3 BI in context – a conceptual model

"An organization's ability to learn and translate that learning into action rapidly, is the ultimate competitive advantage."

Jack Welch
Chairman, General Electric

3.1 Introduction

Someone once commented that the only constant in our lives is change. Human beings become older, sometimes wiser. Governments change, the value of money changes, motor cars change, technology develops, modes of communication change, lifestyles change, toys change, society changes, job content changes, rules and legislation change, tax on cigarettes and liquor changes …

Most of the time change is a good thing. Even changes that are perceived to be bad at the time can have positive end results – think about the creative destruction of job opportunities as illustrated in **Table 3** earlier on. Although people are normally change resistant, very few people would argue today that they prefer telegraphs to cell phones, or horse carriages to modern motorcars.

In situations where people are not directly involved, engineers have been quite successful in designing control systems to handle change. For example, sophisticated control systems would open more water gates in a dam when the water reaches certain levels and would close those water gates when the level drops below another level. Industrial engineers would calculate re-order points for stock replenishment and nowadays orders can be generated automatically to the preferred supplier, should the organization wish to do so. These control systems work well when the triggering event and the action that must follow can be logically defined in "If, Then" statements. For example, "If the stock level of part A is equal to or less than 100 and an order has not been placed, then order 1000 items from supplier XYZ". This implies that the control system has access to certain information and that the information is updated regularly.

Now what a pleasure (or bore!) business would have been if all business decisions could have been automated! Truth is, many business decisions do not have exact cause and effect patterns that can be followed. The same decision in different businesses (or even at different times in the same business) could have completely different results. The aim of this chapter is to propose a qualitative control system for businesses where business intelligence is put into context as the cornerstone of such a control system.

3.2 Overview of the Bigger Picture BI Context Model

For many people BI is a fancy name for boardroom reports, graphs and drill down tables, perhaps because it gets so much attention in demonstration sessions from BI vendors. Although it also includes the delivery of information in a professional and easy to understand format, BI should be seen in a much broader perspective. **Figure 67** gives an overview of this broader perspective, which will be described in more detail in this chapter. This diagram forms the foundation of the contribution by the author.

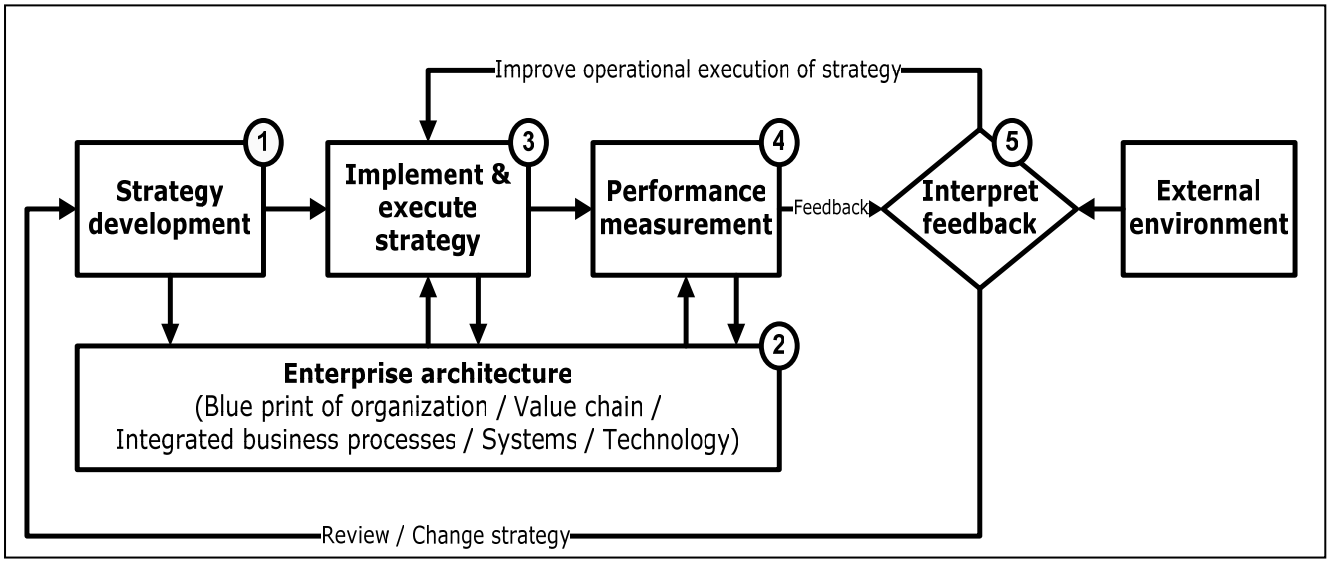

Figure 67. An overview of the Bigger Picture BI Context Model.

The diagram provides a conceptual framework for a qualitative control system in business, comprising of the following process steps:

- Business strategy development
- Enterprise architecture and modelling
- Implementation and execution of the selected strategy
- Capturing data for performance measurement in a data warehouse environment
- Interpretation of the feedback from the performance measurement system, taking into account inputs from the external environment
- Improvement of the operational execution of the strategy, or review and change of the strategy, based on the interpretation of the previous step
- Continuous updates of the enterprise architecture as and when the strategy, execution of the strategy, the performance measurement and the underlying business processes and systems change

It is in essence not a complex model, but it brings together a variety of subjects that are not normally discussed in the same context and are often focused on by different groups of people. The aim is to bridge the gap that often exists between strategy development and strategy execution – also known as the alignment problem.

The following paragraphs will elaborate on the detail of each step. The idea is not to be prescriptive in which tools or techniques to use, but to indicate typical mechanisms that will support each step.

3.2.1 Strategy development

Apart from the traditional approach that starts with a vision and mission statement, exploration of the macro and microenvironment, SWOT (strengths, weaknesses, opportunities and threats) analysis, identification of goals and the action plans that flow from that, the literature has also revealed a number of other approaches that can be used during this step.

Grulke (2001) has identified the following, which can help in the development of strategy:

- The deliberate effort that businesses should put into their strategic thinking to avoid the typical second half characteristics in the business life cycle (see **Figure 9**) – in other words to stay customer focused and improve value through radical innovations.
- The concept of the Innovation Matrix (see **Figure 10**) – The ideal is a good spread between the quadrants with 10-20% of its revenue being invested in carefully selected radical projects.
- Learning from the Future approach (see **Figure 11**). After creating the ideal future of choice, based on first divergent thinking about the future environment and the future market, followed by convergent thinking to define the future business, the strategic team is faced with the task of "looking back from the future" and identifying the sequence of actions that were taken to get there.

Manning (2001) has provided the idea that strategic management should be a constant conversation between the strategy makers and the strategy executors – that it is all about making choices, winning votes from all the stakeholders and building the strategic IQ of all the people in the organization.

He has also identified ten concepts that are important in the strategic management process (see paragraph 2.3.4.2) before describing the following process tools to assist in defining a workable strategy:

- Checking if the business logic adds up (see **Figure 17**) – asking questions about the business opportunity, purpose, recipe, priorities and actions, resources and capabilities within the context of stakeholder ambitions and external factors.
- Frameworks to learn your business (see **Figure 18**) by first analysing the competitive environment and then formulating a value proposition.
- Five building blocks of the strategic plan (see **Figure 19**) – answering a set of 20 detail questions to define the five main questions relating to purpose, business recipe, organizational character, goals/priorities/actions, and strategic conversation.
- The concept that the market is competing in terms of business models with regard to the 7 Ps (see **Figure 20**) – purpose, product, positioning, partners, people, processes and philosophies.
- The Strategy Wheel (see **Figure 21**) to identify and prioritise the strategic issues that need attention at a specific point in time. Innovation is suggested to handle these issues and a suggested 30 day interval between reviews of the Strategy Wheel ensures that those items get urgent attention.

To identify various scenarios from which strategic decisions can be made, Ilbury and Sunter (2001) suggested the use of scenario planning. Their Foxy Matrix approach (see **Figure 22**) provides a conceptual framework for a thought process that takes one through the matrix consisting of four quadrants, representing the stages of identifying the rules of the game, identifying key uncertainties and the scenarios that they imply, identifying options for each scenario and eventually making decisions regarding the options.

In conjunction with colleagues at Fourier Approach (Pty) Ltd the author has also developed another conceptual tool that is useful in the development of strategy – for purposes of this study called the Fourier Model. It consists of a number of concentric rings around a core of functional areas that are relevant to the business. The first ring around this core identifies products and services that can be related to that functional area. These related products and services normally fall into the following categories:

- Generic knowledge of the discipline
- Specific products related to the discipline

- Product knowledge to be able to implement, integrate, maintain or enhance the product
- Market information regarding the functional area

Since there can be multiple identified functional areas, these areas and their related products and services can be visualised as wheels on top of each other around a vertical axis.

The second ring from the core represents the different business entities that are providing those products and services. These entities could include various departments in your organization, but can also list external organizations with which you have partnership agreements, as well as competitors who also provide those products and services.

The third ring from the core represents integrated solutions that form the interface between the product and services offering from the inside and the market requirements on the outside. This ring could include typical pre-packed solutions, but is also used to configure unique solutions that could include components from various functional areas being supplied by different business entities. One can visualise the marketing person who has already gathered the requirements from the client in the market standing in this third ring and moving up and down through the functional area wheels with their products and services and selecting the most appropriate entity (or entities) to deliver the integrated solution.

The fourth ring from the core identifies the market segments in which the organization wishes to operate. It could also identify clients and potential clients by name.

See **Figure 68** for a graphical representation of the model.

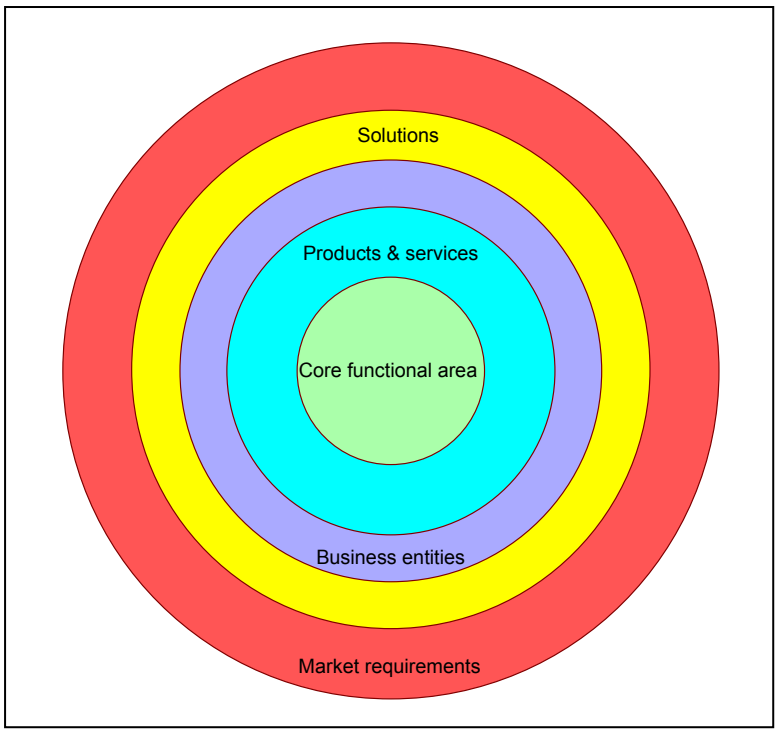

Figure 68. The Fourier Model.

Even though the figure shows the concentric rings in two dimensions, the reader should visualize a three dimensional structure with layers, or rings, for each functional area. The

solution ring represents integrated solutions where components from various functional areas, products and services, as well as various business entities are packaged together to satisfy the needs of a specific client or market segment.

By going through the identification of the functional areas, products and services and related business entities from the inside and identifying target markets and their requirements from the outside, one is able to make various strategic decisions in terms of the priorities of functional areas, partnership agreements, etc.. Enterprise architecture tools facilitate the definition of the components of each concentric circle and the associations between these components very well. A logical entity relational diagram (ERD), without any associative entities to resolve the many-to-many relationships, is shown in **Figure 69**.

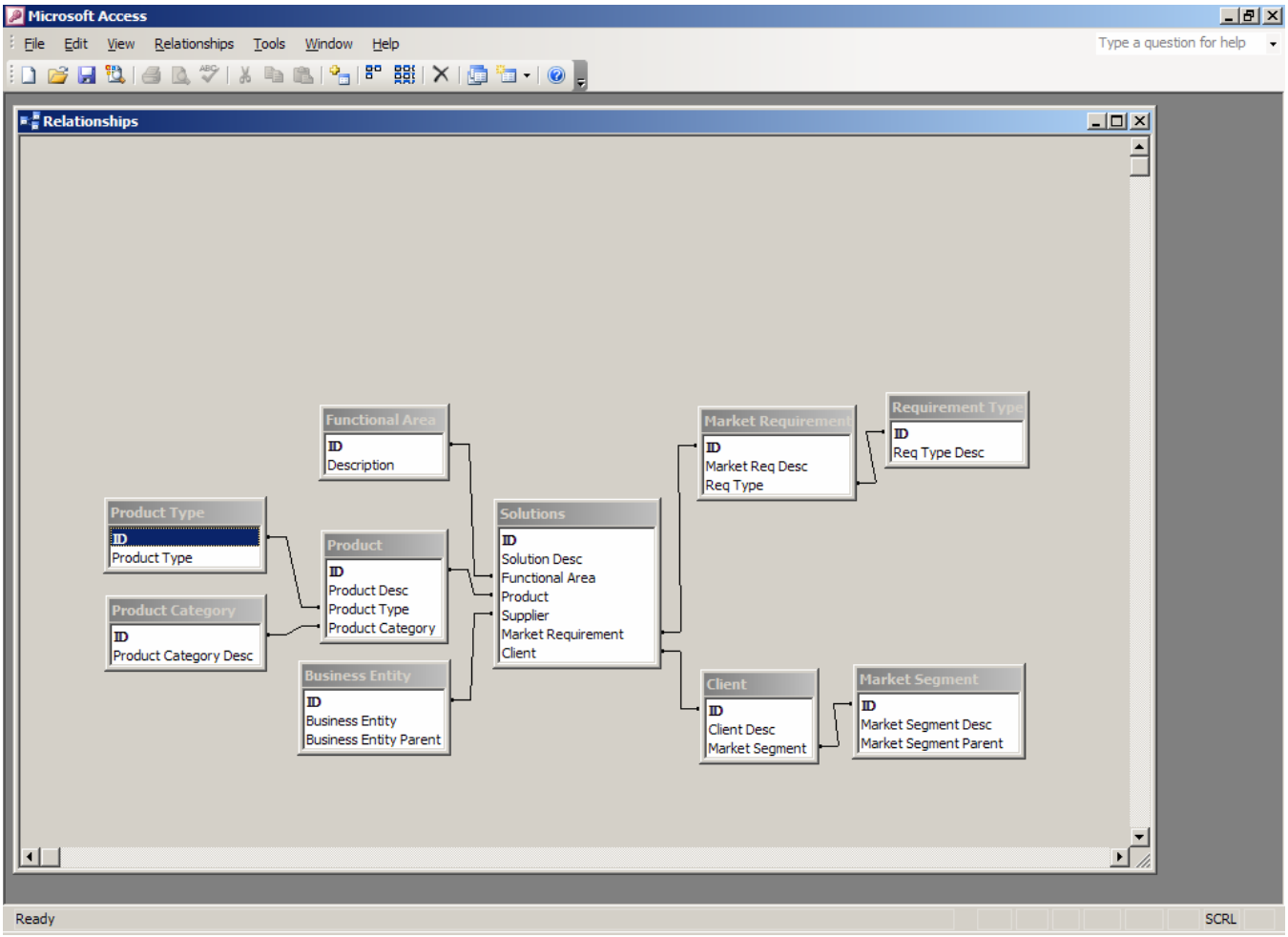

Figure 69. Logical ERD of the Fourier Model

The use of these conceptual frameworks from Grulke, Manning, Ilbury and Sunter and the author will be demonstrated in the next chapter.

3.2.2 Enterprise architecture

3.2.2.1 Selection of methodology

This component in the qualitative control system provides the same function as the blue print drawings, or data pack, of a big building. It provides the documented configuration baseline of the business in terms of organizational structure, the value chain and business processes, products and services, clients, systems and technology.

Although various enterprise architecture models were discussed in the literature study, the Zachman Framework provides enough substance for the overall configuration management and central repository functions that it should fulfil in the Bigger Picture BI Context Model. (See **Figure 26**.) The framework does not only make provision for the investigative questions What, How, Where, Who, When and Why, but also looks at the enterprise from the perspective of different role players, namely the planner, owner, designer, builder and sub-contractor.

The power of this thorough approach is revealed in the lists, or hierarchies, of information that are compiled – and even more so in the multiple associations that can and should be defined between the various dimensions. For example, by linking all business processes to business goals or strategies, one may discover redundant processes or at least be able to define the priorities among the processes, by identifying those business processes that support the high priority business goals.

3.2.2.2 Selection of a case tool

Various application software packages exist that support the enterprise architecture discipline, for example *Casewise* and *Aris*. In the next chapter *Casewise* will be used as an example to demonstrate the powerful functions of an enterprise architecture tool, since it is also firmly based on the conceptual Zachman Framework. See **Figure 70** for the navigation screen in *Casewise* that clearly indicates the Zachman Framework as the foundation for the application software.

The commercially available enterprise architecture software tools are not inexpensive, but they are comprehensive and flexible and provide user-friendly means to capture the different entities (in hierarchical format, if necessary) and build associations between all entities. The complete repository, or selections thereof, can normally be exported in various formats, including typical word processing format, or HTML to make it available through normal web browsing application software. If it is maintained on a central server on the network of an organization, all users will always have read access to the latest version of the repository and many users can access the complete data pack of the organization without having a licence for the enterprise modelling software.

There might be a temptation to build your own enterprise architecture tool in a program such as MS Access to capture the various entity attributes, as well as the associations, in a relational database. In very small organizations and where cost is really a limitation, it might be an option, but the author is of the opinion that investment in such a tool is justified. One should take into consideration that it will become the foundation for evaluation of all future changes to the organization in terms of strategy, structure, products and services, marketing information regarding clients and the competition, business processes, information systems, infrastructure and other technologies. See **Figure 71** for the various ways in which relevant entity data can be captured and associated with each other in *Casewise*. It makes provision for process flow diagrams, data flow diagrams, entity relationship diagrams, hierarchies (e.g. organizational structures), a matrix view to see associations and a generic diagramming tool.

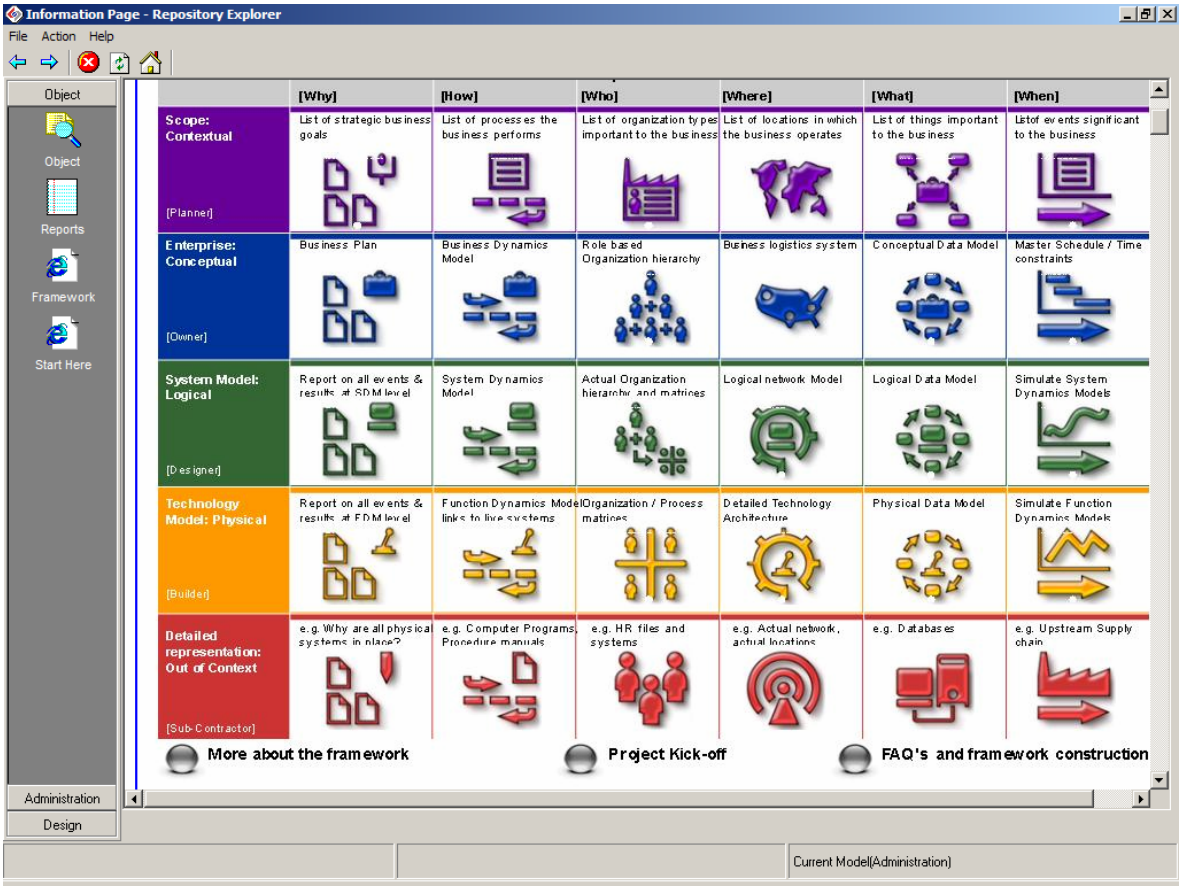

Figure 70. Zachman Framework embedded in *Casewise*

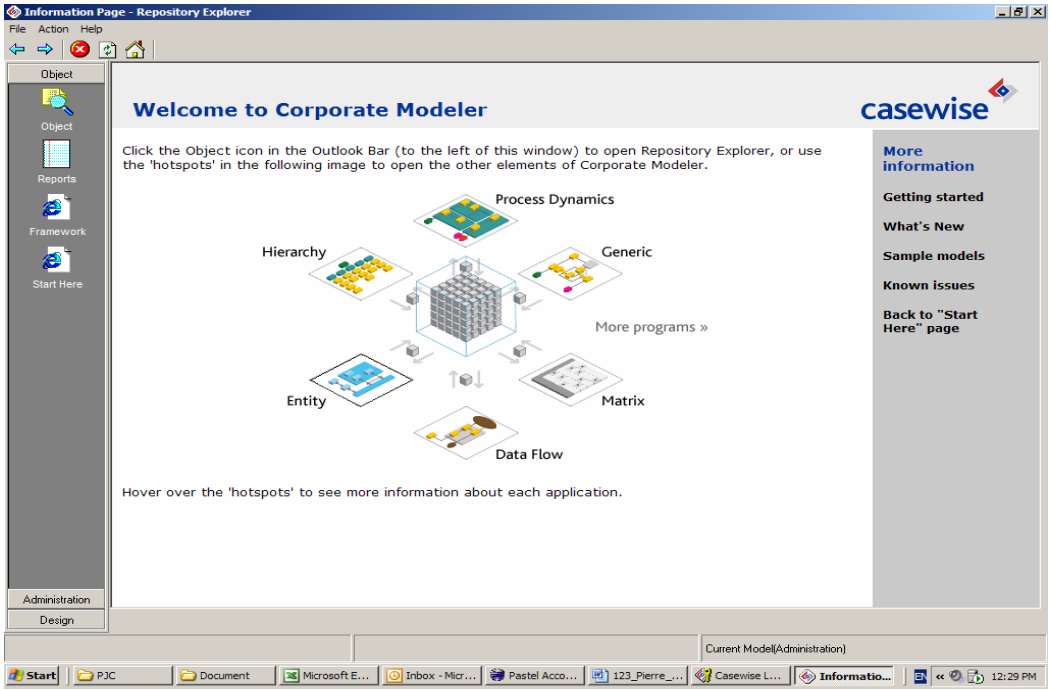

Figure 71. Various formats to capture and associate entities in *Casewise*.

It should be clear that the enterprise modelling component in the proposed Bigger Picture BI Context Model forms the glue that holds the model together. After the initial documentation of the organization in terms of strategy, organizational structure, business processes, products and services, marketing related entities such as clients and

competition and information systems to support the business processes (including performance management processes), the strategy can be implemented through operational processes and performance can be measured and presented through BI related tools. The information that is revealed by these tools is then interpreted within the context of the organization as defined in the enterprise architecture, taking into account information from the external environment.

Any action that is proposed after interpreting the information from BI tools should be tested in the enterprise architecture by looking at the associations before the change is implemented. It can be compared to a multi-storeyed building where someone wants to remove a wall to combine two compartments. It will never be allowed unless the plans of the building are drawn to establish what other functions that wall might have apart from dividing the two compartments. It will also reveal the attributes (e.g. thickness) of the wall and other information that might imply other actions should the wall be removed (e.g. electrical wiring or plumbing that runs in the wall). All this information will help the relevant people to make an informed decision. Similarly, the enterprise architecture should be the central repository where proposed changes are evaluated to determine their complete impact. In the course of time the information in the enterprise architecture should be extended and updated - reducing the risk of bad decisions after the repository has been consulted.

3.2.2.3 Process simulation modelling

Apart from identifying entities and associating them with each other (e.g. a grade three technician is used during the second line preventive maintenance process in the workshop facility, where a skill level, human resource category, business process and facility are associated with each other), another type of modelling is often used by industrial engineers to quantify the number of resources that is required by the organization. This type of modelling is called stochastic process simulation modelling. Although case tools like *Casewise* and *Aris* have embedded simulation modules, other specialised simulation software like *Arena* may also be used. Dedicated simulation software normally has more sophisticated process modelling building blocks to model more complex situations, for example where automated guided vehicles (AGVs) are used to transport parts in a warehouse or manufacturing environment, or where continuous processes in a chemical plant are combined with discrete packaging processes.

The aim of stochastic process modelling is to quantify the number and type of resources that are needed at various locations and also to estimate the total process times given a certain set of input parameters. It is also used to choose between various decision rules that can be used during a process, for example priority rules at queues and resource selection rules. Often the results of these simulation models are used to hard code rules within the information systems that will support the operational business process. These simulation models can also be used to justify certain targets that are set for performance measurement. The models are entities in their own right and can be associated with other entities in the enterprise architecture repository. When changes are proposed to business processes, or technological enhancements promise changes to process times, or certain steps in a process become redundant, these models can be used to verify the promised impact on total process times, resource utilization and various other criteria. Where the normal association matrices will identify the entities that will be influenced by a proposed change, the simulation model(s) will quantify the effect.

Good simulation modelling practice requires that models be developed in an iterative manner with various levels of detail. Relatively simple models may be developed during the strategy development phase and these models may be enhanced to include more and more detail, which will eventually support implementation and execution of the strategy through business processes. Simulation modelling should therefore form an important component of the enterprise architecture building block.

3.2.3 Strategy implementation and execution

3.2.3.1 The move from planning to doing

Implementation and execution of the strategy may differ for different organizations (e.g. new organizations versus existing organizations), but generically it calls for **doing** the normal operational activities according to the **plans** that were made. Often it is not a turnkey event where planning stops and operation takes over. In the case of a new organization there will be a distinct implementation phase when infrastructure is commissioned, people are appointed, information systems are implemented and the organization is prepared to go into operations on a specific date. For existing organizations there is often no clear line between the various stages of the change cycle (see **Figure 16**), namely dissatisfaction with the status quo, planning the new future, implementing (acting to learn) and reviewing and revising.

According to the continuous strategic conversation approach of Manning (2001), the Strategy Wheel (see **Figure 21**) can help to identify the top priority issues that should be addressed in the next period of 30 days. This normally leads to an action plan with goals, priorities and responsible persons. Some issues will obviously stay on the Strategy Wheel for a number of months because they cannot be implemented or solved in 30 days, but the urgency that is created by shorter review cycles and progress reporting is important.

3.2.3.2 Business processes management (BPM)

Strategy is eventually implemented through business processes. There is a relatively new drive to advocate business improvements through a discipline called business process management (BPM). (See various articles on the CD ROM under BPM.) As Smith and Fingar (2004) point out:

- BPM is not new - the term was used when BPMI.org (an organization furthering the advancement of BPM) was founded in 1999 to distinguish it from the older reengineering methods that had become a dirty word at the time. The need for business process management can be traced back to the emergence of management theories in the 1920s.

- Business processes existed since the beginning of business and commerce. Regardless of whether they are called business processes, practices, work activities, procedures, workflow or any other term, they have always existed and **are** the work and **how** the work **gets done** - they exist independently of any technology.

- BPM efforts are called many names, e.g. industrial engineering, ISO certification, business process improvement (BPI), business process reengineering (BPR), Rummler-Brache, integrated definition function modelling (IDEF0) and Lean Thinking, but they all are work **with** processes (management) and work **in** processes (participation).

- Computerized tools for BPM - Business process management systems (BPMS) - will need to represent business processes in such a way that they can be directly manipulated by business analysts. These tools are not mature yet and even analysts like Gartner define BPM tools in various ways: They are the evolution of EAI (enterprise application integration), the evolution of workflow, the evolution of ERP (enterprise resource planning), or the bundling of these to create new products.

- SAP, a successful ERP software vendor that has used RDBMS (relational database management system) as the foundation for their product for the last ten years, is

developing a BPMS (business process management system) called *Netweaver* and declared it their foundation for the next ten years.

It seems as if the basic concept of BPMS is process-oriented programming, where IT will provide back-end engines that will create executable processes. It will probably use simple visual metaphors similar to what business users are already familiar with through process modelling tools such as *Popkin* and *Casewise*. IT will probably control the BPMS platform as they have maintained control over the database management platforms, but business will have control over which processes are run over the BPMS platform. Smith and Fingar (2004) forecast: *"By the end of 2004 it will seem quaint indeed to do BPM using whiteboards, PowerPoint or Visio - BPM 2004 will be the year of flowcharts on steroids. Thanks to the breakthrough of BPMS, work with processes, and work within processes, will never be the same again."*

While the BPMS arena matures, many organizations will still use traditional tools such as flowcharts and swim-lane diagrams to document their business processes. Although the business processes will be identified (and perhaps even modelled with process simulation) at a high level during strategy development and will probably be explored in detail as the business processes are documented in the enterprise architecture, they are normally refined further during implementation to a level where each step in the process can be described in terms of a procedure. Therefore the Bigger Picture BI Context Model makes provision for an interactive relationship between these two components.

3.2.3.3 Workflow impact on business processes

Although the human influence in business processes will never be eliminated, the aim is to focus the human intervention on those aspects in a process where it is really necessary and to automate those steps that can be done better by machines or computers. Workflow packages such as Staffware and K2.net provide the means to automate business processes and to eliminate certain human activities. See **Figure 72** to **Figure 76** for a typical generic process with certain paperwork and "hand-offs" that can be simplified with the introduction of workflow and a few changes to the underlying information systems.

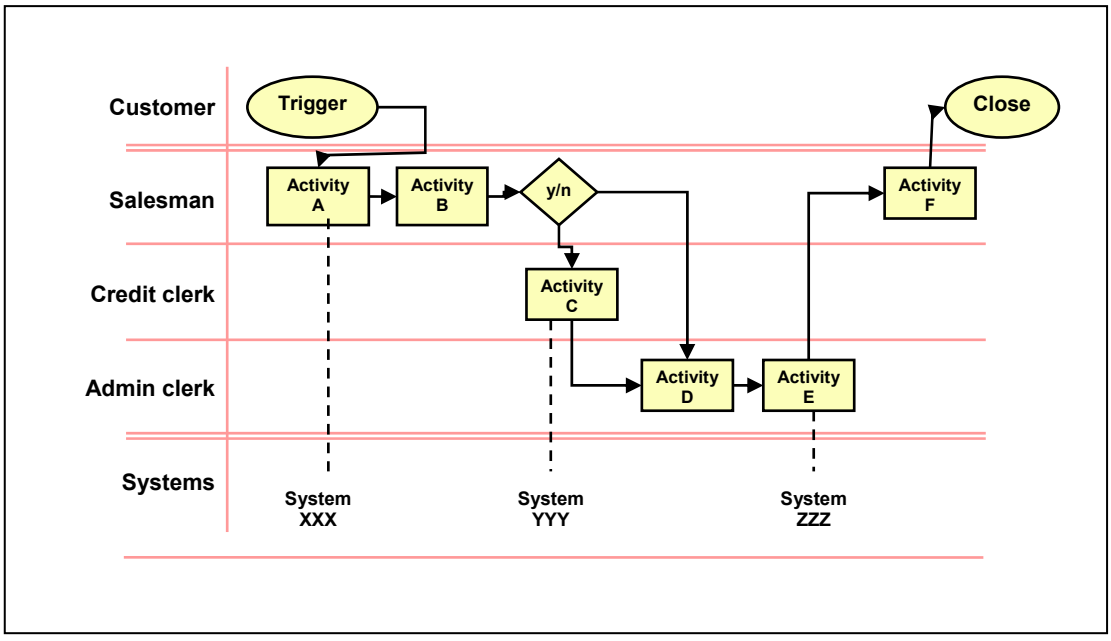

Figure 72. A typical generic process

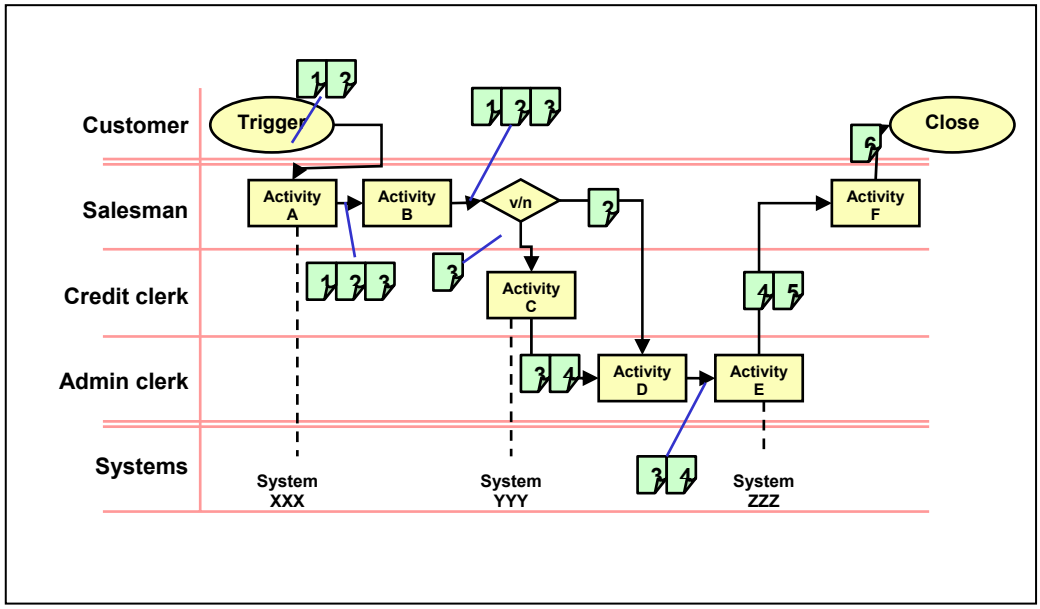

Figure 73. Typical paperwork during activities

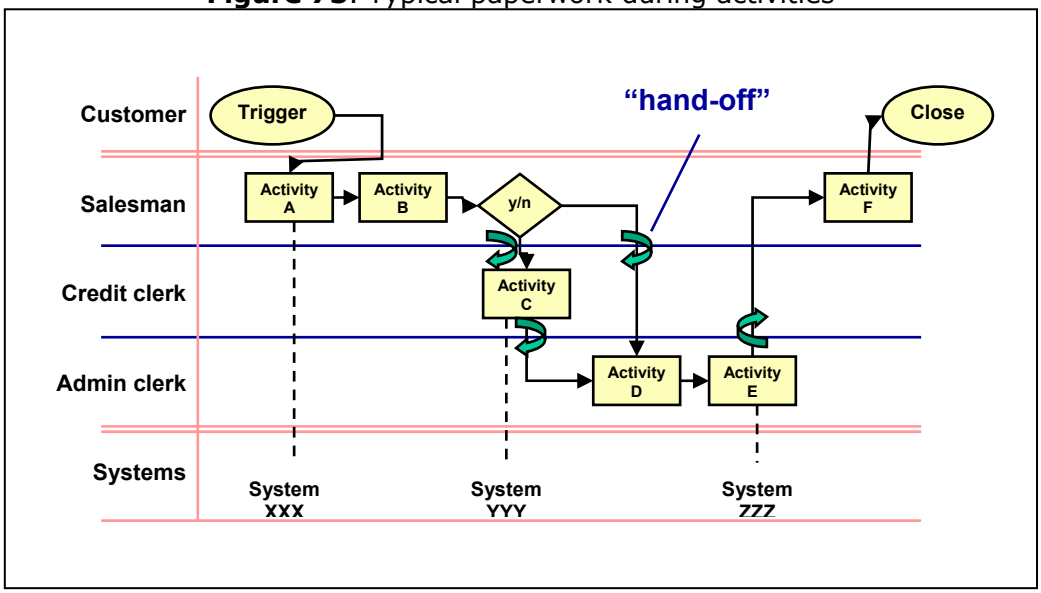

Figure 74. Typical "hand-offs" between human resources

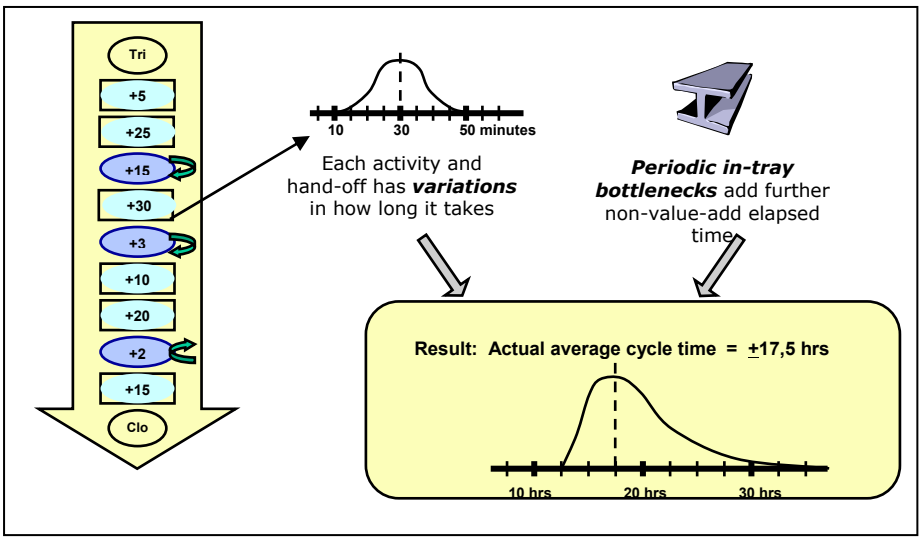

Figure 75. Estimated time for the total process

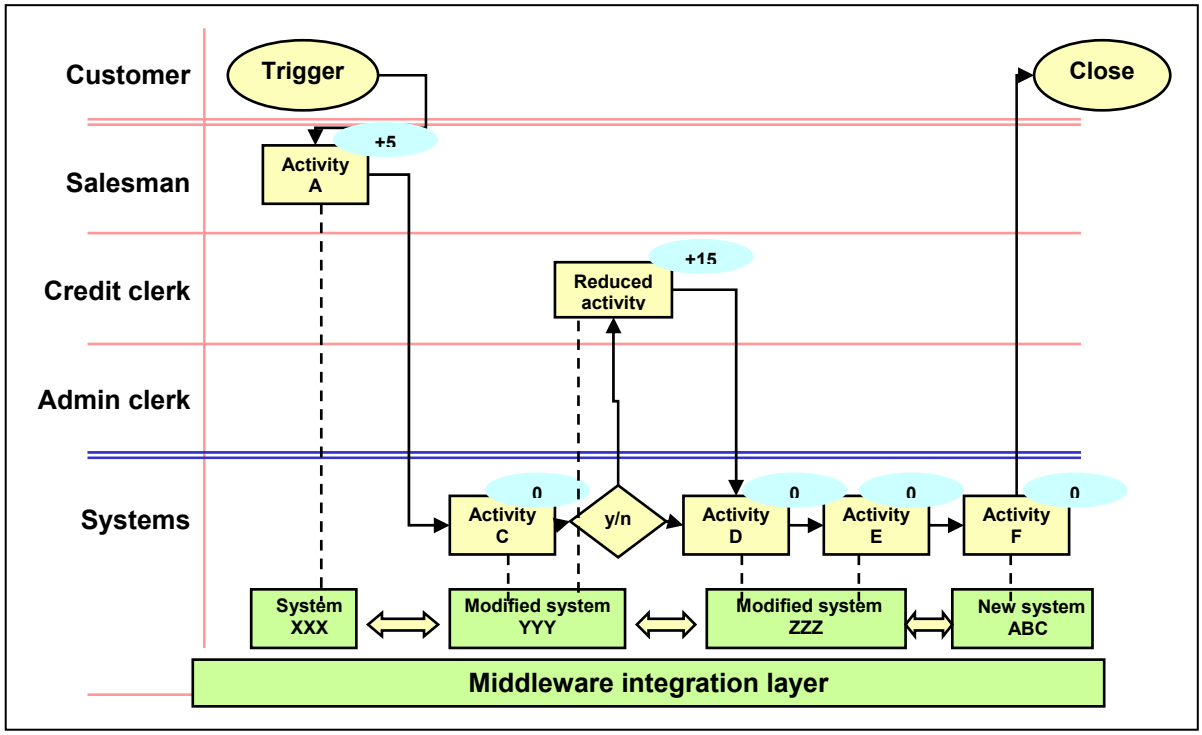

Figure 76. Improved system

The improved system has a dramatic reduction in lead-time for the client (improving customer satisfaction) and the savings in human time can be used in other processes where human intervention is required. The reduction in time is made possible through digitization of most of the paper work and workflow that ensures that the task is escalated to another worker, if the person cannot attend to it within a certain time frame, as well as rule engines that are embedded in the application systems and the fact that the different systems are "talking" to each other through middleware integration software.

Workflow can also be used very effectively to enforce a changed process. Many of the re-engineering projects in the late 1980s failed, because even though the new process was better and should have generated savings, it was possible for the people to fall back on the old ways of executing the process. Workflow also provides the basis for many performance measurements, since it provides time stamps as the work item moves through the process. By analysing the time between any two steps in the process, it is possible to identify bottlenecks and adjust resource allocation. (This data can also be used as valid input data for further simulation modelling of the process.)

In summary, the tools that can be used effectively in this step of the Bigger Picture BI Context Model are the following:

- The Strategy Wheel of Manning
- Lists with goals, priorities, actions and responsibilities
- Simulation modelling to quantify the resources, estimate total process times and to select decision rules
- Swim-lane diagrams to communicate the role of every resource in any process
- Workflow to enforce and streamline processes
- Integrated supporting information systems

Soon BPMS will also provide more control for business analysts to design and change their business processes during and after implementation.

3.2.4 Performance measurement from a data warehouse

This component of the Bigger Picture BI Context Model relies on the following concepts:

- By measuring certain performance criteria, people will behave in a way that will support these performance measures in a positive way.
- In an organization performance should be measured on three levels, namely the organization level, the process level and the individual, or job performer, level. This correlates with the Rummler and Brache (1995) framework.
- Performance measures must be carefully selected to limit them to a manageable amount and furthermore, they should support the cause-and-effect hypothesis of the strategy that management wants to implement. This correlates with the Balanced Scorecard approach of Kaplan and Norton (1996).
- The measurements must be calculated on a regular basis and in a consistent manner to ensure that valid trend information is gathered. If a measurement consists of more than one element in the formula, it should be possible to drill down to the individual components to identify the root cause of a problem. This concept correlates with the aim of establishing a data warehouse to support better decision-making and the use of BI tools.
- Businesses have generic functions and it is possible to refer to a generic list of typical measures (key performance indicators) like the one provided by Connelly (1999) in the 24 Ways. Naturally, given a specific organization with a certain strategy, some of them may be more applicable than others.
- Performance measurement is a sub-set of performance management that includes the planning of performance measures, the infrastructure to provide a basis for measurement, the measurement process itself, the interpretation of the measurements and the action taken. In this regard this component of the Bigger Picture BI Context Model concentrates on the first three steps, given the fact that interpretation and action are handled in other components.

3.2.4.1 Rummler and Brache framework

The Nine Performance Variables with relevant questions (see **Table 9**) provide a holistic view on how the performance needs (in terms of goals, design and management) can be measured at the different levels (organization, process and job/performer level).

The swim-lane approach to business process definition (see **Figure 50**) provides a visual display of the individual business process steps and the responsible organizational unit. It clearly shows the "hand-off" points between responsible parties and forces the designer of the business process to define where responsibility of each party starts and stops.

The identification of measurements should start at the process level, keeping in mind what the organizational goals and strategies are. In this regard the core processes in the value chain will probably have higher priority than supporting processes. Each step in the process is done within an organizational unit and by a person (or a system for which a person takes responsibility). If measurements are taken at appropriate places in the process, some of the measurements at the organizational level and job/performer level will be derived from these process related measurements.

3.2.4.2 Balanced Scorecard approach

The Balanced Scorecard approach from Kaplan and Norton (1996) covers four perspectives of the business (finance, customer, internal business processes and learning and growth) and it is suggested that the cause-and-effect relationships between different measurements should clearly support a strategic theme of the organization (see **Figure 54** for an example).

The reason why this approach forms a cornerstone of the Bigger Picture BI Context Model is the strong link between strategy and measurement. The measurements are often displayed on the BI dashboards of management in the same way as they are linked in the cause-and-effect diagrams. It is therefore easy to evaluate over time whether the assumptions that are made in the cause-and-effect arguments are true. If not, the measurements should be adjusted, or the strategy should be reviewed.

3.2.4.3 Data warehousing approach

The Kimball approach (1998) to build a data warehouse in incremental steps, adhering to a basic discipline regarding conformed dimensions, has been selected to form the foundation from where performance measures are calculated. Conceptual tools that are used include the following:

- Overview of the basic elements of the data warehouse (see **Figure 40**)
- The typical star schema, consisting of a fact table and a number of surrounding dimension tables (see **Figure 41**)
- The Warehouse Bus Architecture to identify conformed dimensions (see **Figure 42**)
- The Business Dimensional Lifecycle diagram that forms a framework for the establishment and maintenance of a dimensional data warehouse, including project management, identification of business requirements, development and acquisition of the technical environment, dimensional database and presentation tools and the implementation, maintenance and growth phases (see **Figure 43**).

The classification of fact tables (see **Table 8**) in transactional, periodic snapshot and accumulating snapshot types provides a valuable guide during the design of the different data marts that will eventually form the complete data warehouse. The concept of three basic ways in which changes to dimension tables are handled (slowly changing dimension types 1 to 3, indicating overwriting, adding a row, or adding a column), forces the data warehouse designer to consider every attribute in a dimension table and to define an update strategy that will eventually become part of the ETL (extraction, transformation and loading) plans.

A separate ODS (operational data store) is normally not necessary, if the data marts are designed at the right level of detail. Often an ODS is introduced when data quality standards of the data warehouse are set too high for the state of the transactional data. If this is the case, it could happen that a large portion of transactions is not loaded into the data warehouse, because they do not have valid dimensional keys and for certain performance measures the data in the warehouse can be completely wrong (e.g. count of transactions). This situation can be handled in various ways. One option is to admit all records and make sure that all dimensions have a record indicating "Not available". These records are then linked to each record in the fact table that does not have a valid dimensional key.

Another option is to reject the record from the data warehouse and to send it back to the source system to be completed. At the next loading process the record will then be loaded, if the errors were rectified. This is the preferred manner, if the turnaround time of rejected records is short and the update processes of the data warehouse are run

frequently (e.g. once a day).

Sometimes an ODS is introduced to provide reports when certain data marts are still in development. This is acceptable, but as soon as the data mart(s) that can provide the same report is developed, that part of the ODS should be deactivated. The idea of a central data warehouse is to provide the single version of the truth in a user-friendly manner. If two sources of data are used to provide the same report (one being the data mart that goes through a process of data cleaning, transformation and quality checks, and the other being a copy of the transactional system tables in the ODS), it is quite possible to arrive at different results. Some users persist that a good (but not 100% accurate) answer from the ODS is better than no answer from the data warehouse - and it is difficult to argue against that.

It is concluded then that in certain cases the ODS is a necessary evil that should be tolerated under the control of the data warehouse manager to handle situations as discussed above and to do prototyping of reports that will eventually be provided through well designed data marts.

3.2.4.4 Business intelligence tools

A large number of BI tools exist ranging from simple reporting tools to sophisticated tools that do not only cover the data access functionality, but also provide functions to extract, transform and load data from various sources into a data warehouse environment (data staging functions). As stated in the beginning, it is not the aim of this thesis to evaluate and compare the various BI products. It is, however, necessary to illustrate some of the functionality that is necessary to present data in such a format that it can be described as business intelligence - information that can lead to better decision-making.

The size of the organization (as well as the size of the budget!) determines the choice between BI products. It does not make sense for a small organization with one or two source systems to spend a few hundred thousand rand or more to accomplish the same results that can be achieved by a professional version of MS Office, costing less than R5000. Investment in a sophisticated BI toolset is however justified if the environment is much more complex - if the organization has many source systems running on different platforms, if a lot of transformations are necessary before the data can be loaded in a consistent manner into a data warehouse database, or if the data volume is very large.

Since the arguments for the establishment of a separate data warehouse environment were put forward in the previous chapter and the author has decided to incorporate the data warehousing approach of Kimball in the Bigger Picture BI Context Model, the following typical tools will be needed:

- An ETL tool to extract data from various data bases, transform data where necessary and load data in a star scheme dimensional database format;
- A database that will serve as the dimensional data warehouse;
- Data access tool(s) to interrogate the data in the data warehouse in such ways that it will lead to better decisions. This could include normal reporting tools, charting tools, dashboard/robot logic tools, analytical tools (like OLAP cubes and pivot table functionality) and data mining tools (such as neural networks, fuzzy logic and classical statistics). Some of the tools may provide static reports that can be published on a portal or intranet, while others cater also for less structured ad hoc queries that users may want to run. Some are available as client / server applications, while others are also available in thin (or zero) client versions through normal web browsers.

Given the above categories of tools that are necessary to build and use the data

warehouse environment, the author is also of the opinion that the tools should be as integrated as possible. If the environment already has an ERP system, for example SAP, then it is suggested that the Business Information Warehouse (BW) of SAP is used (even though The OLAP Report *(www.olapreport.com 2004)* states that *"there are very few successful deployments and large volumes of shelfware".*

If the environment uses MS SQL Server as a database and most of its source data is in MS SQL databases, then it is advised to use the Microsoft environment (see **Figure 77**) until it proves to be a problem. Included in the MS SQL Server pack are products such as *DTS* (data transformation services) as an ETL tool and *Analysis Services* with data access functionality. The pivot table functionality in *MS Excel* is extremely powerful when smaller amounts of data are analysed.

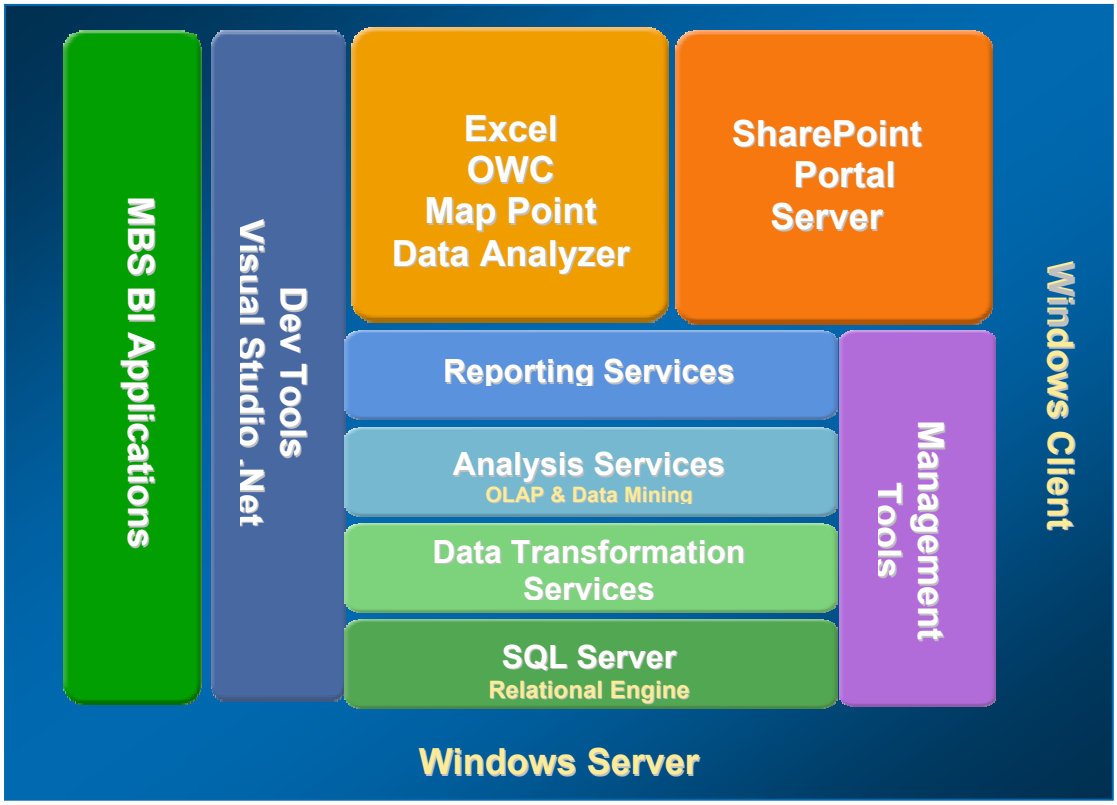

Figure 77. The Microsoft BI tool offering (Microsoft partner information 2004)

For even smaller organizations that use *MS Access* as a database, *MS Office Professional* with *MS Excel* as a data access tool may provide an entry-level environment.

Most organizations in the medium to large category would probably use more powerful products for ETL (such as *Datastage*, *Informatica* and *Sagent*). The more popular data access tools include *Business Objects*, *Cognos PowerPlay*, *Microstrategy*, *ProClarity* and *Hyperion*). It should be noted that many of the popular data access tools do not have any ETL functionality and are therefore running directly on the transactional systems, or rely on other tools to create the data warehouse environment from where the data can be accessed. These products normally create a meta layer (e.g. Business Objects calls it a universe) where a selection of the tables in a specific database are included and end-users have access via the meta layer. The field names of the database tables can also be changed to terminology more familiar to business users.

The author has become familiar with *Sagent Solution* as a BI tool over the last few years and therefore it will be used to demonstrate some of the necessary functionality in the

next chapter. The interesting thing about Sagent is that it has always been a tool that supported the back-office (ETL), as well as front-office functions through a common user interface and panel of transforms. (Transforms are higher-level functions that create SQL statements in the background via a user-friendly interface.) These transforms include building blocks to extract data from various sources, a function to generate surrogate keys, a key lookup function to populate the fact table, functions to filter and remove duplicate records, functions for batch loading of data to various databases and many more. It is supported by a meta data database where all plans, meta views and base views (the link to database tables - similar to universes in Business Objects) are stored. It also provides a powerful automation module that can be used to trigger plans automatically at certain times and inform the responsible person of any problems via SMS, e-mail, or other means.

It can be concluded that BI tools of appropriate sophistication, depending on available funds and functional needs, should support the performance measurement component in the Bigger Picture BI Context Model. The principles on which the data warehouse is built should be adhered to, however, regardless of the BI tools that are used. The content of the data warehouse will be determined by the performance measures, based on the strategic themes. Although the emphasis on the data access side will be on the performance measures that support the current strategic themes, the warehouse will keep on gathering information (through automated update plans) on previous measurements to grow the history of existing data marts.

3.2.5 Interpretation of business intelligence

This component of the Bigger Picture BI Context Model is one step in a business process that will never be automated or taken over by a "rule engine". It requires a human being to make a judgement call on whether the performance measures that he/she is confronted with, within the context of other external environmental factors, ask for the improvement of the operational execution of the current strategy, or that the complete strategy should be reviewed and changed. After the judgement call has been made, it requires action. Even if all measures are according to expectations (which are very unlikely!), they should be communicated to all concerned to motivate them and targets should perhaps be reviewed.

Any deviations from expected performance levels should be investigated. Since performance measures will include measures on all three levels (organization, process and individual level), drill down functionality will be used to identify the core reason for deviations. For example, if the net profit performance of the organization is negative, it can either be that not enough money is coming in (possibly a marketing process problem), or too much money is spent (various expense accounts can be investigated to identify the overspending).

Within the context of the cause-and-effect diagrams of the Balanced Scorecard approach, it is also possible to realise that some of the links are not changing as expected. Sometimes it may be a timing issue (e.g. training of people will not have an immediate effect on customer satisfaction) and therefore the current strategy may still be valid and the results should be forthcoming in a few months. However, sometimes the reasoning behind the cause-and-effect diagrams is in error, or needs additional action to work as intended. In these cases the judgement of the manager is important to take the right action in terms of adjusted business processes and improved performance measurements.

External factors may prescribe drastical changes to the strategy. It may be that the current strategy has been developed during a period when the exchange rate favoured exports (and it could still be a good strategy for those circumstances), but if the

exchange rate has now changed to favour local sales, the strategy should be reviewed and certain marketing and production processes might have to change. This will lead to the development of new strategies that will impact on the enterprise architecture. These strategies will be evaluated (given the associations between entities), before they will be implemented and executed through revised business processes. New performance measurements may be required and the whole process will be repeated.

This component in the BI context model emphasizes the point that BI is not just a technological solution to present information in a user-friendly manner - it is the trigger that leads to decisions and actions that will influence strategy changes or business process execution.

3.2.6 Updating of the enterprise architecture

Similar to updating building plans for a building whenever changes are made to ensure that future proposals for change are measured against the correct baseline (and to operate and maintain the building effectively), it is also important to update the documented enterprise architecture of a business whenever changes are made. This process is necessary for both feedback loops in the Bigger Picture BI Context Model, namely change of strategy and change of operational execution of the strategy.

Although the complete change of strategy may involve a more complete revision of the enterprise architecture, there are basically two categories of changes that must be addressed. Firstly, there may be changes to the existing entities as defined in the various hierarchies of strategies, goals, locations, organizational structure, processes and supporting systems and technologies. Secondly, there may be changes to the associations that were drawn between these entities. In both cases the changes may include additions, deletions or editing. In many cases the repository also refers to other documents, diagrams and even process simulation models. It should be clear that effective configuration management of the documented baseline of an organization in terms of enterprise architecture is therefore of the utmost importance.

Typical changes in the repository may include the following:

- Addition of new goals derived from a new strategy
- Deletion of certain goals, or allocation of different priorities to existing goals
- Addition or editing of business processes to reflect a new way of working, or the introduction of new technology in the process
- Addition or editing of the associations between a business process and the role players in the organizational structure
- Breaking of certain associations (e.g. cause-and-effect relationships in a Balanced Scorecard that proved to be wrong)
- Building of new associations between a new information system and the processes that are supported by the system, while simultaneously removing links to previous systems or manual procedures
- Building of new performance measures and the relevant associations to goals and processes to enable the organization to monitor the implementation of the changes

The value of enterprise architecture tools that are designed to handle these changes in a sophisticated manner and to make the latest baseline available in a timely and accurate way cannot be overlooked. It plays an important role in the quality of decisions that are made and provides a centralised version of the truth where all people in the organization can see what the current blue print of the organization looks like, including structures, business processes, infrastructure and systems, as well as the associations between all of these entities. This step in the Bigger Picture BI Context Model to update the enterprise architecture whenever changes are made is an important prerequisite for the

reliable use of the model.

3.3 Supporting templates

A number of simplified templates to support some of the thought processes in the Bigger Picture BI Context Model have been developed, since some of the commercially available tools to support those aspects are expensive. These templates are available on the CD-ROM that accompanies the thesis. The aim of the templates is definitely not to replace, or compete with commercially available products – rather to illustrate the concepts in another manner through readily available software such as *MS Excel* and *MS Access*.

The following templates are included:

- Innovation Matrix (General idea from Grulke embedded in a spreadsheet)
- Business logic framework (General idea from Manning)
- 7 Ps model (General idea from Manning)
- Strategy Wheel of issues (General idea from Manning)
- Format for action list (General idea from Manning)
- Foxy Matrix (Ilbury and Sunter) combined with "Six hats" technique from De Bono
- Fourier Model of concentric circles
- Data mart matrix (Adapted from Kimball)
- Data mart design database (MS Access framework to document certain meta data)
- Fourier context model database (Basic *MS Access* framework to document associations)

Most of these templates are demonstrated in chapter 4.

3.4 Conclusion of BI in context

The aim of this chapter was to describe and explain the Bigger Picture BI Context Model that is repeated in Figure 78.

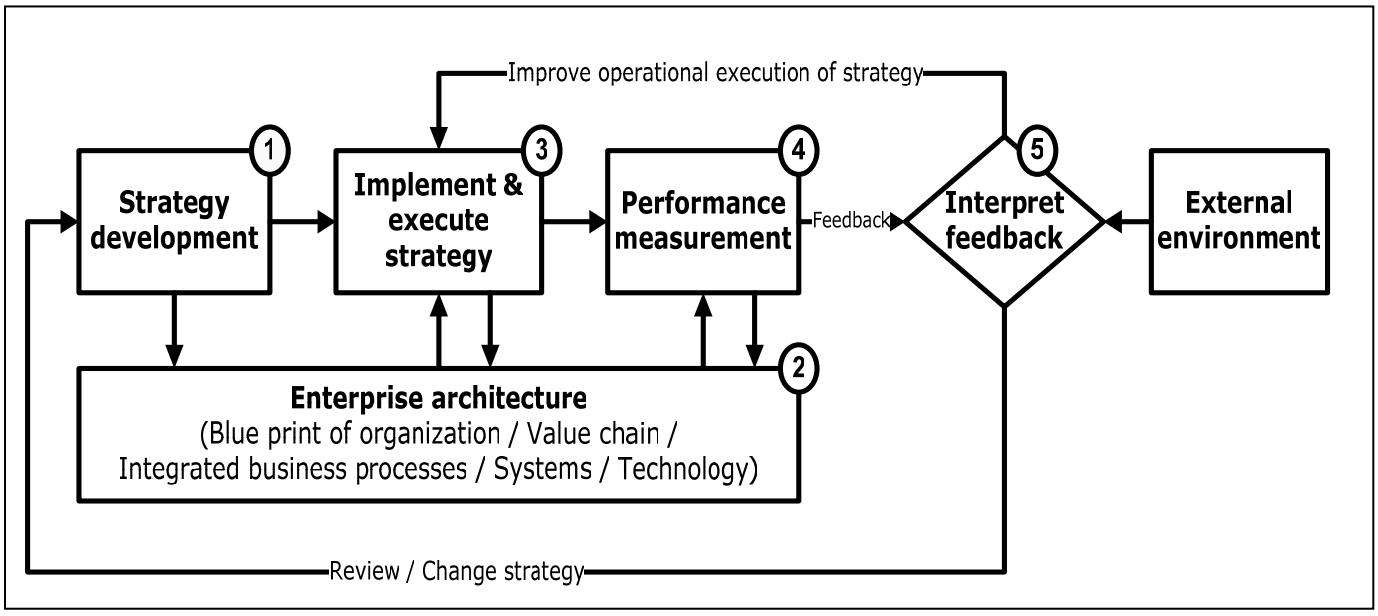

Figure 78. An overview of the Bigger Picture BI Context Model.

The popular view of BI and BI tools is that they provide business related information in various formats through reports, graphs and drill-down capabilities from which better

decisions can be made. The author does not disagree with this view, but has provided a framework in which strategy development, enterprise architecture, implementation and execution of strategy through business processes and performance measurement are put into context to provide a qualitative control system. BI is positioned as part of the performance measurement component of the model.

Each of the components in the model was discussed by referring to various techniques or concepts that were identified during the literature study, without being prescriptive, or excluding other concepts that may also fall into an identified component of the model. For strategy development the following concepts were identified:

- Various ideas from Grulke (e.g. Innovation Matrix and Learning from the Future)
- Various techniques from Manning (e.g. Business Logic framework and 7 Ps)
- Foxy Matrix from Ilbury and Sunter
- Fourier Model developed by the author and colleagues

For the enterprise architecture component the following aspects were included in the model:

- The Zachman Framework for an enterprise architecture methodology
- *Casewise* as typical enterprise architecture software (supported by the Zachman Framework)
- Process simulation modelling to quantify required resources in business processes and to evaluate various operating rules

The following concepts were identified to support the implementation and execution of the strategy phase (moving from planning to doing):

- Business process management (BPM)
- Swim-lane diagrams to communicate business processes
- Workflow to enforce and streamline business processes and activate systems at appropriate times
- Integrated information systems to support business processes
- The Strategy Wheel and action list with goals, priorities and responsibilities from Manning

The following concepts and tools support the performance measurement component:

- The Nine Performance Variables from Rummler and Brache
- The Balanced Scorecard (BSC) approach from Kaplan and Norton
- The data warehouse approach from Kimball
- Various BI tools of appropriate sophistication to support the extraction, transformation and loading processes, as well as information delivery and data analysis

The role of human judgement was emphasized in the interpretation component of the model. At this stage information from the performance measurement component and the external environment is taken into consideration and after interpretation, action is taken to either

- improve the execution of the existing strategy, or
- review and change the strategy all together.

In both cases changes will definitely lead to updating of certain components in the enterprise architecture (e.g. changes in goals, business processes, supporting systems and various associations between these entities in the enterprise architecture). The impact of these changes should also be reflected in the performance measurement

component. Since the enterprise architecture is used to determine the impact of any proposed changes (by looking at the various associations) and perhaps to simulate proposed process changes, the importance of keeping the architecture up to date was emphasized.

The practical use of the model is illustrated in the next chapter by applying it to a typical consulting organization.