

PRACTICAL APPLICATION OF ENTERPRISE ARCHITECTURE, STUDY CASE OF SME METALMECHANIC IN MEXICO

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Abstract

Small and Medium Enterprises are important in the world economy, according to statistics have a low level of survival and are facing serious problems like access to financing, weak management capacity, poor information about market opportunities, new technologies and methods of work organization and limited information about access to innovation and research funds. These firms have opportunity areas in the integration of its key processes into information and communication technologies; the methodology of Enterprise Architecture can provide them a model of integration supported with strategic planning.

Integrated by partial architectures like business, applications and technology; each partial architecture has components that differ from each other. The architecture has been designed with the data of the firm of the study case resulting in the identification of strategic changes supported by the methodology, assessment of option for change and a change plan for the adoption of the methodology in their processes.

This paper is the practical application of the architecture, result of two year of research in mediums enterprises ending with the designing and implementing in the study case.

Keywords: Enterprise Architecture, SME, Metal mechanic Industry

Introduction:

The manufacturing industry in Mexico has a great potential of growth, especially in the northern area, where the automotive cluster is located with important firms like General Motors and Chrysler. Small and Medium Enterprises (SME's) are strategic link in the supply chain that provide products and services to large enterprises.

In the adoption of new methods for organization of work has been placed the Enterprise Architecture methodology. Enterprise Architecture (EA) is a methodology that aims to provide companies with a framework for the use of the information in business processes in ways that support the business strategy, provide the strategic alignment between the business strategy and information and communication technologies (ICT).

Some frameworks have been created for providing a guide or method for the establishing of the EA, these are:

- The Zachman Framework.
- The Department of Defense Architecture Framework (DoDAF).

- The Open Group Architecture Framework (TOGAF).

The Zachman Framework was created by Jhon Zachman in the early 60's at International Business Machines (IBM) Corporation, who developed a framework for to define the information systems. Combining rows and columns that representing perspectives or views and descriptions types; the perspectives are: scope, business model, systems model, technology model, detailed representations and company performance. The description's types are: data, function, network, people, time and motivation the Figure 1 shows the Zachman Framework with its elements. Each celd contains a set of elements that represent diagrams or documents on the specific architecture and level of detail, for example in the column of the functions or processes with line of objectives and scope, the cell has a list of processes that run the business, Ylimaki and Halttunen says that all the columns and rows are important because are abstractions of the company and each celd must include a primitive graphical model that describe the company from the viewpoint of the perspective that is analizaing.

ENTERPRISE ARCHITECTURE - A FRAMEWORK TM

	DATA (Data)	FUNCTION (Function)	NETWORK (Network)	PEOPLE (People)	TIME (Time)	MOTIVATION (Motivation)	
SCOPE (CONTEXTUAL) Planner Ends/Mean = Class of Business Thing E.g. Scenario Model	List of Things Important to the Business 	List of Processes the Business Performs 	List of Locations in which the Business Operates 	List of Organizations important to the Business 	List of Events/Cycles Significant to the Business 	List of Business Goals/Strategies 	SCOPE (CONTEXTUAL) Planner
BUSINESS MODEL (CONCEPTUAL) Owner End = Business Entity Mean = Business Relationship E.g. Logical Data Model							BUSINESS MODEL (CONCEPTUAL) Owner
SYSTEM MODEL (LOGICAL) Designer End = Data Entity Mean = Data Relationship E.g. Physical Data Model							SYSTEM MODEL (LOGICAL) Designer
TECHNOLOGY MODEL (PHYSICAL) Builder End = Component/Technology Mean = Relationship E.g. Data Definition							TECHNOLOGY MODEL (PHYSICAL) Builder
DETAILED REPRESENTATIONS (OUT-OF-CONTEXT) Sub-Contractor End = Field Mean = Instance E.g. DATA							DETAILED REPRESENTATIONS (OUT-OF-CONTEXT) Sub-Contractor
FUNCTIONING ENTERPRISE	DATA	FUNCTION	NETWORK	ORGANIZATION	SCHEDULE	STRATEGY	FUNCTIONING ENTERPRISE

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Figure 1 The Zachman Framework extended, source:

The Zachman Framework established the basis for the next generations of frameworks.

The Department of Defense of the United States Of America created in 1994 its own framework the Technical Architectural Framework for Information Management (TAFIM), which was withdrawn and donated to the association The Open Group, who subsequently developed the standard TOGAF.

TOGAF is based in the Architectural Development Method (ADM), whit 9 phases represented in Figure 2, where these phases are: Preliminary analysis, architecture vision, business architecture, information systems architectures, technology architecture, opportunities and solutions, migration plan, implementation of governance and architecture change management. All these components of TOGAF generate deliverables in form of diagrams, flowcharts, structures, definitions and other artifacts.

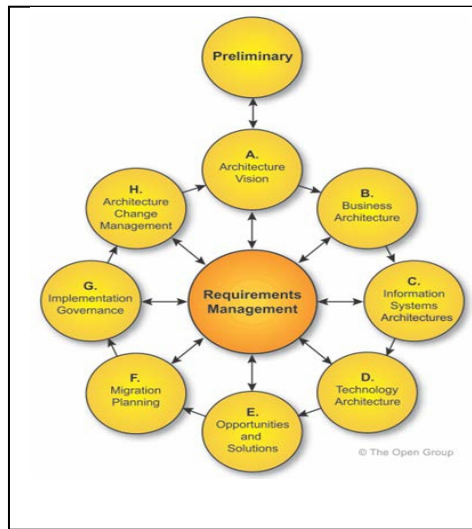


Figure 2 Phases of TOGAF, source

Every framework has a common factor, the empowerment of the company through the ICT, searching increases the productivity and the competitiveness. With the increment of complexity in the companies the needs of data processing are increasingly . In this case has been taken references about TOGAF and Zachman Framework for construct the design proposal of the architecture, software designing tools like Enterprise Architect³⁶ and the editor Protégé Ontology Editor version 3.4³⁷, have been used for the management of the data in the architecture design.

I.

Research and studies in Europe indicate that the EA is a driver for transformations in companies , Orantes, Gutierrez and Lopez mentioned that the company should be constantly evolving, redefining business processes to achieve business architecture (BA) which is the basis for subsequent architectures .

With these premises, have been constructed the partial architectures, the first is the business architecture.

Business Architecture

The purpose of the BA is to define the business, documenting organizational structure, identifying and defining business functions and processes relying on strategic planning with their areas of interest. The BA involucres some elements of the company like mission, vision, objectives, goals, values and policies; business processes, procedures and functions; organizational structure, situational analysis, customers, markets, products and long, medium and short strategies.

The company of the study case is a medium enterprise that provide raw material to the large steel companies in northeast of Mexico, was founded in 1982 to meet the needs of the industry in the manufacture and machining of metal parts, the machined parts are made through computerized numerical control machines (CNC), the main products manufactured are generally forklift parts, rotating joints, plates thousand holes (clamps, screws, etc) and

³⁶ Enterprise Architect is trademark of Sparx Systems Corporation www.sparxsystems.com

³⁷ Protégé Ontology Editor is an editor developed by Stanford University <http://protege.stanford.edu>

various mechanical equipment parts and assembly work. The company has 65 employees. The Figure 3 and Table I presents the data for the BA, with some of its elements.



Figure 3 Elements of the BA

Table I Processes organized by area

Core Processes/ Company area	Process1	Process2	Process3
Distribution	Management of the delivery of the finished products.		
Finance	Management Company's finances		
Human Resources	Personnel administration	Detect training needs of business areas, especially productive areas for develop entrepreneurial training program	
IT	Provision of information technology, support for company's business processes		
Quality	Check during the manufacture that meets production the specifications levels	Testing and inspection using ultrasonic methods or industrial inspection	Identify causes of non-conformity in items or lots and take corrective action
Sales & Marketing	Management clients.	Continuous communication with customers to identify needs and complaints.	
Product development	Program production cycles	Cutting, marking, machining and forming of steel plates and profiles	Management of the manufacturing process, Calibrate equipment periodically

In the Table I Elements of the BA are presented, organized by business area, the core processes are described, all for achieving the objectives and goals of the company.

The structure of the company has 4 levels, corresponding to the CEO and Sales manager the tops position, Head of production machining, Head buyer, Head finance and Human resource manager, and other levels has Supervisors for machining and pailer areas.

Compete in the regional market of Mexico and has a local quality certification, the strategy is to produce with high quality that markets demanding.

Application Architecture

The application architecture contains the software products that the company has for support the processes; objectives, principles and capabilities that govern this architecture are presented in Table II.

Table II Objective, principles and capabilities

AA, Application Architecture	Name	Description
Objective	Define the best kinds of applications to manage data and support business processes	Define the best applications that support the business processes
Principle	Customizing minimum packaged applications	Minimize app package, customization will improve the ability to ensure ongoing maintenance and maximum value obtained from the adoption of a package solution
Capabilities	Analysis, design, programming and implementation of information systems Search packaged solutions tailored to the needs of the SME's Provide technical support for software and hardware throughout the company	Domain in the analysis, design, programming and implementation of IS Domain in search packaged solutions tailored to the needs of the SME's Domain to provide technical support for software and hardware

The objective of AA is “Define the best kinds of applications to manage data and support business processes with minimum packaged applications, the capabilities for the management of the AA are “Analysis, design, programming and implementation of information systems, search packaged solutions tailored to the needs of the SME's and provide technical support for software and hardware in all the company. Some of the current applications are presented in Table III. In this case the applications are related to the processes that support in the firm.

Table III Values for instances of the AA

Name	Description	Performed by the rol	Domain of App	Performed by business processes	
Domain	Stock Information System	Management of the inputs and outputs of the company general store	Stock Warehouse manager	Update catalog of items,Articles inventory processing	Registry inputs and outputs of goods and raw materials.
	Quality	Spreadsheets records quality of finished products	Quality	Data of finished products according to production plan	Verify the manufacturing process according to specifications with production
	Client IS	Manage Client Portfolio	Sales, Head of Sales	Update Clients Portfolio,Electronic Billing	Manage Client Portfolio

Technology Architecture

The technology architecture (TA) represent the computational equipment that support the applications for operation of the company. The objectives, principles and capabilities of TA are displayed in Table IV.

Table IV Basis for TA

TA: Technological Architecture	Name	Description	Support Technology Principle	Capabilities
Objective	Technology infrastructure consolidation	The technology infrastructure will be consolidated in the company	Minimum diversity of technological products	Services management software, hardware platform services
Principle	Minimum diversity of technology products	Minimum diversity for better maintenance of equipment		
Capabilities	Communication and networking services Security services and technical support Software management services Hardware platform services Integration and implementation services Monitoring services	Ability to acquire, install and configure networking and communication. Ability to detect and correct faults in computer equipment Ability to manage all software Ability to manage hardware platforms Ability to integrate data from various sources Ability to monitor processes		

The consolidation of the technology infrastructure is the main objective with minimum diversity for maintenance purposes. The capabilities are complex because TA manages communications, networks, provides technical support and various services like platforms, integration and monitoring. The Figure 4 presents the equipment.

The company has one server with 9 computers in the local area network, one shared printer provides printing services. Areas like quality, purchasing, sales, production, design, finances, human resources and the CEO are supported by the equipment. In one equipment can be runned various applications.

The Table V summarizes the results of the architectures integration with processes, applications and technology that supports the application.

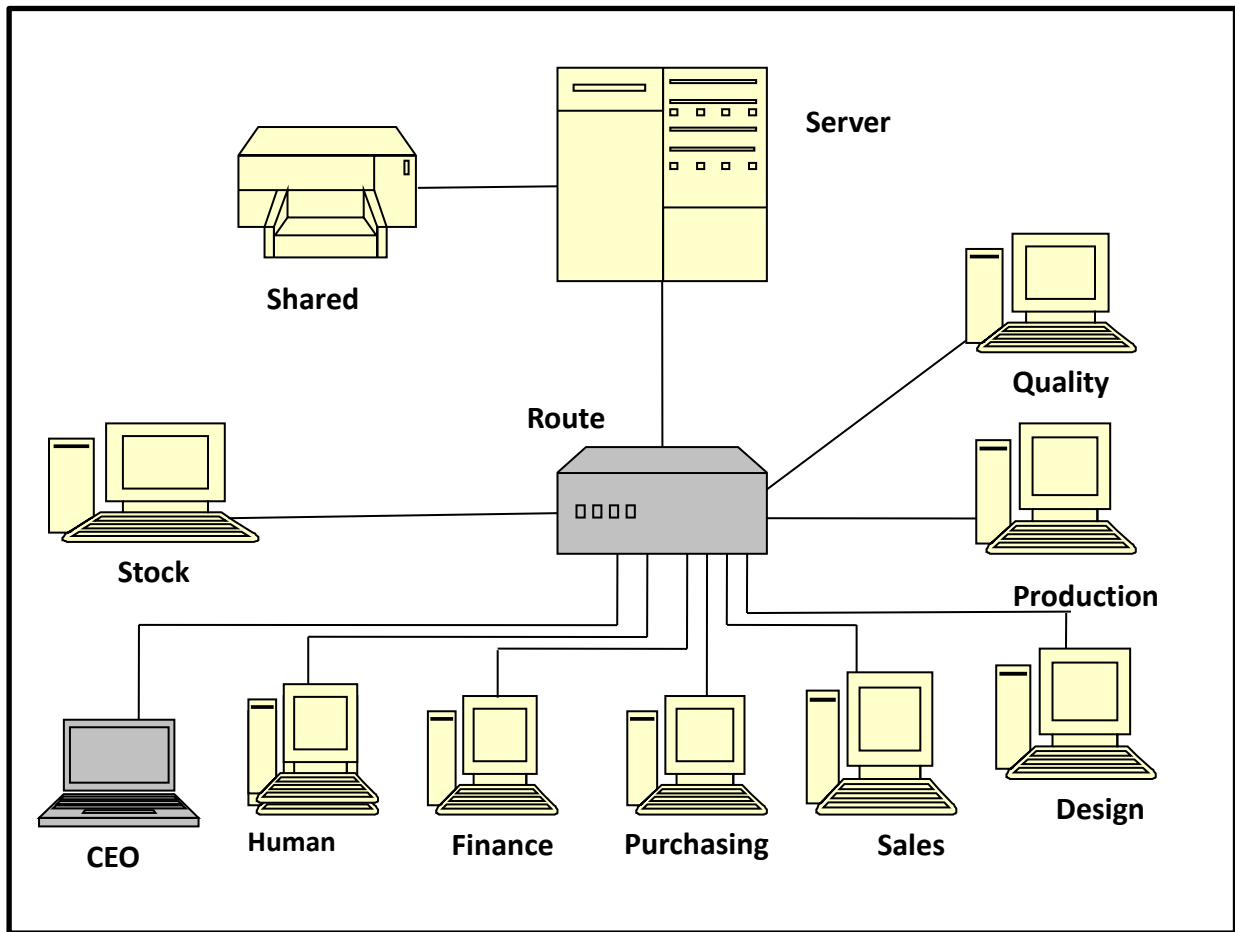


Figure 4 the computational equipment

The Change plan and assesment of the options change

Two processes are not supported by applications and technology, these are: Training and Shipment. The assessment of the options change includes costs for developing projects in these processes. Involving equipment, people, programs, time and the integration with other information systems

Gaps identified by applying the methodology

- Organizational restructuring, strategy long-term growth, investment in ICT to increase competitiveness and growth into new domestic and international markets.
- Establish a definition of roles and functions and policies for recategorizing.
- Get an open line of credit to finance the plan expansion and the purchase of equipment and machinery.
- Competition is intense in this sector of the industry, to achieve a better position in the market is necessary to identify and select new potential customers, increase advertising in all media, expand sales channels and follow up to the customer service.
- Fostering a culture of total quality in whole company.
- The change plan is long term and includes management activities to be closing gaps encountered and the adquisition and implementation of information systems and technology.

Table V Results of integration

Areas	Process 1	Process 2	Process 3	Process 4	Application	Technology
Quality	Controls of input materials, componentes and cosumables	Verify the production plan meets especifications	Testing and inspection using ultrasonic methods or industrial inspection	Identify causes of non.conformity in items or lots and take corrective action	Spreadsheets	Computer connected to LAN and internet access
Training	Planning and monitoring The Training Business Plan	Detect training needs of business areas, especially productive areas			<u>There is no application for this process</u>	<u>There is no technology for this process</u>
Shipments	Shipment management of finished products				<u>There is no application for this process</u>	<u>There is no technology for this process</u>
Billing	Billing management				Billing information system	Computer connected to LAN and internet access
Production / Machining and Pailer	Program production cycles	Cutting, marking, machining and forming plates and steel profiles	Management of fabrication process	Calibrate equipment periodically	Production information system	Computer connected to LAN and internet access
Sales	Sales management	Detecting customer needs			Clients Information System	Computer connected to LAN and internet access

Conclusion:

The Enterprise Architecture methodology applied in this medium business has detected the elements shown with a strong emphasis on the changes that are required for the purpose of aligning the processes with ICT.

The application of the methodology has been successful in the mid-market as it has produced a series of changes within the company to achieve the integration of processes which has improved production rates and competitiveness.

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