Implementing Integrated Software Solutions in Iranian SMEs

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***Abstract* – There has been little research on information systems in Iranian companies, and this paper helps to address this by examining the implementation and functioning of integrated software solutions in two small to medium sized enterprises in Iran. This is of particular interest now that the sanctions on trade with Iran have been removed, which will inevitably lead to increased sales opportunities for western technology companies in the country. This study uses a process mapping and systems profiling approach to establish the current status of software implementation in these manufacturing companies. It investigates the underlying information systems strategy and examines how this has been implemented in the core process areas of these companies. The outcome of these major systems projects is assessed, and comparisons are drawn between these Iranian based "Total Systems" software products and similar products more widely available in the developed world.**

Keywords – Enterprise Resource Planning; Total Systems; Iranian SMEs; information systems; ERP; process change; IS strategy.

I. INTRODUCTION

The first Enterprise Resource Planning (ERP) software packages came to the market in the 1980s, and have been widely implemented in the developed world, particularly by large corporations. Since the turn of the century, there has been an increase in the use of these integrated software systems by small to medium sized enterprises (SMEs) in the developed world [1]. This has been paralleled – part cause, part effect – by an increase in the number of ERP vendors specifically geared to the requirements and budgets of SMEs. In the developing world, the uptake of these new systems has been slower, for a number of reasons, including the lack of the human and financial resources needed for such projects, and the non-availability of sales and support offices for many of the main ERP vendors in developing world countries. Nevertheless, the use of ERP packages in developing world countries has accelerated in recent years, but the current literature suggests that there have been both significant failures [2] as well as successes [3].

One interesting development in Iran has been the emergence of integrated software solutions developed in the country, by and large for the home business market (Table 1). These are sometimes called "Total Systems," being produced and sold by Iranian software companies. The term "ERP" is also used, but these products are usually more customizable than western based ERP products to specific user requirements, and are also available in both the Parsi language, as well as English. The sanctions on trade with the West have further encouraged Iranian companies to look inside their country for integrated software solutions. This article examines the implementation of two such packages in Iranian SMEs and discusses the underlying information systems (IS) strategy.

TABLE I. HOME GROWN TOTAL SYSTEMS PACKAGES IN IRAN (INDICATING VENDOR WEB ADDRESSES)

BEHKO	http://www.behko.com/?page_id=96
GREEN/ GALAX	http://www.greendataware.com/about/history/
PARS ROYAL	http://parsroyal.net/products
MEDAR GOSTARESH	http://www.itorbit.net/
HAMKARAN SYSTEM	http://www.systemgroup.net/products/%D8%B1%D8%A7%D9%87%DA%A9%D8%A7%D8%B1-%D8%AF%D9%88%D9%84%D8%AA
RAYDANA SYSTEM	http://www.danabarcode.com/
EADEGOSTAR	http://ideagostarco.net/Page/About
EADEPARDAZAN	http://www.eadepardazan.com/pages/ltr/LTRDefault.aspx?pid=2&lang=2
RAYVARZ	https://rayvarz.com/about-us
FARAGOSTAR	http://www.faragostar.net/automation/
PARNIAN PARDAZESH PARS	http://www.parnianportal.com/OA/Pages/Home.aspx
BARID SAMANEYE NOVIN	http://www.baridsoft.ir/products/integrated-approach/office-automation

This introductory section is followed in Section II by a discussion of the background to this paper. In Section III, a

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brief description of the case study methodology used in this research is given. The final two sections – Sections IV and V - focus on the case study findings and analysis.

II. BACKGROUND

ERP is a modular but integrated software system which automates business processes, shares common data, and produces and accesses information in a real time environment [4]. ERP software can be implemented in stages, module by module, and therefore be used to integrate previously isolated IT systems and functional departments within a company. ERP is also viewed by some researchers [5] [6] as a fundamental method for achieving best practice within business operations – the implementation of an ERP package requiring the application of certain disciplines within main business processes. As Koch has noted, "ERP attempts to integrate all departments and functions across a company on to a single computer system that can serve all those departments' particular needs" [4]. According to Turban *et al*. [7], ERP not only provides business discipline, it also allows the alignment of IT deployment with overall business strategy and business goals. Implementing ERP thus may also require change in core processes, often termed business process reengineering or "BPR" [8].

There remain divergences of opinion regarding the suitability of systems developed in the Western world in a developing world context. When discussing IS in the developing world, Gomez and Pather [9] observe that there is a lack of literature and evaluation studies, and the World Bank view that "analysts and decision makers are still struggling to make sense of the mixed experience of information technologies in developing countries" is highlighted by other authors [10]. In spite of uncertainty and failure in the adoption of information systems (IS), the overall deployment of ERP and IS in general is increasing in the developing world.

Increasing professional skills and training is viewed as a key element for successful IS project delivery by Noudoosbeni et al. [11], who argue that lack of planning and management as well as inadequate training led to IS project failure in Malaysian companies. Research of companies in Iran [12] [13] [14] highlight a range of issues that have hampered IS deployment in general in the country - lack of managerial skills, low IT maturity, poor training, poor internet access, governmental policies, and poor business planning; but there is very little literature on the more specific issues faced by SMEs attempting to implement ERP software. Other researchers [15] [16] suggest that the lack of human capability and economic conditions in developing countries lead to IS failure and prevent overall economic growth. There nevertheless appears to be a significant market for ERP software in SMEs in the developing world. The studies of Dezar and Ainin [17] and Arabi et al. [18] indicate that 90% of businesses in developing countries are SMEs; but adoption of ERP systems by SMEs in developing countries is a new activity, in part due to the high expense and technical complexity of such systems.

Iran is an interesting example of the potential of ERP systems in a developing world country. Talebi [19] reports that the great majority of businesses in Iran are micro, small and medium-sized enterprises. According to Molanezhad [20], the majority of SMEs in Iran are in the manufacturing sector. He also suggests that due to the location of Iran in the Middle East, its access to Russia, Europe and Asia, and its considerable market size, ERP systems have significant potential in supporting Iranian SMEs grow their business and increase their employment. This potential has been reinforced by the recent international agreement on nuclear development in Iran, and the subsequent opening up of trading with the West. Hakim and Hakim [21] assert that "IT, as a new industry in Iran, has not found its rightful place within organizations, as the managers are still adamant and adhere to the traditional management systems, and show resistance to the required organizational and infrastructural changes".

Research by Heeks [22] suggests there are several main elements of change that are important in implementing new IS in developing world environments. He identified people, process, structure and technology as key dimensions of what he termed the "design-actuality gap". Heeks' model can be used in various business change contexts, and in this paper it is used to support the analysis of the implementation of the integrated software systems in the two case study companies. Other authors [23] have adopted a similar approach in looking at structures that are embedded in both packages and organisations in trying to assess the reasons for misalignments between IS strategy and the overarching business strategy of the organisation.

The process mapping technique can help the researcher assess systems deployment at process level. It generates a sequence of maps that are used in identifying the information systems that are used in defined business areas. While process mapping is used as a framework to identify the business processes and sub-processes, it can also be used as a point of reference for assessing the functionality of the information systems themselves. This "systems profiling" encompasses a review and assessment of functionality, reporting capabilities, user interface and soundness of the underlying technology [24].

Within this context, and in accordance with the research aims and objectives given above, this research addresses the following questions:

1. What is the nature of the Iranian Total Systems products and do they parallel the modular structure typical of their western ERP counterparts?
2. How successful has the implementation of these products been in supporting the growth of selected case study companies?

III. RESEARCH METHOD

The case study is a widely used research method within business research. Bryman and Bell [25] argue that the case study is particularly appropriate to be used in combination with a qualitative research method, allowing detailed and

intensive research activity, usually in combination with an inductive approach as regards the relationship between theory and research. The case study is also appropriate for a combination of qualitative methods, which is of particular relevance to this study of information systems in two SMEs, where mapping and profiling techniques are combined with questionnaire and interview material. Saunders, Lewis and Thornhill [26] argue that case studies are of particular value for explanatory or exploratory investigation, such as that pursued in this research.

The case studies under investigation are manufacturing SMEs in Iran. This paper reports on the initial findings from two case studies, but additional cases are currently being researched, which will allow stronger conclusions to be drawn in due course. Aliases are used because of confidentiality issues. The first case study is the Isfahan Bus Company, which was founded in 1985 as a family business in Najafabad in Isfahan province. The company designs, manufactures and sells a range of buses, vans and spare parts and currently employs 350 staff. The second case study is Electronic Transmission Systems, a company employing 160 staff which was founded in 1978, and is another family business in the Isfahan province. The company designs, manufactures and distributes electronic vehicles, E-bikes, differential transmission systems (for Pride, Nissan Jounior and Tiba engines), and pinion and gear differential systems and parts.

Data collection to date has been achieved through questionnaires, interviews, and documentary evidence. Yin [27] suggests that the utilisation of multiple sources of evidence is one way of increasing the construct validity of case studies. A detailed structured questionnaire was filled in by two respondents in one case study and three in the second company and follow-up interviews have been conducted with the questionnaire respondents. The job roles of these respondents were:

Isfahan Bus Company

Head of IT: he was heavily involved in supporting main departments in specifying their requirements and in package selection. In implementation phase, he had regular meetings with department heads to progress check and make sure they understood the implementation process.

Head of quality control and engineering: he was on the steering group that was responsible for selecting and implementing the Total Systems solution. As main user and responsible for overall project quality, he represented individual departmental needs, and met with the head of IT regularly.

Head of commercial department: he worked closely with the head of IT in the selection and implementation processes, identifying and planning training for most of the staff.

Electronic Transmission Systems

Head of IT: he was involved in selecting the Total Systems package, but all main decisions were made by the company director

Head of human resources: he was not involved in the software selection process but has played an important role in post implementation in reviewing and proposing training needs for new systems users.

The questionnaire responses and follow-up interviews have clarified the processes and sub-processes that are central to the companies' business operations, and allowed a mapping of current technology deployment in each process area. More specifically, the topics included in the questionnaire can be categorised as follows:

a) Company information: basic company data, company profile, size, operations and other general information.
b) Company processes: the company's main business processes and also the secondary processes (sub-processes within each main process area).
c) Information systems: the deployment of information systems and the underpinning technical architecture.
d) Current systems status: the functionality of the main information systems and general satisfaction levels in different departments that use them.
e) Problems and challenges: key problems or issues, both from a technical perspective and from the point of view of the end user; integration and interfacing of systems, report quality, systems performance.

Questionnaires and interviews were conducted in Parsi and have been translated into English.

IV. CASE STUDY FINDINGS

This section will apply process mapping and systems profiling to the two manufacturing SMEs in Iran.

Case Study 1: The Isfahan Bus Company (IBC)

IBC has six major top level business processes and a number of sub-processes. These are briefly outlined below, along with the information systems which currently support them (Figure 1).

The *manufacturing process* comprises three sub-processes: production planning and production, quality control, and engineering. Production planning is automated via the materials requirements planning (MRP) module of the BEHKO system. This systems module assesses the requirements for production against current company stock and suggests replenishment works orders for the appropriate dates and quantities to meet production requirements. The system takes account of current stock levels, outstanding orders, and minimum purchase order quantities. It will suggest a schedule of what should be made and when, what should be purchased and when, and current and future loading of production lines, by resource by week. This sub-process includes the bill of materials (BOM) function. When the MRP module receives an order, it will also create a list of required components to make that order. The MRP module also has additional forward planning functionality. It has the capability to plan requirements for meeting new orders and rescheduling existing orders.

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In contrast, the quality control and engineering sub-processes are only partly automated. These sub-processes are supported by Microsoft Excel and Access to monitor, store and report upon key events and stock transactions. These include inspection and testing records, and inventory transactions for engineering parts.

The *sales and marketing process* is also supported by the BEHKO system. There are two sub-processes – sales management and marketing management, supported, respectively, by the BEHKO sales management module (that encompasses customer records, sales orders, price lists and quotation functions) and the BEHKO customer relationship management (CRM) module.

A customer record includes customer details, customer status, and customer discounts, and is linked to the sales ledger which shows outstanding invoices and displays these along with other real time data from BEHKO so that sales and purchasing staff have a total up-to-date view of pertinent financial data for each customer. The sales order function allows the entry and editing of sales order information and the generation of sales reports. The quotation function allows the processing of requested quotes for business and the generation of quotation reports to send to customers. The BEHKO CRM module provides the systems functionality to manage and report upon sales contacts, prospects, existing customers and suppliers, in support of improved customer service and better information availability across the internal customer facing processes.

The purchasing and procurement process centres on purchasing management and related operations. Purchasing management is supported by the BEHKO purchasing module, which provides a full range of purchasing functions. After the MRP module calculates requirements to fulfill a works order, a purchase requisition is generated electronically to be accessed by the purchasing department

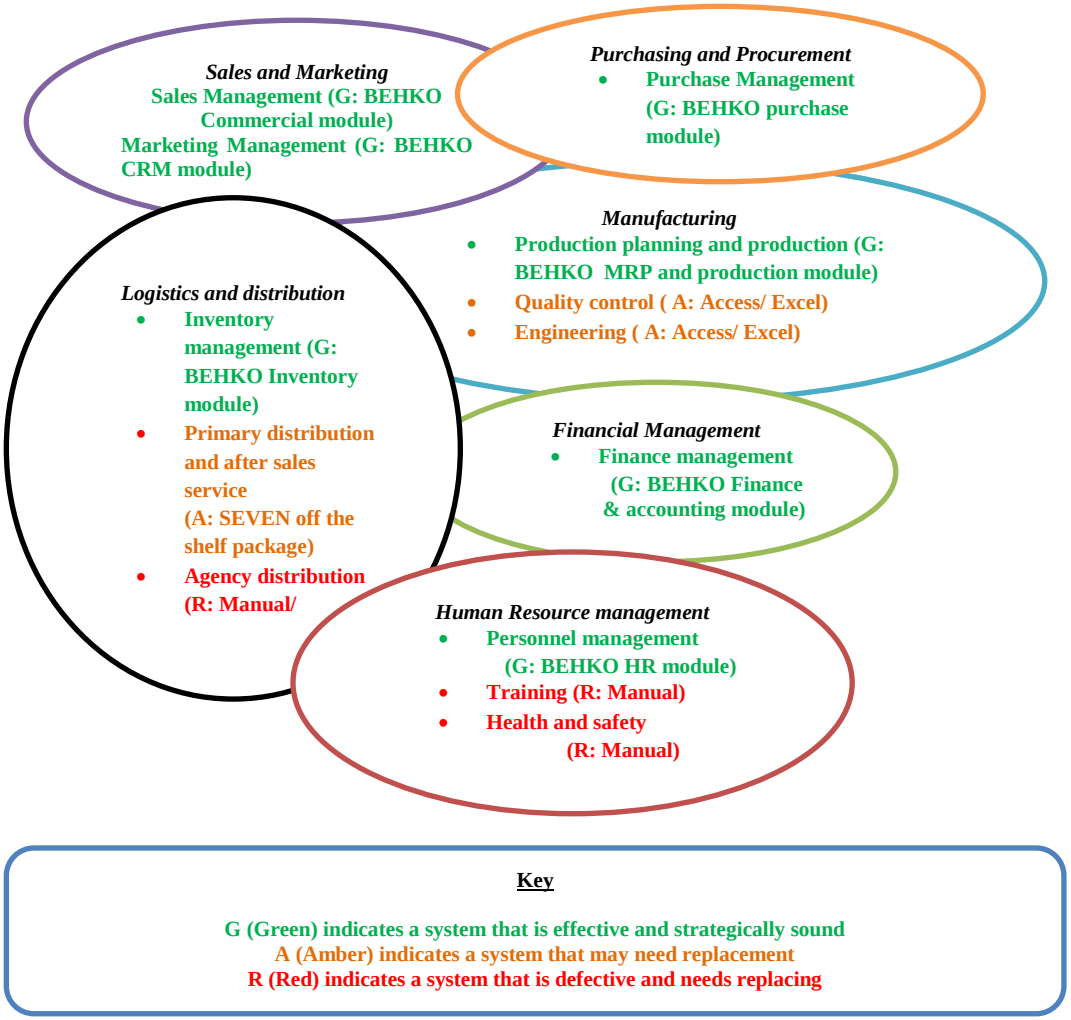

Figure 1. Main Business Processes and IS profiling at IBC

and processed as a purchase order on the system; copies are also made available electronically to the finance department. The BEHKO purchasing module generates unique supplier reference codes and provides purchase reports for each supplier. It also has the capability to assess suppliers' credit worthiness and overall supply performance, and also attach picture, voice or any other document to supplier files.

The *financial management* process is again supported by a BEHKO systems module – the finance and accounting module. This system reports the current sales order book (accounts receivable), purchase order book, outstanding purchase invoices and staff payments (accounts payable), alongside the company general ledger and cash management transactions. This system assesses current outstanding sales orders to raise sales invoice to customers, and matches goods received notes against purchase orders and purchase invoices. The module defines the financial period start and end dates and can accommodate a variety of foreign currencies and exchange rates.

The *logistics and distribution* process has three sub-processes - inventory management, primary distribution and aftersales services, and agency distribution. Inventory management is automated via the BEHKO stock control system. The primary distribution and aftersales services sub-process manages customers' orders to ensure customer delivery and post sales service. It is supported by an off the shelf after sales information systems package called SEVEN. The agency distribution sub-process involves the sale of spare parts for buses and other vehicles via company agencies located in different cities in Iran. This process is partly manual and partly automated by use of spreadsheets.

The *human resource (HR) management* process can be subdivided into three main sub-processes: personnel management handles employee records (including payment, staff absence and leave, and timesheet recording) and this is centrally managed and automated using the BEHKO HR systems module. There are also the staff training and health and safety sub- processes, which are mainly manual.

The information system strategy adopted at IBC has been to implement modules of the BEHKO total system in the core process areas of the business, some of which have been customized to meet the specific requirements of the company. BEHKO is an Iranian software company, and its selection was based on functionality, language – it uses both Parsi and English – and easy access for systems support and

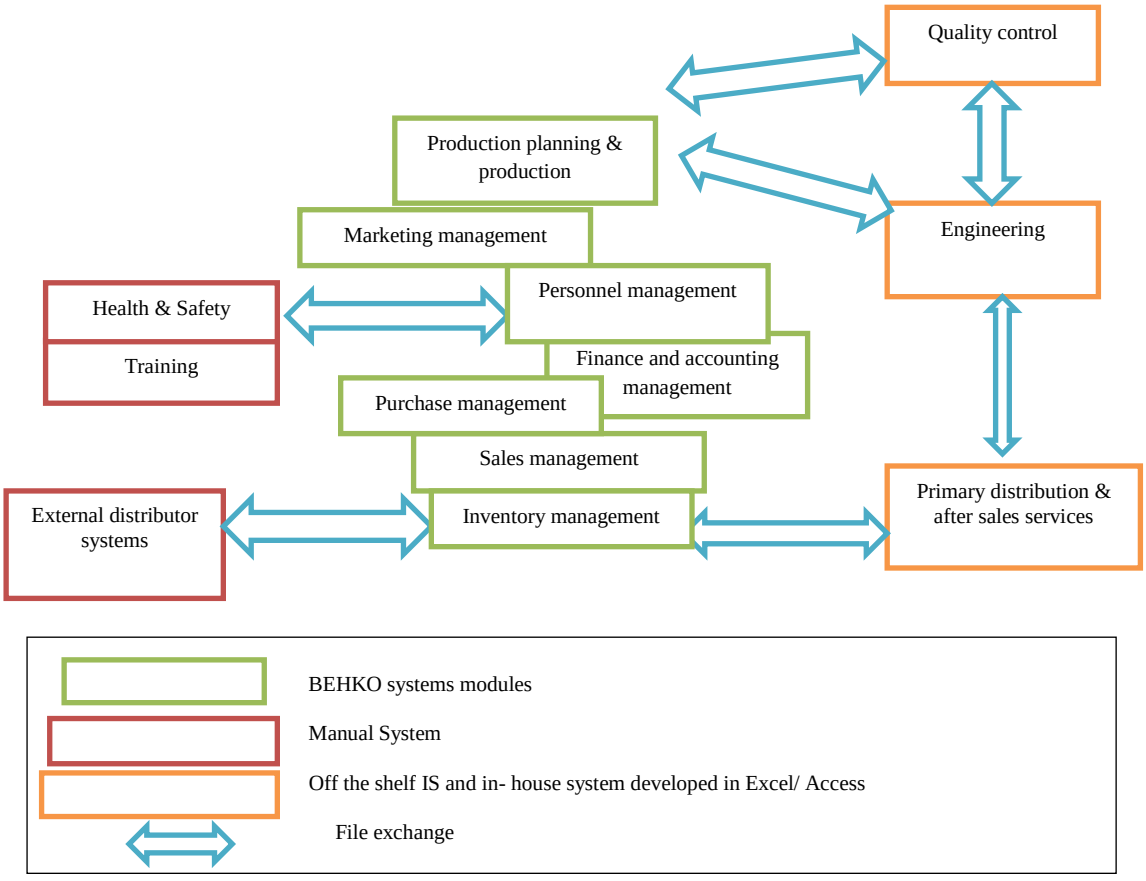

Figure 2. Systems Interfaces at IBC

upgrade. IBC pursued a phased implementation to enable a careful phasing out of previous systems and a managed exchange of data between old and new systems. In addition, it allowed staff to adapt to the changes in systems and procedures in an orderly and controlled manner. Many modules were customised based on requested requirements specified by senior management in each process area. In all, it took three years to implement the system, but even now some sub-processes are still manual or are supported by using spreadsheets and semi-automated file exchanges (Figure 2).

Although the BEHKO system modules are well integrated, there is no effective integration with the stand alone SEVEN system, or with the MS Excel and MS Access applications. The BEHKO system is developed in C++ and uses the SQL database and is administered by senior managers who have access to all system generated reports and invoices. These reports include key business performance information, providing an overview of all sales, purchases, stock levels, financial data and staff reports.

The current IS strategy at IBC was adopted in 2008 in support of the company's business strategy to expand production and drive up bottom-line company profit. The strategy was a formal decision made by a committee comprising selected managers from across all departments - commercial, finance, production, engineering, quality control, and the IT manager. Previous systems were a mix of off the shelf packages and end-user applications. The initial focus was to be on the in the logistics and distribution process area, to establish consistent inventory product codes and simplify and standardise product information for both internal processes and also for customer facing sales and marketing departments. After a successful six month parallel run of old and new systems in this area in 2008, the BEHKO systems modules were introduced in stages, completing in 2012. The software vendor continues to provide support and upgrades, IBC is now planning a major upgrade to the BEHKO ERP product in 2017. This package includes improved functionality which should allow the replacement of the SEVEN package and other standalone applications.

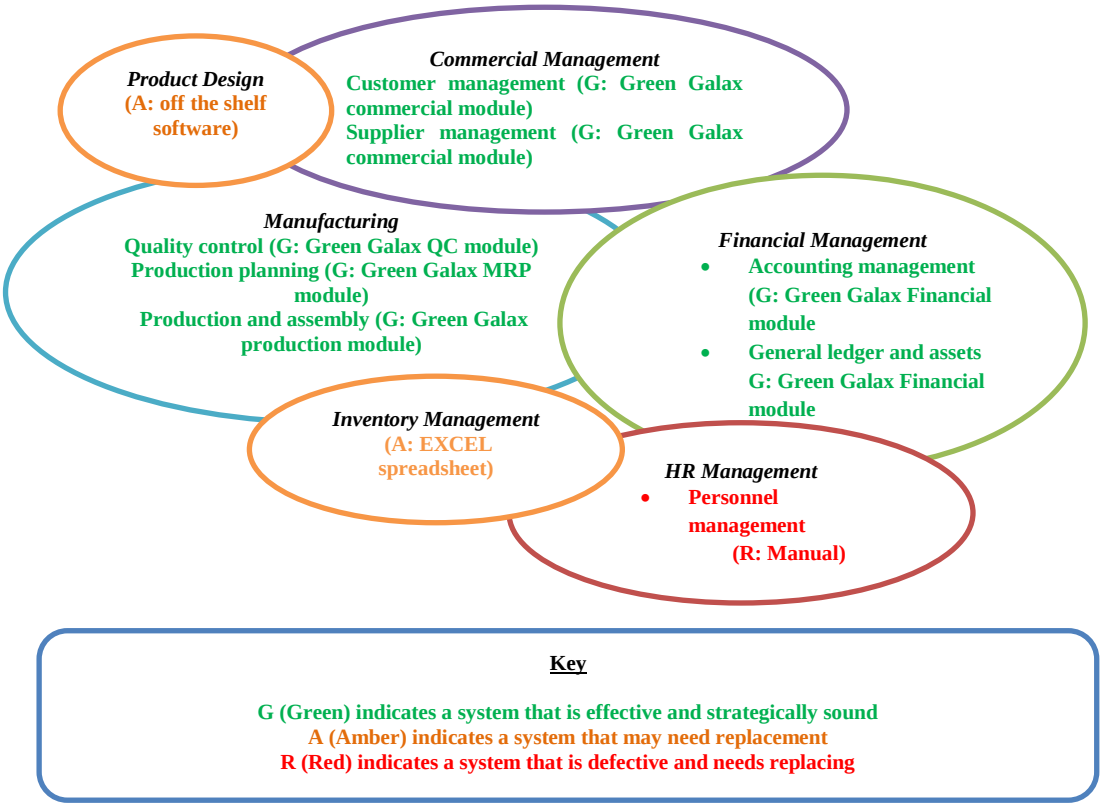

Figure 3. Main Business Processes and IS profiling at ETS

Case Study 2: Electronic Transmission Systems (ETS)

Initial process mapping suggests there are six top level business processes, and each process has several sub-processes. The processes are depicted in Figure 3, along with the information systems which currently support these business processes.

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The *manufacturing process* comprises three sub-processes: quality control, production planning, and production and assembly. The quality control sub-process encompasses the inspection of both purchased and manufactured parts and products, and the recording and monitoring of test results. The GREEN/GALAX quality control module records and manages all data associated with product sampling, testing and results recording and reporting. Security aspects are supported by systems controls on access, allowing only staff with the required skills and competence levels to undertake inspection testing.

The production planning sub-process is automated with the GREEN/GALAX materials requirements planning (MRP) module, which determines the quantity and timing of component purchases. MRP stores the bills of materials and explodes these into requirements, based on received orders, and will then compare the demands to available company stock to generate necessary procurement requirements. The production and assembly sub-process encompasses production control and final inspection operations. The GREEN/GALAX production module also provides time estimates for parts delivery at production line and for final inspection of finished products. The production team can attach drawings of product designs and technical specifications to job sheet records.

The *inventory management* process covers stock control and is partly automated with MS Excel spreadsheets monitoring manufactured and component products in and out of the stockrooms. The *product design* process is automated with a range of off the shelf design and planning software packages, including Catia V5R18, MSC Super Forge, Master CAM 9.0, Autodesk Mechanical desktop 2007, Power Mill 6.0, Primavera Project planner, MS project 2007, and Minitab 13.0. This process encompasses the design and drawing of company products based on received orders and customer specifications.

The *commercial management* process has two sub-processes - customer management and supplier management – and both are supported by the GREEN/GALAX commercial management module. This module supports the categorization and management of both customers and suppliers, and recording of relevant details. The *financial management* process is similarly supported by a GREEN/ GALAX module. There are two sub-processes: accounts management, and general ledger and asset management. The system manages financial activities, financial figures and reports and invoices; it contains the ledgers for sales and purchase transactions, and records company assets, liabilities, owners' equity, revenue, and expenses.

The *human resource management* process covers personnel management, including employee records, staff absence and leave, and timesheets. The process is mainly manual. Employees have their own identity and attendance card, which are checked and monitored by security guards at

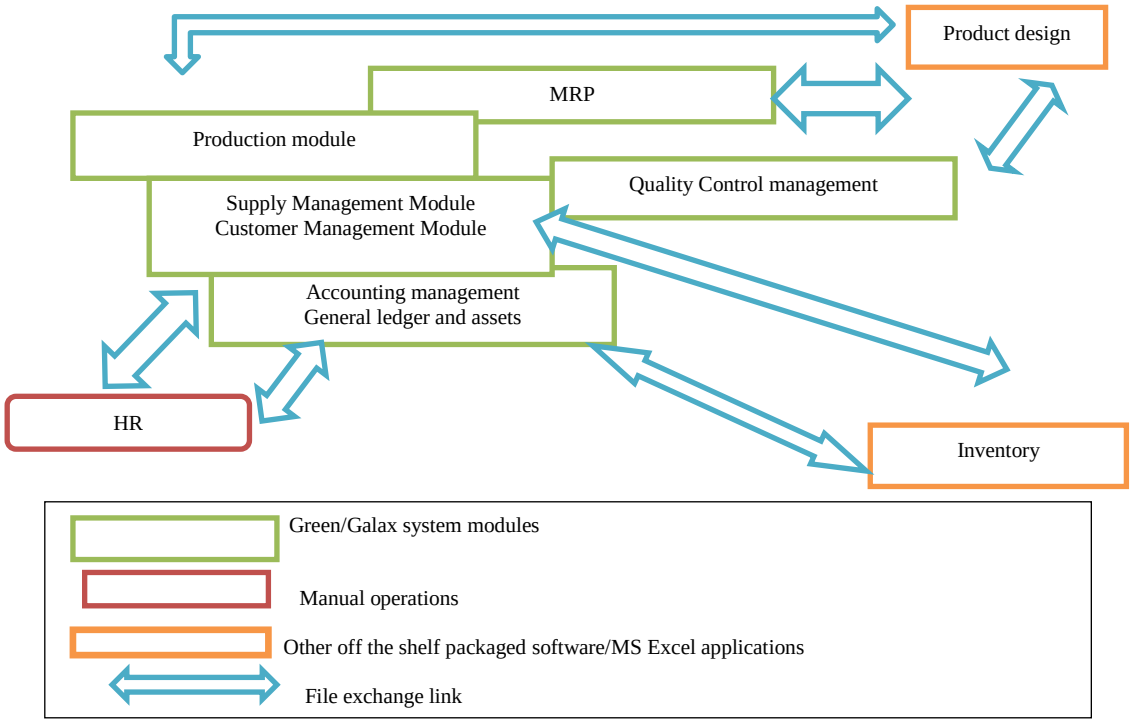

Figure 4. Systems Interfaces at ETS

the company entrance. Annual leave is also authorised and recorded by a manual, paper-based system.

The information system strategy adopted at ETS is based on the GREEN/GALAX Total Systems package, combined with point solutions developed in MS Excel. The choice of the main software system again was influenced by the fact that it was available in the Parsi language and there was easy access to software support and technical advisors.

The current IS strategy was adopted in 2014 and was a formal decision made by the IT manager in conjunction with the company director. Modules of the GREEN/GALAX were implemented simultaneously in core business functions. Unfortunately, training was poor and insufficient and there have been significant user issues with some departments reverting to previous semi-manual processes. There also remain a number of file exchange operations whereby data is extracted from the GREEN/GALAX system and input into standalone applications for inventory management and product design (see Figure 4). In 2015, external consultants were engaged to review the status of the ERP project and specifically to provide training and user support. Despite this initiative, there remain significant issues to address. The implementation of new modules has not been adequately coordinated with changes in people capability. The HR system needs to be automated and integrated with finance and the accounting department to prevent duplication and data inconsistencies in payroll. Similarly, the inventory management module of the GREEN/GALAX system needs to be ushered in to provide consistent product codes and enhance the capability and functionality of company business activities. The company needs to address the training issue to encourage and support staff in using all of the available functions in the new system.

V. CONCLUDING REMARKS

The current information system strategies at both IBC and ETS have some similarities. Both companies elected to adopt a Total Systems package, from Iranian based software suppliers, to provide the benefits of integrated systems and consistent management information to support company growth aspirations. In both companies, however, some of the old legacy systems remain in some core process areas, and these should be replaced in the near future with appropriate Total Systems modules.

There were significant differences between the two companies' strategy implementation approaches. At IBC, the strategy development and its implementation was agreed to, and guided by, a cross-departmental steering group that carefully managed a staged implementation, providing the necessary training and support for end-users. At ETS, the package selection process was more the result of discussions between the IT manager and the company director, and lacked cross-company involvement and support. Implementation was simultaneous in most process areas, increasing the risk of systems problems and data issues. This was compounded by the absence of adequate training and support for end-users, which left the project in a parlous state. Only recently has the engagement of third party support helped to provide much needed training and bed in the new systems modules.

This initial analysis reinforces the findings of Heeks [22] and other recent studies [28][29] that suggest large scale technology implementation, even in SMEs, must be accompanied by appropriate process improvement and an upgrade in people skills to accommodate the new ways of working that are often introduced with new systems modules. At IBC, where a cross-departmental steering group guided and controlled the project, this was largely achieved; but at ETS, the lack of a similar project management capability constituted a major risk to successful project outcomes, which is only now being adequately addressed.

The research outcomes also provide some interesting insights into the ERP market in Iran, where, with international sanctions now lifted, the opportunities for western based ERP vendors are likely to be enhanced. However, the home-grown Total Systems packages, which exhibit a similar modular structure to the ERP packages used in the West, have an established user base which is likely to grow, in the short-term at least, given the benefits of customisation and bi-lingual operation that most of these packages offer. Nevertheless, the research to date is just a "snapshot" of the current situation and recent history in two small manufacturing SMEs and it is unwise to make broader generalisations from just these two cases. To address this limitation, other company case studies are now being undertaken, and it is expected that this will allow the development of an implementation model for ERP products in the specific environment of Iranian manufacturing SMEs, that will be useable in future systems projects in the country.

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