flexibly model business processes to ensure that isolated functions can be interfaced. Access to and customisation of corporate information management is done through a web interface, thus providing ease of use, low training costs and a flexible development environment. The web-based control console also aides in monitoring performance of the system.

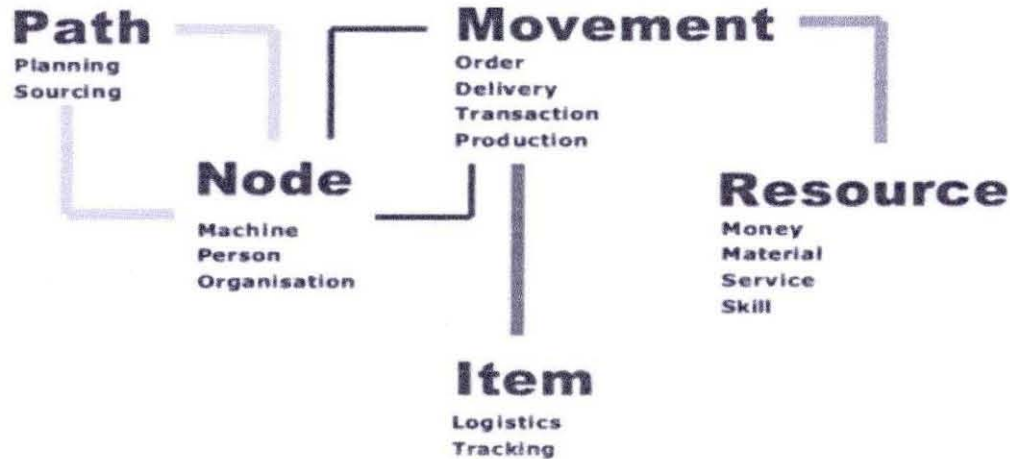


Figure 2.4: ERP5 Model

The ERP5 Unified Business Model is used for accounting, warehouse management, production and human resource management in ERP5. All features developed for one module are available in the other modules due to the unified vocabulary which is independent of specific business processes. ERP5's unified approach dramatically reduces the learning curve and reduces the risk of data inconsistencies over multiple modules. This model is based on five classes:

- **Resource** : a resource describes an abstract resource in a business process like a raw material, a product, a currency or an individual's skill.
- **Node** : a node can receive and send resources. It can relate to physical entities such as a workshop or to abstract entities such as a bank account.
- **Movement** : a movement describes a movement of resources between two nodes at a given time and for a given duration. For example, a movement might send raw material from a warehouse to a workshop or money from one account to another.
- **Item** : an item is a physical instance of a resource. A movement can be expanded into a series of traceable movements through items. Items are typically used to handle serial numbers.
- **Path** : a path defines a way for a node to access a resource it might need. Prices and commercial profiles can be attached to a path to define the default price for a given resource procured by a given maker.

ERP5 is a simulation based ERP. All future consequences of every business decision are calculated in real time according to configurable business rules and made available to reporting. MRP is an example of a simple application of ERP5's simulation based approach. ERP5 simulation rules can be extended to cover new functional areas.

2.4 ADEMPIERE ERP BUSINESS SUITE

2.4.1 Overview

ADempiere is open source ERP software released under the GNU license. It is a fork of popular ERP software Compiere. ADempiere started its journey from September 2006 and quickly became a popular choice for business solution. Like its name implies the software works "to fulfill" business productivity by bridging the different functionalities together.

The goal of the ADempiere project is the creation of a community-developed and supported open source business solution. The ADempiere community follows the open-source model of the Bazaar. ADempiere is developed with J2EE technology, specifically utilizing the JBoss application server. Currently the database support is restricted to Oracle and PostgreSQL.

2.4.2 Functionality

ADempiere is an integrated ERP and CRM solution built on a powerful Model-driven Application Platform, which gives the capability to customize the software to meet business requirements. The following business areas are addressed by the ADempiere business processes:

- Enterprise Resource Planning (ERP)
- Supply Chain Management (SCM)
- Customer Relationship Management (CRM)
- Financial Performance Analysis
- Integrated Point of sale (POS) solution
- Integrated Web Store

2.4.3 Key- Features

ADempiere's scalable architecture makes it viable for deployments of just a few localized users or thousands distributed across the world. ADempiere functionality is designed around business processes rather than inflexible modules. It is truly stable, high performance, flexible and easy to use. The user Interface is easy to use, intuitive, attractive

and well organized. There are two modes of or user interfaces (UI) that can be use to login into ADempiere.

- Web-based UI Client
- Java-based UI Client

ADempiere inherited the Data Dictionary from the Compiere project. This architecture extends the Data Dictionary concept into the application; thus the application's entities, their validation rules and screen layout can be controlled from within the application itself. In practice, this means that customization of the application can be done without new coding. A Workflow Management Coalition and Object Management Group standards based workflow engine is utilized to provide Business Process Management. These features allow for the rapid customization of the application to a business needs.

ADempiere stores all information and transactions entered into the system for as long as the user organisation chooses. Information is also captured for all changes to static information recording the date and time of the change as well as the ID of the user who created and updated the record.

ADempiere provides comprehensive reporting capabilities. ADempiere's reporting is based on the data dictionary. Business Views are designed for end users and allow information to be accessed using standard SQL based tools without the need to create SQL table joins. As the report viewer has access to the definitions, this allows drill-down to any entity referenced and drill-across to entities where the reported entity is used. The links are automatically generated, while ensuring adherence to security and access definitions. The report viewer provides for the selection of data, sequencing, grouping, totaling and display formatting. Reporting output can be viewed on screen before sending it to a printer, an email or fax address or generating files in many different formats (e.g. Excel text formats, HTML, XML, PDF and Postscript).

2.5 POSTBBOOKS ERP BY XTUPLE

2.5.1 Overview

xTuple is an Enterprise Software company, author of three products branded under the name xTuple ERP. It is dedicated to using the power of open source ERP software to help businesses of all sizes grow and prosper. There are three editions of the software, PostBooks, Standard Edition and Manufacturing Edition. All three editions use the same client software; only the database is different. All application business logic resides in the database, and all three editions are based on the same core code. All three products run equally well on Windows, Linux, and Mac - and are fully internationalized (multi-currency, support for multiple tax structures, and multilingual translation packs maintained by our global community). All three contain a full copy of OpenRPT, the open source report writer also created and maintained by xTuple.

xTuple ERP is a powerful, fully-integrated Enterprise Resource Planning application, designed to scale to meet the needs of the most demanding companies. The design of the system intentionally places the burden of transaction processing on the server - specifically the database server. All the business logic resides in the procedural language of the open source database PostgreSQL, allowing for a variety of client interfaces and scalability unbound by client-side limitations.

The primary interface today is a full, rich graphical user interface (GUI) client written with the open source framework Qt - this allows for a client that looks and feels exactly the same on Windows, Linux/Unix, and Mac. There are also wireless devices which leverage the server-side logic for inventory and related transactions, as well as a range of options for web/portal front-ends and interaction with other applications through xTuple's service-oriented architecture (SOA).

The PostBooks Edition of xTuple ERP is a Free and Open Source Software (FOSS) application, available under the open source Common Public Attribution License (CPAL). The Standard and OpenMFG Editions are commercially licensed Enterprise resource planning solutions. Both products are built on the same Open source technology foundation, and share the same code base. The Standard and OpenMFG Editions have more functionality for larger companies and those companies needing more manufacturing capabilities. For the case of this thesis we will consider the PostBooks edition of xTuple ERP.

2.5.2 Functionality

PostBooks is a full-featured, fully-integrated accounting, ERP, and CRM system, based on the award winning xTuple ERP Suite. Built with the open source PostgreSQL database and the open source Qt framework for C++, it provides the ultimate in power and flexibility for a range of businesses and industries. It includes the following modules:

- Accounting (general ledger, accounts receivable and payable, bank reconciliation, financial reporting)
- Sales (quotes, order entry, sales reporting, shipping)
- CRM (universal address book, incident management, opportunity management, to-do lists, project management)
- Purchasing (purchase orders, receiving, vendor reporting)
- Product Definition (items, infinite-level bills of material)
- Inventory and Distribution (multiple locations, other advanced warehouse features)
- Light Manufacturing (work orders, strong support for make-to-order)
- OpenRPT open source report writer

2.5.3 Key- Features

xTuple ERP products contain sophisticated product definition, inventory control, purchasing, manufacturing, distribution, CRM, sales, and a fully integrated general ledger. All are fully multi-currency, and feature fully integrated custom reporting (both ad hoc operational reports and financial reporting). The key features which stand out from other ERP solutions include:

Technical Requirements

The technical requirements to run xTuple are very simple—the graphical client software runs on Windows, Mac OS X, or Linux computers with entry-level memory and disk space. There is also a wireless client which runs on a handheld barcode scanner. The server software, powered by the open source PostgreSQL database, can also run on Windows, Mac, or Linux. It can run locally, or hosted in a data center.

Security

There are several layers of security available with xTuple ERP. The software can utilize a Secure Sockets Layer (SSL) connection, and can also enable an enhanced authentication mechanism that scrambles users' passwords. Individual privileges within the system can also be assigned in much detail as seen fit for the business.

Sales Order Kitting Function

Enables users to sell kit items on a sales order that automatically explodes to include shippable line item components. The kit components are printed on the sales order pick list, issued to stock and shipped, all accomplished without an intermediary work order.

Multi-Company Financial Consolidation

Allows users with a multi-company chart of accounts implemented on separate databases to report on a single, consolidated financial statement. The xTuple Financial Reporting Engine synchronizes trial balances across these databases, while child databases maintain company-specific trial balance data and the parent database receives copies of the data from each child.

Average Costing

Targeted towards distributors and light manufacturers requiring a streamlined, low-maintenance solution which does not require periodic cost recalculations as does the standard costing system.

Sales Order Reservations by Location

Sales Reservations functionality is expanded to be able to reserve quantities at the location level and print these location allocations on a pick list, reducing the possibility of conflict where items are stored in multiple locations in a warehouse but there is more demand than supply in any one location at a given time.

2.6 OPEN SOURCE MANAGEMENT SOLUTION OPEN ERP

2.6.1 Overview

Open ERP is one of the leading ERP/CRM system in use today. The software is claimed to be a complete ERP and CRM system. It has separate client and server components. The software is open source and is released under the GNU General Public License. Open ERP is known to be very complete and extremely modular, with 350 available modules. It is based on a strong MVC architecture, with a distributed server, flexible workflows, an object database, a dynamic GUI, an XML-RPC interface, and customizable reports. Among the features are management accounting, financial accounting, inventory management, sales and purchase management, tasks automation, Human Resource Management, marketing campaigns, help desk, and point of sale.

Open ERP has a 3 layer structure. The database is PostgreSQL. The server part is written in Python. Business functionality is organised into "modules. A module defines data structure, forms, reports, menus, procedures, workflows etc. Web client is written in Python. It uses turboGears platform up to version 5.0.1. Open ERP offers to customers a set of editions that bundle Open ERP with commercial maintenance and services. Open ERP editions are not differentiated on functionalities. All editions are based on exactly the same code, software and documentation. The differences between the 3 editions are only related to the service level agreement.

2.6.2 Functionality

Open ERP has been specifically designed to help businesses improve their performances. Its functional coverage expands to all kinds of different areas. Perhaps it is the only ERP solution that covers almost all functional areas of a business. The list below gives a summarized idea of the various functionalities that Open ERP provides.

Enterprise Modules	Logistics	Accounting & Finance
<ul style="list-style-type: none"> • Sales • Purchase • Services Management • Invoicing 	<ul style="list-style-type: none"> • Warehouse Management • Shipping Management • Manufacturing • Quality & Repairs 	<ul style="list-style-type: none"> • Accounting • Analytic Accounting • Budgets • Payments

<ul style="list-style-type: none"> • Point of Sales 	<ul style="list-style-type: none"> • Products and pricelists 	Management <ul style="list-style-type: none"> • Asset Management • Bank interfaces
Human Resources <ul style="list-style-type: none"> • Expenses • Skills Management • Holidays • Attendances 	CRM & SRM <ul style="list-style-type: none"> • Customer Relationship Mgt. • Mail Gateway • Portals • Direct Marketing • Phone Calls 	Project Management <ul style="list-style-type: none"> • Operational Management • Financial Management • Timesheets

2.6.3 Key- Features

The first thing to appreciate is that Open ERP is modular. It has many modules to choose from and of course you are free to write your own. It follows that one can assemble what is effectively a tailored package to meet the company's processes. The modular approach allows for enormous flexibility and provides a powerful way to model your company's processes.

Open ERP comes with a Dashboard whose appearance and functionality is tailored to the needs of each user. Rule-based templates for setting pricing policies across the board including customer specific discounts, percentage markups and so on add more flexibility. Propagation of accounts data into all areas of the ERP are done automatically. The double-entry stock management system minimizes errors. It also introduces a fully integrated email/sms and company wiki. The complete logic of all documents is managed through the powerful workflow engine of Open ERP. This system allows being very flexible and adapts the way the application is running to fit your own specific need.

The event module allows you efficiently organize events and all related tasks: planning, registration tracking, invoicing, attendances, getting the payments, etc. It is completely integrated with the CRM and accounting modules. You can also use the mail gateway to get information requests or registrations directly by email. Report designer plug-in connects Open Office with Open ERP to ensure that useful information is coordinated and shared across the company. With a few simple clicks, users can open Open ERP reports and

lists with Open Office and modify them from their favorite document application. It can be included into various Open ERP modules, including: Accounts, Opportunities, Leads, Cases, Contacts and more.

Open ERP makes extensive use of business intelligence to better plan the workflow of the company. The OLAP module of Open ERP supports a full featured hybrid OLAP database that can connect on any kind of relational databases to perform multi-dimensional analysis. Open Object supports MDX queries performed through one of the web-services provided by Open Object. The Business Intelligence cube browser allows end-users to easily navigate through the information and statistics of the company and design their customized reports in a few drag & drop. The employees can consolidate, drill up, drill down, slice, filter data to benefit from a very user-friendly report interface. The power of Business Intelligence becomes available to all users of the system to extract the exact information needed from any screen. It is also able to analyze others databases, to allow you to consolidate data in one single user interface.

The “ideas” module has been developed in Open ERP to allow employees to suggest ideas, sorted in different boxes or subjects. Then, people can rate the proposed ideas and discuss on the different points. Open ERP has modules to help manage and maintain company IT infrastructure. One can manage softwares, licences, hardwares, warranties and control interventions on the different components. Each components can be linked together to design the network infrastructure. Open ERP provides modules to synchronize automatically with all main open source eCommerce systems: OSCommerce, eZpublish, Magento, Joomla. It allows you to streamline and automate the sales process, from the online order to the delivery and the invoicing. In order to benefit from all the power of Open ERP you can also use our own eCommerce system that automatically plugs in an existing website.

2.7 COMPARISON AND RESULT OF ERP SOFTWARES

The analysis of the open source ERP software packages has shown that open source software carry more advantages for organisations of similar scale and functions to that of BRAC University. Because of the need for a cost effective solution, an open source ERP software such as the ones mentioned in this document are more suitable than a commercial alternative. The products analyzed in this document provide fully fledged ERP functionality that would otherwise be expensive if procured from a commercial vendor. Also because the source code is attached with all these packages there is room for tailoring the solutions to the organisations' needs.

Any of the above 6 ERP solutions can be implemented for an organization like BRAC University to better coordinate their information flow and functionalities. However, detailed study of the organization reveals that the best ERP software that can be implemented to maximize efficiency and reduce information loss is Open ERP. Open ERP offers the most number of modules in comparison with the other softwares and also gives the scope of implementing Business Intelligence. The web based interface is a leap forward and has more advantages than desktop user interfaces. In a study where Open ERP was evaluated against OpenBravo the following results were obtained:

Summary

— Open ERP — Open Bravo

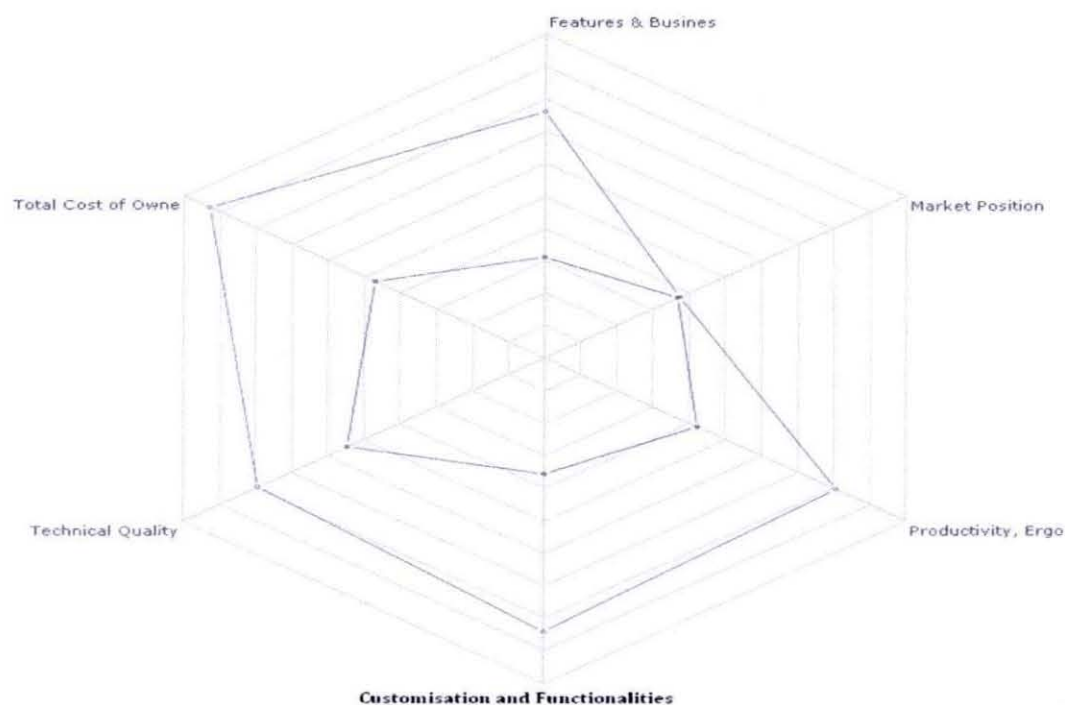


Fig 2.5: Comparison of the features of OpenERP against OpenBravo

Features & Business Applications

— Open ERP — Open Bravo

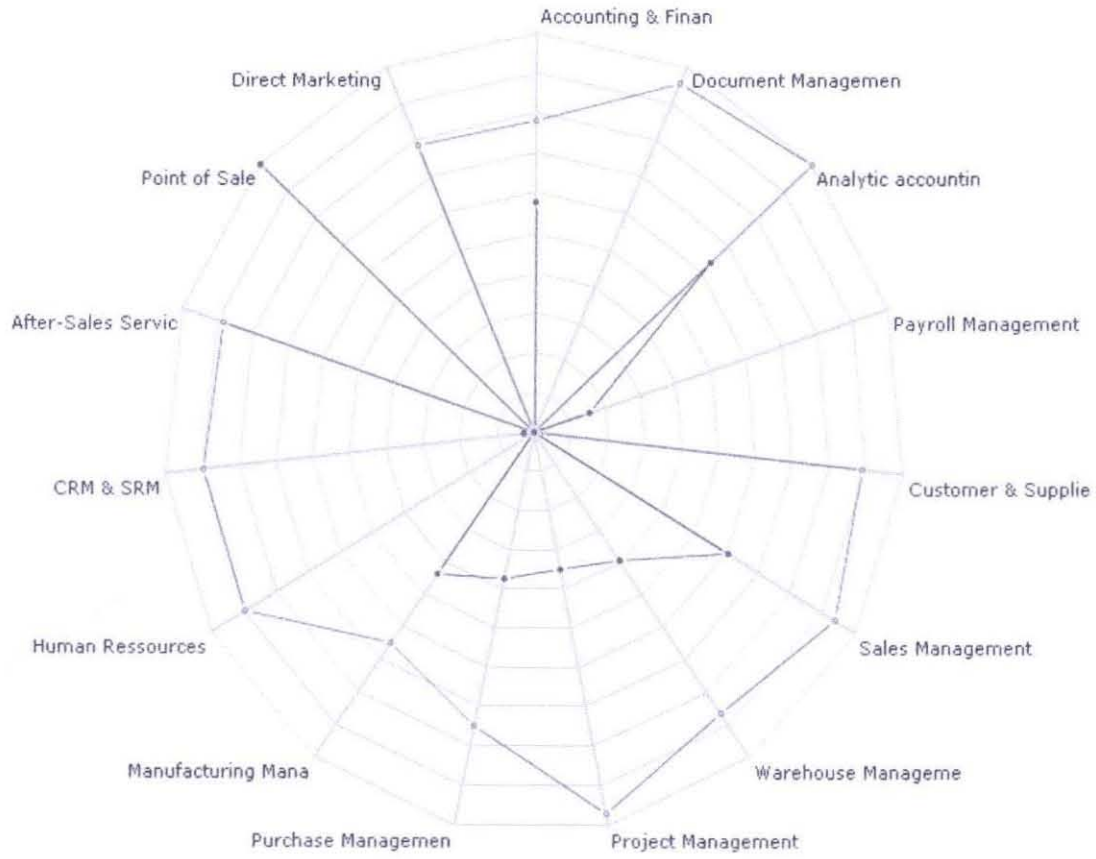


Fig 2.6: Features and Business Application Comparison

Productivity, Ergonomy & Ease of Use

— Open ERP — Open Bravo

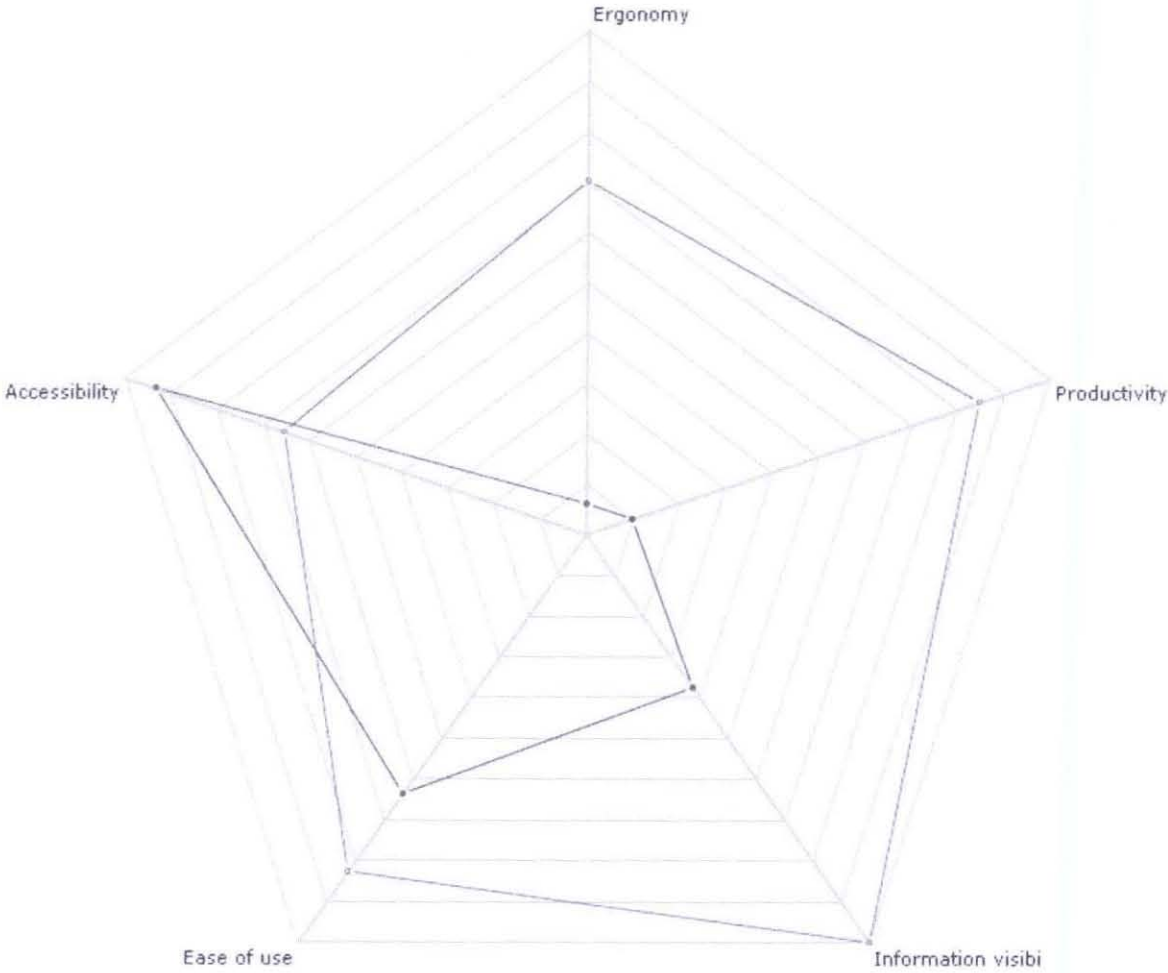


Fig 2.7: Productivity, Egronomy and Ease of Use Comparison

Customisations & Flexibility

— Open ERP — Open Bravo

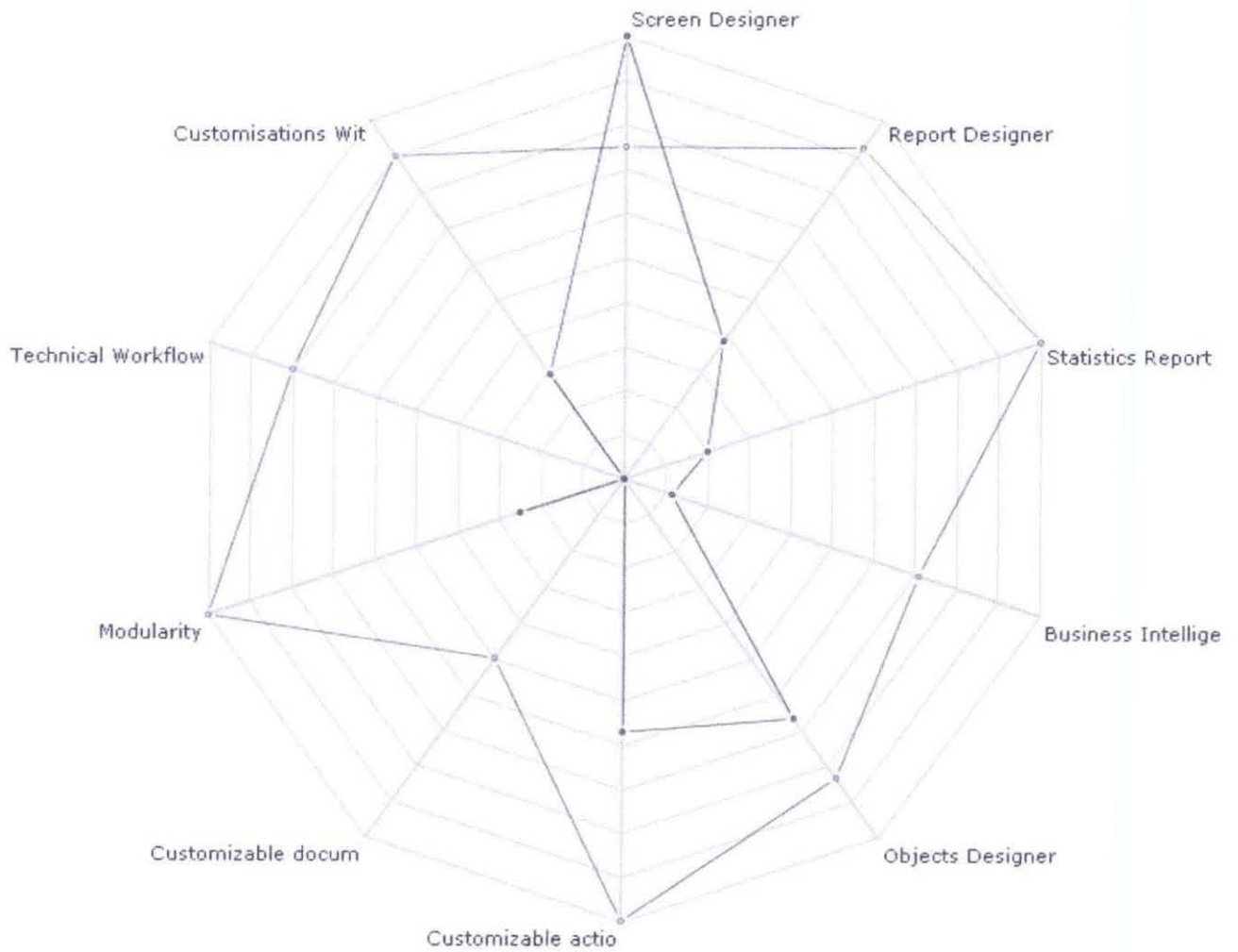


Fig 2.8: Customizations and Flexibility Comparison

Technical Quality

— Open ERP — Open Bravo

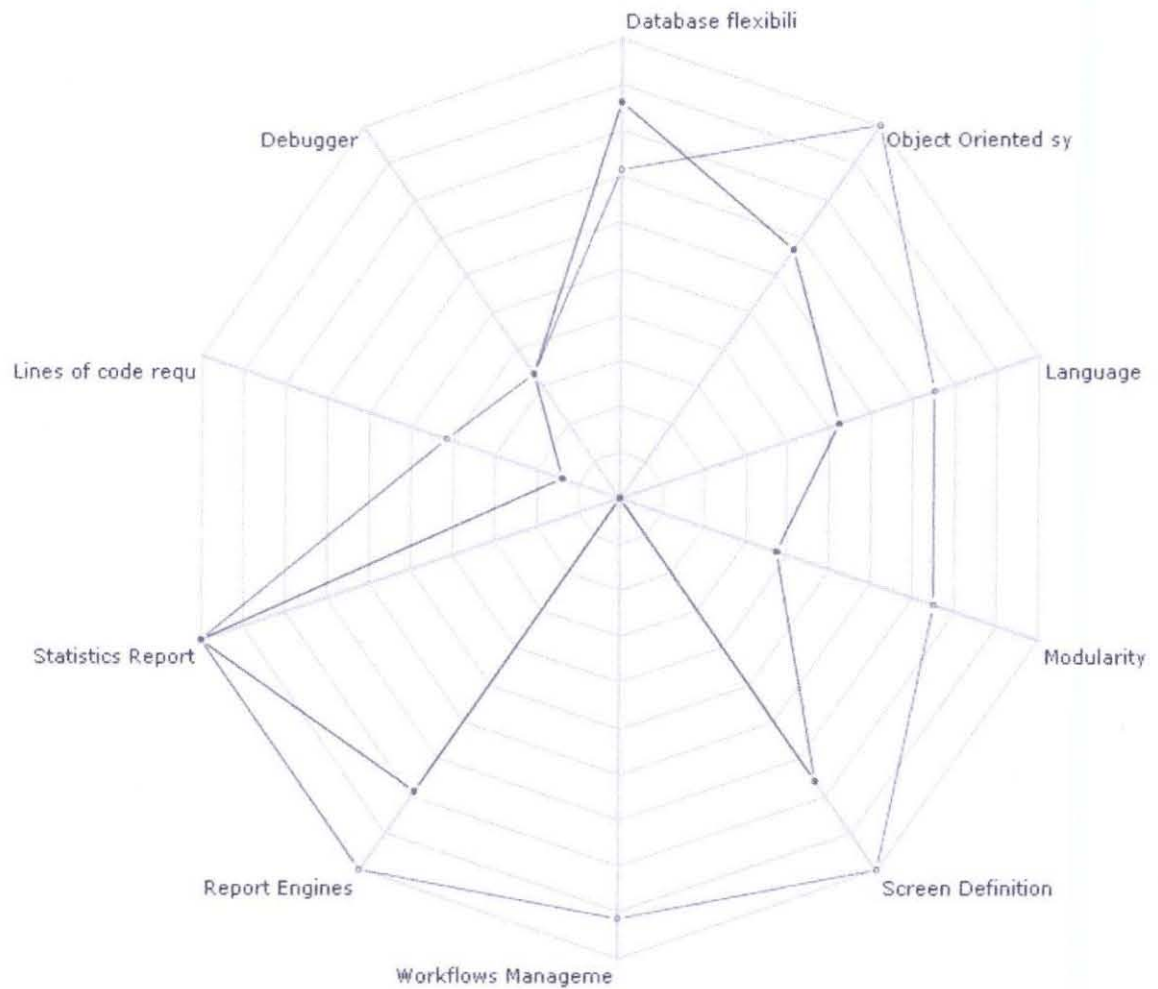


Fig 2.9: Technical Quality Comparison

All these comparisons were done at www.evaluation-matrix.com and restate the success story of OpenERP over its rivals and is the optimal solution for BRAC University's needs.

3.1 INTRODUCTION TO HUMAN RESOURCE MANAGEMENT

Whether an organization consists of five or 25,000 employees, human resources management is vital to the success of the organization. HR is important to all managers because it provides managers with the resources – the employees – necessary to produce the work for the managers and the organization. Beyond this role, HR is capable of becoming a strong strategic partner when it comes to establishing the overall direction and objectives of key areas of human resource management in order to ensure that they not only are consistent with but also support the achievement of business goals. Managers rely on HR to provide effective staff capable of accomplishing the goals of the organization. HR is valuable in ensuring employees are high performers, dealing with performance issues, and certifying that existing methods are compliant to the rules, contracts and laws under which the organization operates. When HR succeeds in developing processes to attract, hire and develop motivated employees, managers are able to focus on the objectives of their department and the organization.

3.2 HUMAN RESOURCE MANAGEMENT AT BRAC UNIVERSITY

The HRM function of an organization includes a variety of activities, and key among them is deciding what staffing needs you have and whether to use independent contractors or hire employees to fill these needs, recruiting and training the best employees, ensuring they are high performers, dealing with performance issues, and ensuring your personnel and management practices conform to various regulations. Activities also include managing your approach to employee benefits and compensation, employee records and personnel policies.

Despite the importance that a HRM department carries in an organization study during this semester has revealed that there is a lack of urgency and drive for implementing a robust solution at the university. Human resource management is considered as the 'Cinderella' at BRAC University as its importance has not been discovered by the senior

management. The HRM department mainly works to store basic information of its employees and manage their salaries. The software they use to help them in this process has been poorly designed and not very user friendly. The function of HR department starts from the planning phase of employee workforce management but at BRAC HR department comes into play once an employee has been hired. The HRM role of planning, forecasting and developing a suitable pool of candidates are not utilized by the management. Employee benefit management and training needs are handled manually through numerous arduous steps.

3.3 PROPOSED SOLUTION FOR THE PROBLEMS

All the aforesaid obstacles can be overcome by redesigning the way the HR department works. An ERP system can be implemented to take over the existing system and improve efficiency and functionality. The new system will introduce several processes. Together they will work to achieve the organization goal. These processes can be performed in an HR department, but some tasks can also be outsourced or performed by line-managers or other departments. When effectively integrated they will provide significant economic benefit to the company.

- Workforce planning
- Recruitment
- Induction, Orientation and Onboarding
- Skills management
- Training and development
- Personnel administration
- Compensation
- Attendance Management
- Travel management
- Payroll
- Employee benefits administration
- Personnel cost planning
- Performance appraisal

The combination of these modules into one application assures the perfect platform for re-engineering and aligning HR processes along with the organizational goals. However, due to the limitation of time and scope only the following parts of the HRM system will be implemented. However the design can be used in the future to implement the other functionalities as well.

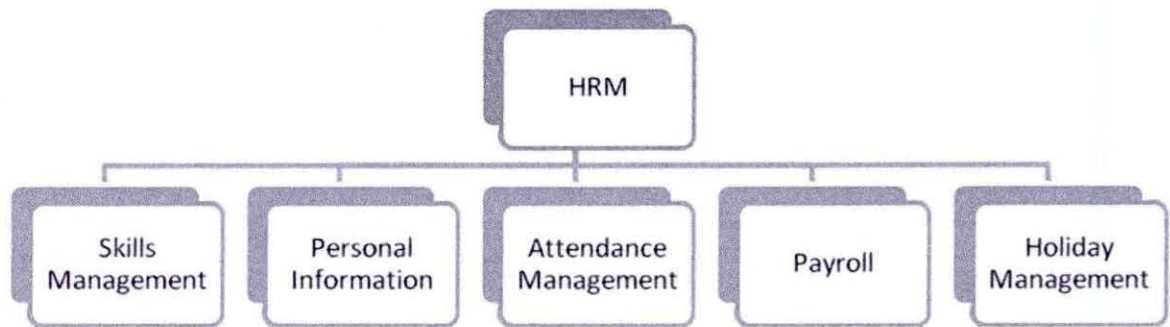


Fig 3.1: Modules of the proposed HRM system

3.4 USE CASE DIAGRAM

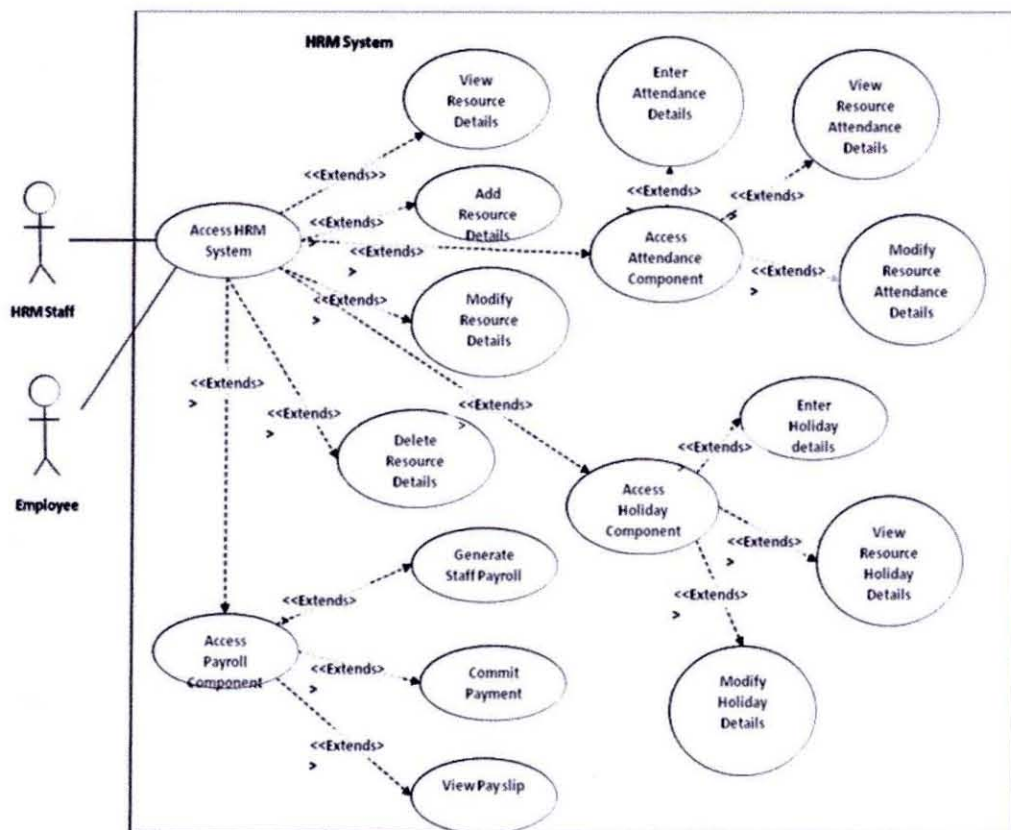


Fig 3.2: Use Case Diagram of the proposed HRM system

3.5 USE CASE NARRATIVES

Alternate Flow 4: Invalid Credentials. Please verify and enter correct details.	
Use Case	View Resource Details
Actors	HRM Staff
Purpose	To view existing resource information.
Overview	A HRM staff member requests to modify existing resource information after execution of use case 'Access HRM System'. The system provides HRM staff with appropriate options to modify resource details.
Pre-condition	<ol style="list-style-type: none"> 1. Actor must be HRM staff. 2. Use Case 'Access HRM System' must have been executed.
Post-condition	Resource information is shown.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. HRM Staff requests to view existing resource information.	2. System requests parameters to identify resource(s) information.
3. HRM Staff provides resource identifiers.	4. System displays resource details.
Alternate Flow of Events	
4. System indicates that records do not exist for given search parameters at step 4.	
4.1. System goes to step 2 of normal flow.	
Extends	
None	
Error Messages	
Alternate Flow 4: Records do not exist for given criteria.	

Use Case	Modify Resource Details
Actors	HRM Staff
Purpose	To modify existing resource information.
Overview	A HRM staff member requests to modify existing resource information after execution of use case 'Access HRM System'. The system provides HRM staff with appropriate options to modify resource details.
Pre-condition	<ol style="list-style-type: none"> 1. Actor must be HRM staff. 2. Use Case 'Access HRM System' must have been executed.
Post-condition	Changed details are entered into system.
Special Requirements	None
Flow of Events	
Actor Action	□□□□□□□□□□□□□□
<ol style="list-style-type: none"> 1. HRM Staff requests to modify existing resource information. 3. HRM Staff provides resource identifiers. 5. HRM Staff modifies resource details. 6. HRM Staff commits to save details. 	<ol style="list-style-type: none"> 2. System requests parameters to identify resource(s) information. 4. System displays resource details 7. System saves details.
Alternate Flow of Events	
None	
Extends	
None	
Error Messages	
None	

Use Case	Add Resource Details
Actors	HRM Staff
Purpose	To add new resource information.
Overview	A HRM staff member requests to add new resource information after execution of use case 'Access HRM System'. The system provides HRM staff with appropriate options to enter new resource details.
Pre-condition	<ol style="list-style-type: none"> 1. Actor must be HRM staff. 2. Use Case 'Access HRM System' must have been executed.
Post-condition	New resource details are entered into system.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. HRM staff requests for options to add new resource information.	2. System provides screen to enter new details.
3. HRM staff enters resource details.	5. System saves information.
4. HRM staff commits to saving information.	
Alternate Flow of Events	
None	
Extends	
None	
Error Messages	
None	

Use Case	Delete Resource Details
Actors	HRM Staff
Purpose	To delete existing resource information.
Overview	A HRM staff member requests to delete existing resource information after execution of use case 'Access HRM System'. The system provides HRM staff with appropriate options to delete resource details.
Pre-condition	<ol style="list-style-type: none"> 1. Actor must be HRM staff. 2. Use Case 'Access HRM System' must have been executed.
Post-condition	Requested details are deleted.
Special Requirements	None
Flow of Events	
Actor Action	System Action
<ol style="list-style-type: none"> 1. HRM Staff requests to delete existing resource information. 3. HRM Staff provides resource identifiers. 5. HRM Staff commits to delete details. 	<ol style="list-style-type: none"> 2. System requests parameters to identify resource(s) records. 4. System requests confirmation for deleting appropriate records. 6. System deletes records.
Alternate Flow of Events	
None	
Extends	
<ol style="list-style-type: none"> 5. HRM Staff desires not to delete at step 5. <ol style="list-style-type: none"> 5.1. Use case is terminated 5.2. System executes use case 'Access HRM System' with user credentials. 	
Error Messages	
None	

Use Case	Access Payroll Component
Actors	HRM Staff, Employee
Purpose	To get access to the component surrounding payroll.
Overview	A HRM staff or Employee member requests to access payroll component after execution of use case 'Access HRM System'. Then the system provides HRM staff access to the payroll component.
Pre-condition	1. Use Case 'Access HRM System' must have been executed.
Post-condition	Access granted to Payroll System.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. HRM Staff requests to access payroll system.	2. System displays options to be access within payroll component.
Alternate Flow of Events	
None	
Extends	
<ol style="list-style-type: none"> 1. Generate Staff Payroll 2. Commit Payment 3. View Pay-slip 	
Error Messages	
None	

Use Case	Generate Staff Payroll
Actors	HRM Staff
Purpose	To get access to the component surrounding payroll.
Overview	A HRM staff member requests to generate payroll for all staff after execution of use case 'Access HRM System'. Then the system calculates pay for each staff based on timesheet and pay rate data.
Pre-condition	<ol style="list-style-type: none"> 1. Actor must be HRM staff. 2. Use Case 'Access HRM System' must have been executed.
Post-condition	Payroll is generated.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. HRM Staff requests to generate payroll.	<ol style="list-style-type: none"> 2. System accesses resource time sheet and resource pay rate. 3. System calculates pay for each staff.
Alternate Flow of Events	
None	
Extends	
None	
Error Messages	
None	

Use Case	Commit Payment	
Actors	HRM Staff	
Purpose	To issue a payment to each resource's nominated bank account.	
Overview	A HRM staff member requests to issue salary payment for all staff after execution of use case 'Access HRM System'. Then the system then issues a payment request to all nominated bank accounts.	
Pre-condition	<ol style="list-style-type: none"> 1. Actor must be HRM staff. 2. Use Case 'Access HRM System' must have been executed. 	
Post-condition	Payroll is generated.	
Special Requirements	None	
Flow of Events		
Actor Action	System Action	
<ol style="list-style-type: none"> 1. HRM Staff requests for resource salary to be paid. 3. HRM Staff confirms request 	<ol style="list-style-type: none"> 2. System requests confirmation for payment request. 4. System accesses calculated pay and resource bank details. 5. System sends transaction requests to transfer funds from company account to each staff account. 	
Alternate Flow of Events		
<ol style="list-style-type: none"> 3. HRM Staff desires not to commit payment at step 3. <ol style="list-style-type: none"> 3.1. Use case is terminated 3.2. System executes use case 'Access Payroll Component' with user credentials. 		
Extends		
None		
Error Messages		
None		

Use Case	View Pay Slip
Actors	HRM Staff, Employee
Purpose	To view existing resource information.
Overview	A HRM staff member or Employee requests to view pay slip after execution of use case 'Access HRM System'. The system provides Actor with pay slip.
Pre-condition	1. Use Case 'Access HRM System' must have been executed.
Post-condition	Pay slip is shown.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. Actor requests to view resource pay slip.	2. System requests parameters to identify resource(s) information.
3. Actor provides resource identifiers.	4. System displays pay slip.
Alternate Flow of Events	
4. System indicates that records do not exist for given search parameters at step 4.	
4.1. System goes to step 2 of normal flow.	
Extends	
None	
Error Messages	
Alternate Flow 4: Records do not exist for given criteria.	

Use Case	Access Attendance Component
Actors	HRM Staff, Employee
Purpose	To get access to the component surrounding attendance.
Overview	A HRM staff member or employee requests to access attendance component after execution of use case 'Access HRM System'. Then the system provides Actor access to the attendance component.
Pre-condition	1. Use Case 'Access HRM System' must have been executed.
Post-condition	Access granted to attendance component.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. Employee requests to access attendance system.	2. System displays options to be access within attendance component based on Actor credentials.
Alternate Flow of Events	
None	
Extends	
<ol style="list-style-type: none"> 1. Enter Attendance Details 2. View Attendance Details 3. Modify Attendance Details 	
Error Messages	
None	

Use Case	Enter Attendance Details
Actors	HRM Staff, Employee
Purpose	To enter attendance details.
Overview	A HRM staff member or employee requests to enter attendance details after execution of use case 'Access HRM System'. Then the system provides Actor appropriate options to enter details.
Pre-condition	2. Use Case 'Access HRM System' must have been executed.
Post-condition	New attendance details are added to system.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. Actor requests to enter attendance details.	2. System displays options to enter attendance details based on Actor credentials.
Alternate Flow of Events	
None	
Extends	
None	
Error Messages	
None	

Use Case	Modify Attendance Details
Actors	HRM Staff, Employee
Purpose	To modify attendance details.
Overview	A HRM staff member or employee requests to modify attendance details after execution of use case 'Access HRM System'. Then the system provides Actor appropriate options to modify details.
Pre-condition	1. Use Case 'Access HRM System' must have been executed.
Post-condition	System records are modified.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. Actor requests to modify existing resource information.	2. System requests parameters to identify resource(s) information.
3. Actor provides resource identifiers.	4. System displays attendance details permitted to be modified based on Actor credentials.
5. Actor modifies attendance details.	
6. Actor commits to save details.	7. System saves details.
Alternate Flow of Events	
None	
Extends	
None	
Error Messages	
None	

Use Case	View Attendance Details
Actors	HRM Staff, Employee
Purpose	To view attendance details.
Overview	A HRM staff member or employee requests to view attendance details after execution of use case 'Access HRM System'. Then the system provides Actor appropriate attendance details.
Pre-condition	1. Use Case 'Access HRM System' must have been executed.
Post-condition	Appropriate details displayed.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. Actor requests to view existing resource information.	2. System requests parameters to identify resource(s) information.
3. Actor provides resource identifiers.	4. System displays attendance details permitted to be viewed based on Actor credentials.
Alternate Flow of Events	
None	
Extends	
None	
Error Messages	
None	

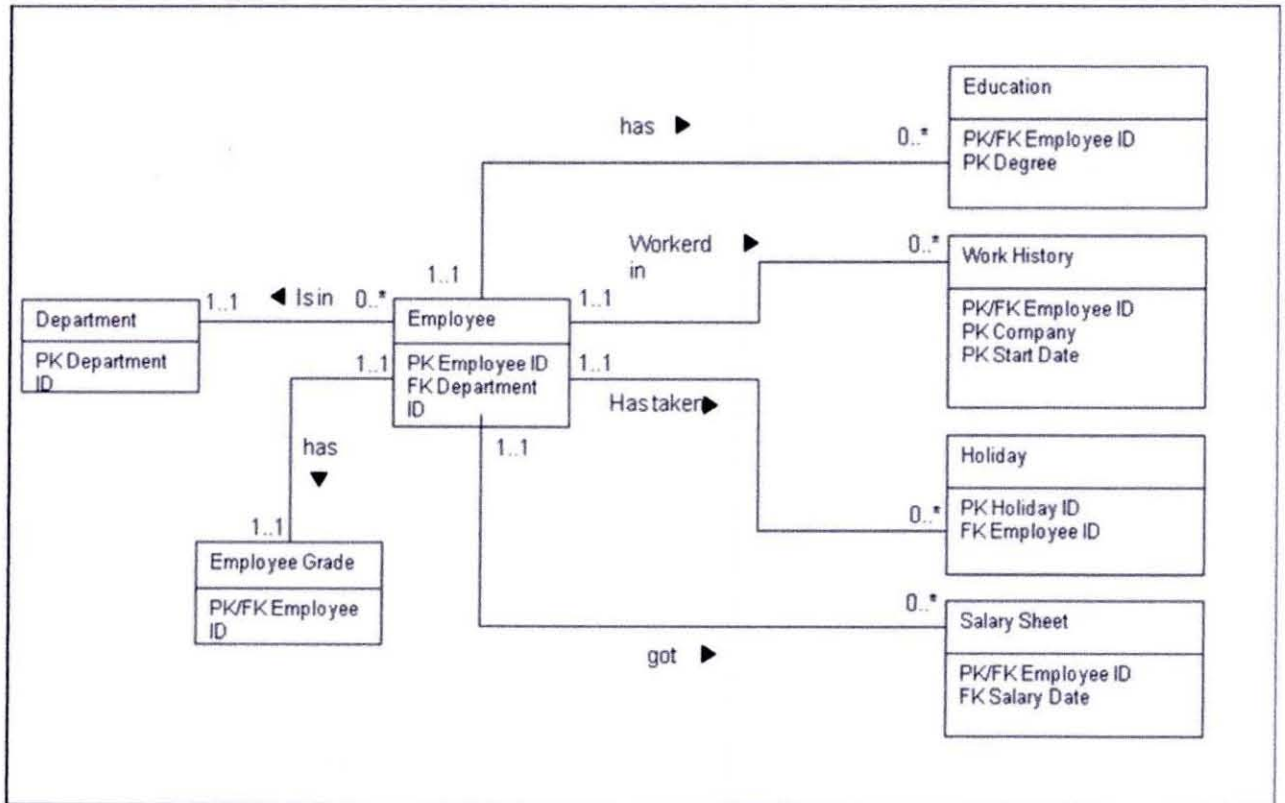
Use Case	Access Holiday Component	
Actors	HRM Staff, Employee	
Purpose	To get access to the component surrounding Holiday.	
Overview	A HRM staff member or employee requests to access Holiday component after execution of use case 'Access HRM System'. Then the system provides Actor access to the Holiday component.	
Pre-condition	3. Use Case 'Access HRM System' must have been executed.	
Post-condition	Access granted to Holiday component.	
Special Requirements	None	
Flow of Events		
Actor Action	System Action	
1. Employee requests to access Holiday system.	2. System displays options to be access within Holiday component based on Actor credentials.	
Alternate Flow of Events		
None		
Extends		
4. Enter Holiday Details		
5. View Holiday Details		
6. Modify Holiday Details		
Error Messages		
None		

Use Case	Enter Holiday Details
Actors	HRM Staff, Employee
Purpose	To enter Holiday details.
Overview	A HRM staff member or employee requests to enter Holiday details after execution of use case 'Access HRM System'. Then the system provides Actor appropriate options to enter details.
Pre-condition	4. Use Case 'Access HRM System' must have been executed.
Post-condition	New Holiday details are added to system.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. Actor requests to enter Holiday details.	2. System displays options to enter Holiday details based on Actor credentials.
Alternate Flow of Events	
None	
Extends	
None	
Error Messages	
None	

Use Case	Modify Holiday Details
Actors	HRM Staff, Employee
Purpose	To modify Holiday details.
Overview	A HRM staff member or employee requests to modify Holiday details after execution of use case 'Access HRM System'. Then the system provides Actor appropriate options to modify details.
Pre-condition	2. Use Case 'Access HRM System' must have been executed.
Post-condition	System records are modified.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. Actor requests to modify existing resource information.	2. System requests parameters to identify resource(s) information.
3. Actor provides resource identifiers.	4. System displays Holiday details permitted to be modified based on Actor credentials.
5. Actor modifies Holiday details.	7. System saves details.
6. Actor commits to save details.	
Alternate Flow of Events	
None	
Extends	
None	
Error Messages	
None	

Use Case	View Holiday Details
Actors	HRM Staff, Employee
Purpose	To view Holiday details.
Overview	A HRM staff member or employee requests to view Holiday details after execution of use case 'Access HRM System'. Then the system provides Actor appropriate Holiday details.
Pre-condition	2. Use Case 'Access HRM System' must have been executed.
Post-condition	Appropriate details displayed.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. Actor requests to view existing resource information.	2. System requests parameters to identify resource(s) information.
3. Actor provides resource identifiers.	4. System displays Holiday details permitted to be viewed based on Actor credentials.
Alternate Flow of Events	
None	
Extends	
None	
Error Messages	
None	

3.6 E-R DIAGRAM OF HUMAN RESOURCE MANAGEMNT SYSTEM



4.1 INTRODUCTION TO INVENTORY MANAGEMENT

Inventory management is an integral part of a successful business. Inventories typically consist of goods, raw materials and finished products. Each of these elements translates into money for the business owner. The key to profitability is a carefully balanced inventory. Inventory mismanagement can be detrimental to a business, especially considering the weight these items carry. Inventories that run out of control can lead to significant losses that the company may not be able to recoup. Considerable investment is required to develop adequate stock. Poorly managed supplies lead to profit loss. *Inventory Management* must be designed to meet the dictates of market place and support the company's Strategic Plan. The many changes in the market demand, new opportunities due to worldwide marketing, global sourcing of materials and new manufacturing technology means many companies need to change their Inventory Management approach and change the process for Inventory Control.

4.2 INVENTORY MANAGEMENT AT BRAC UNIVERSITY

The Inventory Management function of an organization includes listing the available resources of the company, track their usage rate, predicting their use in the future, planning and forecasting needs, tracking orders, supplying them and managing information related to all such operations. *Inventory Management* system provides information to efficiently manage the flow of materials, effectively utilize people and equipment, coordinate internal activities and communicate with various stakeholders. Inventory Management does not make decisions or manage operations; they provide the information to managers who make more accurate and timely decisions to manage their operations.

Study of the present management system at BRAC reveals a very sorry picture. Inventory management is done in the traditional fashion. Resources of BRAC University include rooms, labs, transport facilities, resources such as computers, projectors, stationery necessary for the faculty and management etc. There is very little use of technology in the process and the whole system is sluggish and inefficient. There is no way to monitor the

usage of resources by individual employees and this leads to wastage. Furthermore material planning cannot be done using the manual system. Orders for requisition have to be placed through written requests or forms which is again slow. Loss of documents often creates confusion and storage of information takes a lot of space.

4.3 PROPOSED SOLUTION FOR THE PROBLEMS

Successful inventory management may seem as if it requires psychic abilities, and while a peek into the future can help, managers can fare pretty well by addressing managerial performance. Creating realistic goals backed by evaluations can be beneficial. The data collected in evaluations can give managers insight into the best approach for purchasing stock in the future. Managing inventories can be complicated, but some considerations can make the process much easier. Management may be concerned primarily with having a balanced stock while keeping supplies readily available without overstocking the shelves. The following factors are important for managers to consider as well:

- Balanced assortment of items
- Quick, efficient turnover
- Maintaining service quality
- Stocking up-to-date items
- High volume purchases
- Cost control

Technological advances in the realm of inventories can provide the necessary tools to help managers make reliable decisions according to current trends in their industries. Software products have a significant impact on the efficiency of a company's performance. Well-balanced inventories translate into profits and effective inventory management can be very lucrative. Different programs offer different features, so it is important to consider the company's specific needs. After a thorough study the various processes of BRAC University's inventory functions were listed as follows:

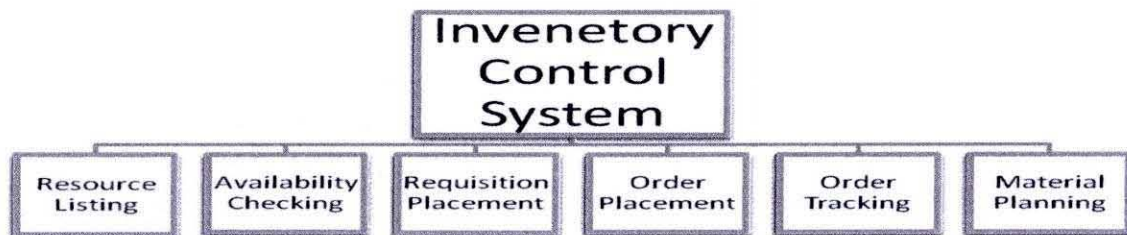
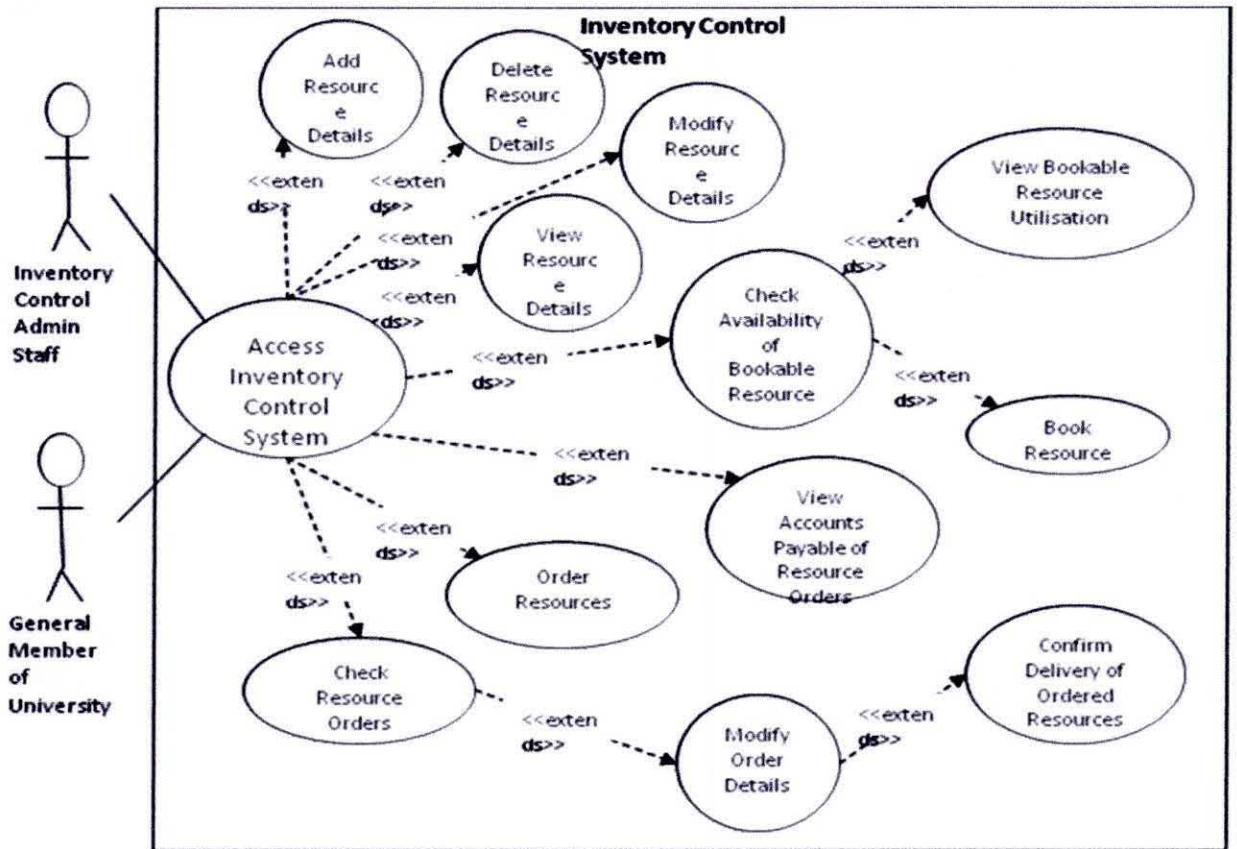


Figure 4.1 Modules of the Proposed Inventory Control System

4.4 USE CASE DIAGRAM



4.5 USE CASE NARRATIVES

Use Case	Access Inventory Control System
Actors	Inventory Control Admin Staff, General Member of University
Purpose	To use the HRM System functionalities
Overview	An actor requests use of the Inventory Control system and the system grants access to various system components based on the staff member's credentials.
Pre-condition	None
Post-condition	Actor is granted or denied access to system.
Special Requirements	None

Flow of Events

Actor Action	System Action
1. The use case begins when a Actor wishes to access the Inventory Control system.	2. System produces screen requesting Actor credentials.
3. Actor submits identification details to gain access to system.	4. System verifies Actor credentials to grant access.
	5. System produces list of components for Actor to access based on credentials provided.

Alternate Flow of Events

- 2. Actor already logged into system.
 - 2.1 System goes to basic flow step
- 4. Invalid credentials at step 3.
 - 3.1. Notify Actor on incorrect or unauthorized credentials
 - 3.2. Return to Step 2.

Extends

At Step 5:

- 1. View Resource Listings
- 2. Add Resource Details
- 3. Modify Resource Details
- 4. Delete Resource Details
- 5. Check Availability of Bookable Resource
- 6. View Accounts Payable of Resource Orders

- 7. Order Resources
- 8. Check Resource Orders

Error Messages

Alternate Flow 4: Invalid Credentials. Please verify and enter correct details.

Use Case	View Resource Details
Actors	Inventory Control Admin Staff, General Member of University
Purpose	To view existing resource information.
Overview	An actor requests to view existing resource information after execution of use case 'Access Inventory Control System'. The system provides actor with requested information.
Pre-condition	3. Use Case 'Access Inventory Control System' must have been executed.
Post-condition	Resource information is shown.
Special Requirements	None

Flow of Events

Actor Action	System Action
1. Requests to view existing resource information.	2. System requests parameters to identify resource(s) information.
3. Actor provides resource identifiers.	4. System displays resource details.

Alternate Flow of Events

- 5. System indicates that records do not exist for given search parameters at step 4.
 - 5.1. System goes to step 2 of normal flow.

Extends

None

Error Messages

Alternate Flow 4: Records do not exist for given criteria.

Use Case	Add Resource Details
Actors	Inventory Control Admin Staff
Purpose	To add new resource information.
Overview	An actor requests to add new resource information after execution of use case 'Access Inventory Control System'. The system provides HRM staff with appropriate options to enter new resource details.
Pre-condition	3. Use Case 'Access Inventory Control System' must have been executed.
Post-condition	New resource details are entered into system.
Special Requirements	None

Flow of Events

Actor Action	System Action
1. Actor requests for options to add new resource information.	2. System provides screen to enter new details.
3. Actor enters resource details.	5. System saves information.
4. Actor commits to saving information.	

Alternate Flow of Events

None

Extends

None

Error Messages

None

Use Case	Modify Resource Details
Actors	Inventory Control Admin Staff
Purpose	To modify existing resource information.
Overview	An actor requests to modify existing resource information after execution of use case 'Access Inventory System'. The system provides actor with appropriate options to modify resource details.
Pre-condition	3. Use Case 'Access Inventory Control System' must have been executed.
Post-condition	Changed details are entered into system.
Special Requirements	None

Flow of Events

Actor Action	System Action
1. Actor requests to modify existing resource information.	2. System requests parameters to identify resource(s) information.
3. Actor provides resource identifiers.	4. System displays resource details
5. Actor modifies resource details.	7. System saves details.
6. Actor commits to save details.	

Alternate Flow of Events

None

Extends

None

Error Messages

None

Use Case	Delete Resource Details	
Actors	Inventory Control Admin Staff	
Purpose	To delete existing resource information.	
Overview	An actor requests to delete existing resource information after execution of use case 'Access HRM System'. The system provides actor with appropriate options to delete resource details.	
Pre-condition	3. Use Case 'Access Inventory Control System' must have been executed.	
Post-condition	Requested details are deleted.	
Special Requirements	None	
Flow of Events		
Actor Action	System Action	
1. Actor requests to delete existing resource information.	2. System requests parameters to identify resource(s) records.	
3. Actor provides resource identifiers.	4. System requests confirmation for deleting appropriate records.	
5. Actor commits to delete details.	6. System deletes records.	
Alternate Flow of Events		
6. Actor desires not to delete at step 5.		
6.1. Use case is terminated		
System executes use case 'Access Inventory Control System' with user credentials.		
Extends		
Error Messages		
None		

Use Case	Check Availability of Bookable Resource	
Actors	Inventory Control Admin Staff, General Member of University	
Purpose	To check availability of resources, such as rooms and transport, that can be booked.	
Overview	An actor requests to view availability of a resource. The system displays requested information.	
Pre-condition	1. Use Case 'Access Inventory Control System' must have been executed.	
Post-condition	Requested details are displayed.	
Special Requirements	None	
Flow of Events		
Actor Action	System Action	
1. Actor requests to check availability of resource.	2. System requests parameters: resource identifier, date.	
3. Actor provides parameters.	4. System displays availability of resource for given date.	
Alternate Flow of Events		
None		
Extends		
At Step 1:		
1. View Bookable Resource Utilisation		
At Step 4:		
1. Book Bookable Resource		
Error Messages		
None		

Use Case	View Bookable Resource Utilisation	
Actors	Inventory Control Admin Staff, General Member of University	
Purpose	To check utilization of a given resource. This is a rendering of availability of a given resource on a timeline.	
Overview	An actor requests to view resource utilization and the system renders a timeline showing segments where the resource is booked.	
Pre-condition	1. Use Case 'Access Inventory Control System' must have been executed.	
Post-condition	Requested details are displayed.	
Special Requirements	None	
Flow of Events		
Actor Action	System Action	
1. Actor requests to check utilisation of resource.	2. System requests parameter: resource identifier.	
3. Actor provides parameter.	4. System renders timeline showing availability and unavailability of resource.	
Alternate Flow of Events		
None		
Extends		
None		
Error Messages		
None		

Use Case	Book Resource
Actors	Inventory Control Admin Staff, General Member of University
Purpose	To book resources, such as rooms and transport.
Overview	An actor requests to book a resource. The system then books resource.
Pre-condition	
Post-condition	Requested resource is booked if possible.
Special Requirements	None
Flow of Events	
Actor Action	System Action
1. Actor requests to book a resource.	2. System requests parameters: resource identifier, date, start time, and end time.
3. Actor provides parameters.	4. System books resource.
Alternate Flow of Events	
4. Resource unavailable	
4.1 System displays notification that resource is unavailable for given parameters.	
4.2 Systems returns to Step 2 of basic flow.	
Extends	
None	
Error Messages	
None	

Use Case	View Accounts Payable of Resource Orders	
Actors	Inventory Control Admin Staff	
Purpose	To view payables of ordered resources	
Overview	An actor requests to view payment details of orders.	
Pre-condition	1. Use Case 'Access Inventory Control System' must have been executed.	
Post-condition	Requested information is displayed	
Special Requirements	None	
Flow of Events		
Actor Action	System Action	
1. Actor requests to view payment details of orders.	2. System requests parameters: resource identifier.	
3. Actor provides parameters.	4. System displays details of payments to be made for given resource orders.	
Alternate Flow of Events		
None		
Extends		
None		
Error Messages		
None		

Use Case	Order Resource
Actors	Inventory Control Admin Staff, General Member of University
Purpose	To order resources
Overview	An actor requests order resources. System stores details for order.
Pre-condition	1. Use Case 'Access Inventory Control System' must have been executed.
Post-condition	Order details are stored
Special Requirements	None

Flow of Events

Actor Action	System Action
1. Actor requests order resources	2. System requests parameters: resource identifier, quantity.
3. Actor provides parameters.	4. System stores details.

Alternate Flow of Events

None

Extends

None

Error Messages

None

Use Case	Check Resource Orders
Actors	Inventory Control Admin Staff
Purpose	To view new orders that has been placed.
Overview	An actor requests to view orders that have been placed. System then displays details of order.
Pre-condition	1. Use Case 'Access Inventory Control System' must have been executed.
Post-condition	Requested information is displayed
Special Requirements	None

Flow of Events

Actor Action	System Action
1. Actor requests to details of new orders.	2. System displays details of new orders.

Alternate Flow of Events

None

Extends

At Step 1:

1. Modify order details.

Error Messages

None

Use Case	Modify Order Details
Actors	Inventory Control Admin Staff
Purpose	To view new orders that has been placed.
Overview	An actor requests to modify to details of orders.
Pre-condition	1. Use Case 'Check Resource Orders' must have been executed.
Post-condition	Modified details stored.
Special Requirements	None

Flow of Events

Actor Action	System Action
1. Actor requests to modify existing resource information.	2. System requests parameters to identify resource(s) information.
3. Actor provides resource identifiers.	4. System displays resource details
5. Actor modifies resource details.	7. System saves details.
6. Actor commits to save details.	

Alternate Flow of Events

None

Extends

At Step 1:

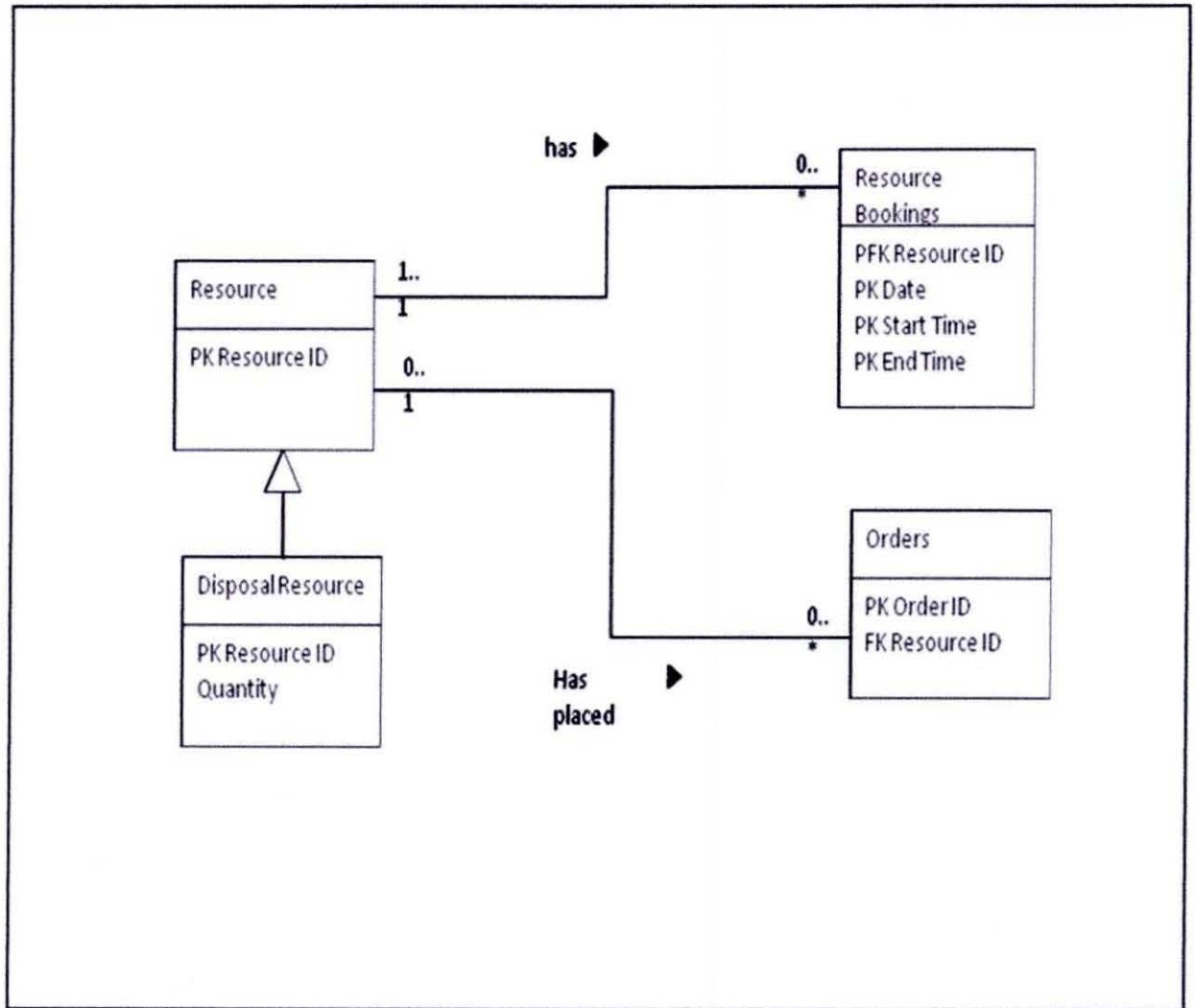
1. Confirm Delivery of Ordered Resources

Error Messages

None

Use Case	Confirm Delivery of Ordered Resources	
Actors	Inventory Control Admin Staff	
Purpose	To update inventory details with newly received resources.	
Overview	An actor confirms that ordered resources have been delivered. The system then updates resource details accordingly.	
Pre-condition	1. Use Case 'Modify Order Details' must have been executed.	
Post-condition	Modified details stored.	
Special Requirements	None	
Flow of Events		
Actor Action	System Action	
1. Actor confirms that ordered resources have been delivered.	2. System requests parameters to identify resource(s) information and additional details.	
3. Actor provides resource identifiers.	4. System displays to be updated details.	
6. Actor commits to save details.	7. System saves resource details.	
Alternate Flow of Events		
None		
Extends		
None		
Error Messages		
None		

4.6 E-R DIAGRAM OF INVENTORY CONTROL SYSTEM



5. CONCLUSION AND RECOMMENDATION

5.1 Findings

BRAC University lacks adequately integrated systems and sufficiently transparent information management practices. Because of this, the value of the University's information assets is not realised, thus the University is disadvantaged in its strategic decision making activities.

5.2 Recommendation

It is recommended that an appropriate ERP system is designed and implemented to enable better information storage and retrieval practices, as well as an enterprise view of the University's operations. This system must be furthered with strategies to align the University's information management efforts to industry standards and best practices. Our study has shown that OpenERP is the optimal solution for BRAC University's needs.

5.3 Shortcomings and Further Work

Due to shortage of time and severe electricity problem in the last three months the HRM system could not be fully implemented in the opener software. However, a test database was run after installing openerp successfully in Linux and test run suggests that if further efforts are made the designed systems can be easily integrated to run smoothly.

BIBLIOGRAPHY AND LIST OF REFERENCES

- <http://www.erpsoftware360.com/erp-open-source.htm>
- www.wikipedia.com
- www.sourceforge.net
- www.erp5.com
- www.adempiere.com
- www.compiere.com
- www.xtuple.com
- www.opentaps.org
- <http://mauriziororani.wordpress.com/2008/12/06/enterprise-resource-planning-erp-concepts-methods-and-frameworks/>
- www.openerp.com
- <http://doc.openerp.com/book/>
- Daniel E. O'Leary, Enterprise Resource Planning Systems: Systems, Life Cycle, Electronic Commerce and Risk
- Kent Sandoe, Gail Corbitt and Ray Boykin, Enterprise Integration