White Paper

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Business Intelligence as a Driver for Business Transformation

Introduction

By recognizing Business Intelligence as a transformative inflection point, Intel Corporation made Global Procurement Reporting (GPR) a major contributor to the $300M business value of the company's e-Procurement program. This article suggests that by formalizing the design approach utilized by GPR and adopting it throughout the enterprise, transformation programs will dramatically increase their chances for attaining pre-defined business value.

A Business Intelligence (BI)-driven approach can be very effective in implementing business transformation programs within an enterprise framework. In this respect, the value proposition associated with BI reaches far beyond the capability to pull together and analyze data. In fact, this paradigm is a key enabling process and technology that can drive the resolution of fundamental enterprise design challenges.

This article focuses on the design approach of enterprise-level BI solutions – specifically the place of BI in the business transformation activity within an enterprise environment. The analysis is represented through the experience gained in the design and implementation of Global Procurement Reporting (GPR) in the development of a Materials Spends Visibility solution that was initiated within the Materials e-Procurement program at Intel Corporation in the period of 2002 to 2004.

After four releases, creating the ability to analyze 97% of corporate spends, GPR is regarded as a major success, This article documents the role of BI within an enterprise business transformation, as well as it captures key learnings that surfaced during the course of the project, **in an attempt to establish a methodology that can be used both by program managers and enterprise architects designing enterprise business transformation programs**.

An acronym glossary is provided at the end of the paper that includes all of the acronyms used.

BI and the Enterprise

Driven by cost and revenue-optimization incentives, many companies are attempting to adopt enterprise business models. These organizations recognize that they become more effective, lean, and competitive by utilizing enterprise-level infrastructures in all aspects of their operations. The drive to enterprise operation is reinforced by the realization that the company should be defined more by its horizontal value chain (i.e., the supply chain) than by its vertical operations (e.g., Accounts Payable, Materials, Logistics, Human Resources, Finance, etc.).

In this respect, enterprise-planning considerations transcend geographical and organizational boundaries. They support the creation of a synchronized engine that runs on top of integrated architectures managed by centralized operations.

Modern companies create an abundance of business data. The broad availability of advanced computing technology, as well as platforms such as Enterprise Resource Planning (ERP) and Enterprise Data Warehouse (EDW) technologies, enable this data to be analyzed effectively. Thus, in the reporting/analytics area, the term “Business Intelligence” reflects the fact that such analysis can readily create “Intelligence” about the company's internal and external operations.

Although the primary connotation of BI solutions lies within the realm of advanced analytics (i.e., statistical analysis: identification of patterns and trends, forward-looking analysis, etc.), the main enterprise challenges to industry today concern basic visibility of operational

data. That is, most organizations are struggling just to see what happened or much better, what is happening (closer to real time visibility). Along with the need for a comprehensive enterprise picture, of course, they want high Data Quality.

Clearly, the creation of the enterprise model is a major challenge –success stories are not common. A BI-focused approach can help build an enterprise model that can drive the realization of the 'one version of the truth' concept. Intel's experience with GPR supports this assumption.

The Business Process/Data/Application/Technology (BDAT) stack accurately represents the fact that enterprise-infrastructure creation requires four elements, and the general assumption is that they need to be designed in harmony. Trying to separate out the elements of BDAT and singling out one of them as being more important than the others is likely to be a futile exercise. At the same time, however, the e-Procurement-GPR experience does single out Data as an effective mechanism for creating the foundation of a business transformation program.

GPR – Global Procurement Reporting

GPR was born out of the need to 'see' spends specifically in the Indirect Procurement area. Direct spends (defined as spends that represent materials used for manufacturing the product) were traditionally a high priority within the procurement/materials activity. The realization that indirect spends became 50% to 60% of total procurement spends created the need to design a solution that enables detailed analysis, in order to control over $5B-$6B (see Figure 1). A program named *e-Procurement* was created to deal with the business transformation required to enable indirect procurement re-engineering. GPR started as the reporting leg of the solution, but it gradually grew in significance to become the transformation engine in the creation of a comprehensive BI infrastructure within the corporate Spends Analysis Subject Area.

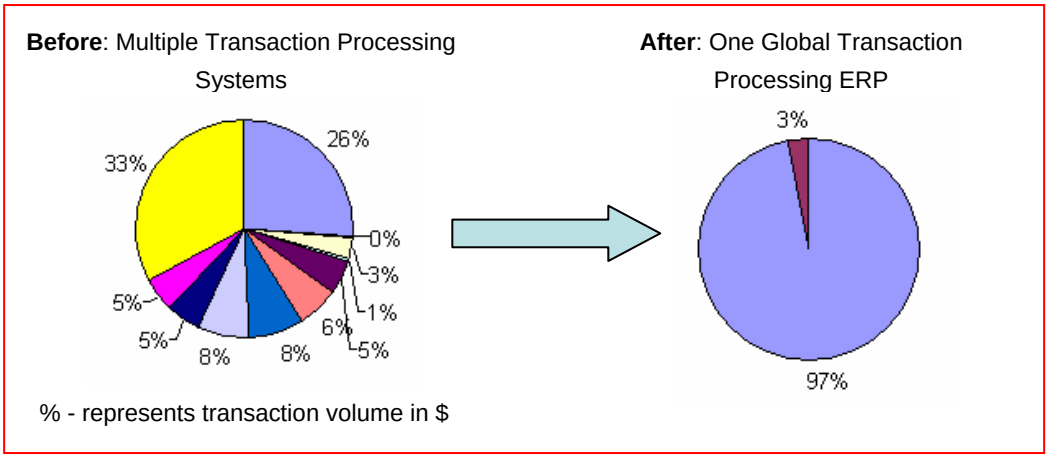


Figure 1. GPR transaction architecture

Through a release strategy that spanned more than two years, GPR represents today 97% of corporate spends. These spends include indirect, capital, and direct spends. About 1000 users are running 2000 reports per week. The solution enables sourcing (aggregated) and operational (line-level detailed) analysis.

GPR enabled the transition from a regional model—in many cases, a primitive one where commodity managers asked suppliers to provide spends information—to a globally centralized model that supports comprehensive spends visibility. GPR and the corresponding design activity (the positioning of the Commodity-based model) were major contributors

to the e-Procurement program's $300M business value, as depicted in Figure 2.

eProcurement program - 300M savings

"Data/BI" - critical enabler:

- **Supports the Global Sourcing and Operational Procurement re-organization.**
- **Provides Data for newly created 5 step sourcing process.**
- **Reduction in Maverick Spends.**
- **Supports volume aggregation and supplier optimization strategy.**
- **Identifies and assigns responsibility for $2B non-po spends.**
- **Productivity gains – exponentially shorter planning cycle.**
- **Visibility to DQ – 28% commodity assignment improvement**
- **Creates a Global "One version of the truth"**
- **Infrastructure optimization - Legacy End Of Life.**

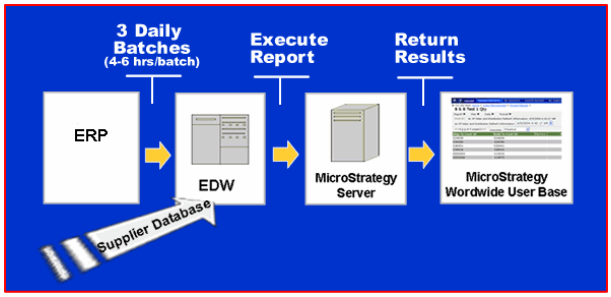
Purchasing Magazine (2004) honors Intel (with 6 other companies) – "Heroes of Spends Management"

Figure 2. Data/BI driving Program value

GPR Design Approach

The critical business value within the e-Procurement program was approached through optimized sourcing, volume aggregation, increased contract utilization, and a reduction in maverick buying. The sheer notion of sourcing optimization on a global level, within a relatively unclear area (indirect spends) meant that the problem was defined at the enterprise level. Both the application and technology layers of the solution support the realization of the enterprise model—SAP's ERP was chosen as the OLTP (Online Transactional Processing) layer, EDW (Teradata™ a division of NCR) as the container Decision Support System / Reporting layer of the Enterprise Data Model, and MicroStrategy as the Relational Online Analytical Processing (ROLAP)-based technology, within a web-interfaced reporting solution. (Figure 3).

Figure 3. GPR transaction architecture



The first step was to create a conceptual data model that provides visibility to data, in order to support the program value dials. The key in GPR's case was to connect Commodity, Supplier, and Contract. The creation of this model, shown in Figure 4, and its representation within the e-Procurement program team was a key milestone.

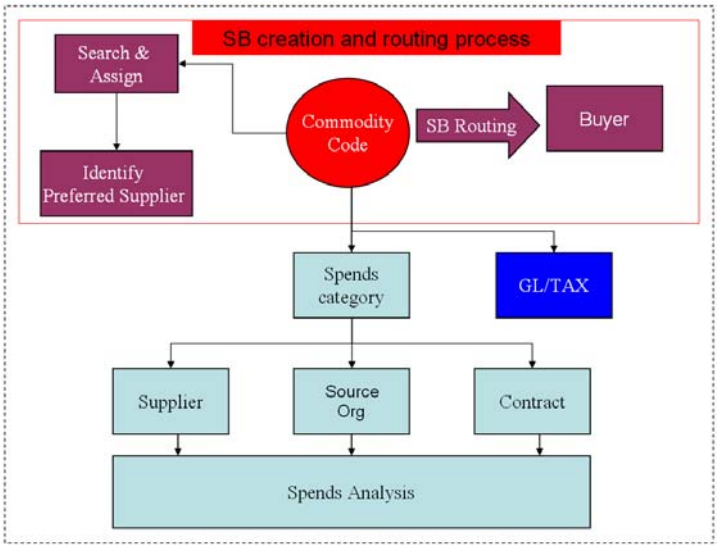


Figure 4. Conceptual model connects Commodity, Supplier, and Contract

A small team of business experts with application-design experience created a dimensional model based on this conceptual model. Their goal was to identify the key dimensions—most with a hierarchical structure—that will be able to answer most business questions (see Figure 5).

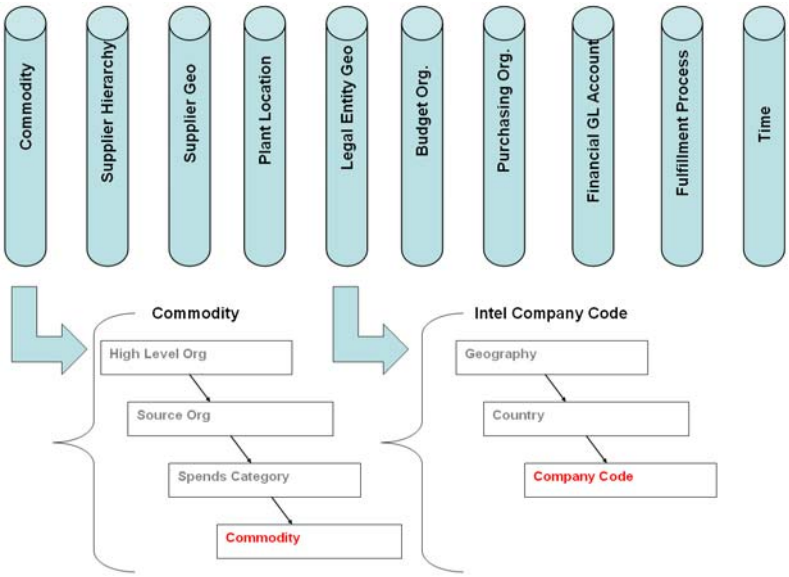


Figure 5. GPR Dimensional model (sample)

The dimensional structures were mapped back to SAP, which managed the Master data and the transactions. The Commodity dimension did not exist within SAP in the form required to enable procurement-relevant spends analysis. The implications were as follows:

- The business process had to be designed such that the Commodity data element was assigned throughout the transaction process.
- The content of Commodity had to be defined.
- The correct interface—SAP Enterprise Buyer Professional (EBP)—had to be configured/custom built.
- The data model in the application layer had to reflect all the above, meaning that tables had to be created in SAP CRS to support the four levels of the Commodity hierarchy.

This last point means that new master data structures had to be created. A similar process was undertaken in the re-engineering of the Supplier data. It was evident that the as-is Supplier data structures would not support spends analysis, due to issues such as multiple locations for same supplier, name/address data-quality, and other. A team formed specifically to deal with “Supplier”, enacted a dramatic extent of change; they designed and implemented a completely new architecture, with a new supplier database interfaced to SAP. Finally, it was decided to push out the Contract data re-engineering, waiting for the design and integration of Contract management application into SAP.

Using TQdM* methodology, Data Quality assessments were made on the critical master data elements, and key definitions were created for concepts such as “Invoiced”, “Commits”, and “Paid”.

These metadata definition discussions were extremely tedious but necessary.

The team gathered report requirements only after all the above was completed. Initially, they defined requirements at a high level, mapped against the dimensional model within a fit/gap assessment. The key goal was to identify whether any dimensions were missed. In the detailed design phase, the required attributes were identified, and the logical data model was completed, enabling the actual solution development to start.

Observations

GPR represents an enterprise **Subject Area** that uses the PO, Invoice, and Payment data within the Requisition to Settlement business process. A Subject Area is defined by the fact it deals with core business processes. These processes are linked to core master data elements. In this respect, Spends Analysis is a Subject Area using master data elements like Supplier, Commodity, Contract, and Source Organization. These elements are core to the Subject Area. Factory Spares management will regard Item and Equipment as core. Supply/Demand analysis will regard Product and BOM (Bill of Materials) as core. Business transformation programs that operate on a Subject Area level therefore provide a natural mechanism of dealing with master data re-engineering. Furthermore, a well-formed synchronized plan can build out the enterprise master data required to run the entire supply chain. The transformation programs do not always comprehend this aspect of the re-engineering scope up-front.

Subject Area design, utilizing multi-dimensional Online Analytical Processing (OLAP) technology, focuses on identifying the dimensional structure on which the entire Subject Area is built. The identification of the hierarchies within those dimensions creates a foundation for nearly unlimited reporting scenarios to cover an open-ended number of business questions that may arise in the future.

The other critical attribute of a Subject Area design is that enterprise data models that reside in an Enterprise Data Warehouse should be created once and used by all potential applications. In this respect, spends data will be used by many groups and organizations within the enterprise. Instead of recreating it repeatedly, a Subject Area design approach will create a 'one version of the truth' model that can be reused.

As new subject areas are added to the EDW container, any overlapping data between subject areas must be rationalized within the overall design. This is in keeping with a “Single Version of the Truth” and ensuring that there is always one uniform view of the business.

The **conceptual model** (and dimensional structure) triggers changes in both the Business Process and Architecture layers of the program. The GPR team created a conceptual model representing the business logic of the commodity data element necessary to achieve the program goals. This presentation was a critical milestone, as it focused attention on the true goal of the program (to deliver spends visibility capability to global sourcing managers), as opposed to the means (deploy SAP).

Unfortunately, transformation programs tend to dedicate a disproportionate amount of their energy into the implementation of the transaction system, with relatively little attention to the Data/BI aspects. For example, in the e-Procurement case, 97% of the value was sourcing-related, while only 3% was transaction-management-related. Furthermore, the sequence of events that goes "first deploy the transaction engine, then deal with the reports" is backward, creating a strong risk that the reporting output will not be tied to the actual transformation business values.

An interesting aspect of the conceptual model is the fact that it created a 1:1 relationship between commodity and source organization. It implied a globally centralized commodity-management structure, and the team found that without it, the model would crumble. Thus, the BI-driven design

process influenced and confirmed the organizational change driven by the e-Procurement program.

GPR expanded beyond the program that hosted it. In other words, the Subject Area design was enterprise-focused in its scope. While e-Procurement focused on Indirect Procurement activity, GPR could not stop within the given boundaries, as a matter of its core definition. That is, it had to expand into the Direct area due of the need to cover the enterprise activity within spends analysis.

The host program (e-Procurement) was therefore forced to deal with master data re-engineering, even though such re-engineering was not in the initial project scope. The master data re-engineering activity, especially in the Supplier area, proved to be highly complex. The e-Procurement program office dealt with difficult questions, such as the following:

- To what extent can the program re-engineer the Supplier area?
- Is this really the scope of the program?
- How long will it take? What is the cost?
- Who (which organization) really owns Supplier?
- What is the goal state?

Ultimately, the project team created a sub-team specifically to work on the Supplier area, and that sub-team did accomplish results, although several scope related compromises were required along the way. As much as the program was concerned with the risk of initiating master data-related re-engineering activity, management was aware that bypassing the problem would lead to failure. **Unless Master data is not dealt with centrally on an enterprise level, business-transformation programs must include master data re-engineering within their scope.**

Design Approach: Key Findings

On the basis of the experience described in this paper, Intel proposes a BI-driven design approach that supports the enterprise goals of creating horizontal, standardized, streamlined and effective business processes, as illustrated in Figure 6.

Key findings that support this approach are as follows:

- **Break the system's global capability into Subject Areas.** It is very difficult to re-engineer the supply chain as a whole, so it is useful to break it into logical pieces, based on activity. As an example, Materials primarily runs three types of activities—spends, inventory, and Supply Demand Analysis (SDA)—each of which can be approached separately. We can confirm that these are organic (exclusive) Subject Areas by looking at the key master data; an organic Subject Area will have core master data elements that were created within the Subject Area. Note that the schema for breaking up capabilities in this manner do not fall along organizational lines.
- **Identify the business value drivers –** what are the specific drivers the transformation aims to support. How will success be measured?
- **Create a conceptual model** that supports the business value drivers, identifying the key dimensions and master data elements. This model should be produced by a small team of business experts.
- **Map high-level requirements to the dimensional model.** Detailed gap analysis needs to be performed at this point, ensuring that all aspects of the high-level picture are addressed by the dimensional model.

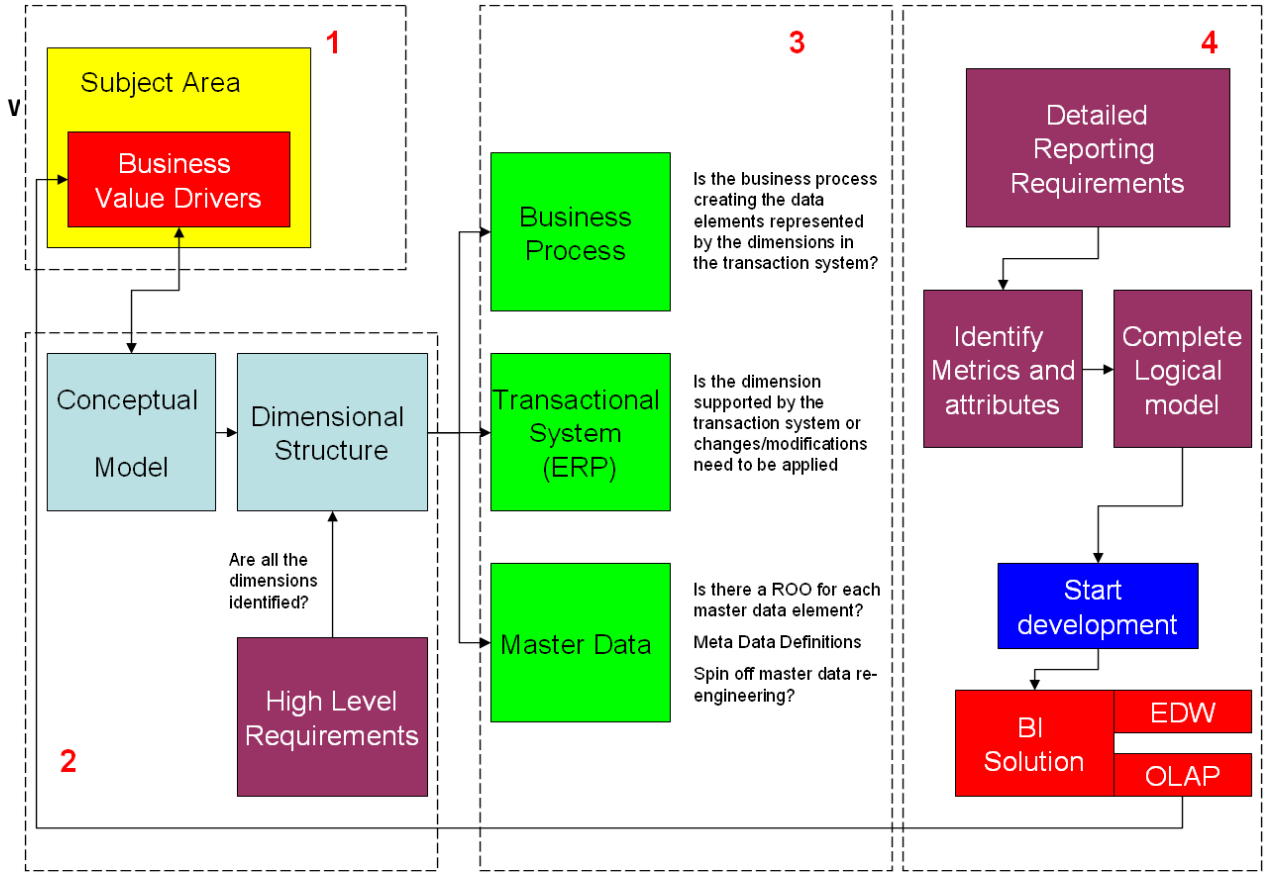


Figure 6. BI-driven design approach

- **Present the model within the project team.** This critical milestone represents the core transformation. Outline the implications of the proposed model on systems, in terms of what needs to be configured or changed in the transaction system, as well as business processes. The gaps will occur in areas where the required data is not created within the transaction system (not at all or not in the right structure). Both the system and the business process teams have to adjust their design based on the BI-driven data model.

- **Do not bypass master data problems.** If needed, spin off a project that deals with the master data, to address issues such as Record of Origin (ROO) creation and definitions, including how the master data is created within the transactions, impacting the business process.

- **Gather detailed requirements.** Complete the build up of the logical data model with all required attributes, and prepare for development.

Summary

By utilizing the conceptual model and dimensional view, the BI-driven approach to business transformation connects back to the business process and application architecture. The outcome is a highly flexible model that allows extensive data visibility - both operational (detailed) and strategic (aggregated) become a key component in driving the transformation to success.

The Subject Area-based breakdown of the activity is very efficient in building out the enterprise model, effectively identifying the core master data elements, and forcing the need to deal with them. Further, Subject Area-focused business transformation helps to overcome organizational barriers: sourcing capability should be same for indirect and direct, and raw materials SDA (Supply/Demand Analysis) requires alignment with planning, the groups that design the products and manufacturing.

The Subject Area design within a BI-driven approach also highlights the transformation versus the

implementation of the transaction system (i.e., focus on the transformation itself, rather than on how to implement the ERP).

Master data is foundational, not well scoped and understood within the business transformation program. Two different approaches emerge:

- According to the first approach, the focus should be on building the enterprise Master data layer as a pre-requisite to, and independent of the business transformation programs. First complete the architecture layer, then transform. Unfortunately, while IT understands this approach, business groups typically find it difficult to identify the short-term linkage to business value.
- According to second approach, use the Subject Area focused business transformation programs as the vehicle and catalyst for master data re-engineering. The programs will have to include this consideration in their scope up-front, usually as a first step within the transformation effort. While the Business groups focus on the transformation activity value, architecture governance processes need to "force" the inclusion of Master Data re-engineering in the program scope.

The BI driven design drives a reverse re-engineering-based approach - first, identify the data that is required to accomplish the program value drivers, and then influence the business and system/application architecture aspects.

During the e-Procurement program, the work on GPR and the related experience and learnings directly influenced the organizational realization of the importance of Data. – Both the analytics and Data Quality aspects. A BI strategic framework was created, with ongoing education to change the perspective around BI's role in the transformation. That is, it is necessary to continually espouse BI as a key vehicle in creating an enterprise capability, as opposed to being perceived as an end-result of the process (i.e., a 'reporting solution').

In sum, the BI-driven approach to business can be a mechanism for creating an enterprise model with master data re-engineering as one of the key implications - an outcome that is critical for attaining the integrated enterprise supply-chain that is a key enabler to support Intel's platform strategies.

Conclusion: Business Intelligence Methodology – A 'How-To' Guide

The GPR case study is a fitting example of the powerful benefits to be achieved using BI to transform business. The GPR case study describes how a Business Intelligence (BI)-driven methodology can be very effective in implementing business transformation programs within an enterprise framework.

Modern companies create an abundance of business data, and most organizations typically use their BI services such as departmental reporting, cube analysis, and ad hoc query to help understand the '*what happened*' and '*why it happened*' via reporting on historical data. These traditional BI services only scratch the surface of the analytic possibilities.

The real value proposition associated with BI reaches far beyond pulling together and analysis of vertical slices of business data. The BI paradigm is an enabling technology that can drive fundamental issues of enterprise design. As the term implies, "Business Intelligence" reflects the fact that we can readily create "Intelligence" about a company's internal and external operations.

The BI Requirements Engineering Workflow in 'Appendix A' is a standard Business Intelligence methodology for Business Units to follow. The approach described dove-tails the GPR experience, design approach, and key findings described in this paper and provide a next level of detail for utilizing BI. Motivated by the GPR transformation success, the intent of 'Appendix A' is to provide the next level of detail on 'How-To' move forward with BI.

Acknowledgements

- Kieran Mulqueen for contributing content and information to this article.
- James Arama for additional input and content.

Additional Resources

The following materials provide a point of departure for further study of the topics discussed in this paper:

- e-Procurement – Strengthening the Indirect Supply-Chain Through Technology Globalization: This Intel® Technology Journal article demonstrates how Intel Corporation has been refining e-Procurement processes to achieve greater flexibility, greater efficiency, and lower costs.
- Intel Goes Global with Indirect Buying Strategy: This article published in Purchasing Magazine shows how Intel uses a single global sourcing process across its entire indirect materials spend, uniting purchasing, business and finance units.
- Super Spend Analysis: This Purchasing Magazine article relates to Figure 2 above. As part of the magazine's chronicle of leading-edge practices in spend analysis, it identifies Intel's spend analysis focus on leading-edge tools that aggregate spending, enabling buyers to leverage their purchases with suppliers.
- Building an Enterprise Data Warehouse and Business Intelligence Solution: This white paper describes how Intel migrated more than 50 applications and 200 individual data marts into a consolidated enterprise data warehouse (EDW).
- The Five Styles of Business Intelligence: This analysis by platform provider MicroStrategy summarizes enterprise approaches to realizing the value of BI in maximizing the value of data assets.

Acronym Glossary

Following is a comprehensive list of the acronyms used in this paper.

BDAT: Business Process; Data; Application; Technology

BI: Business Intelligence

BOM: Bill of Materials

CAM: Capability & Account Management

CRS: Central Reference System (in SAP)

DQ: Data Quality

DSS: Decision Support System

EBP: Enterprise Buyer Professional

EDW: Enterprise Data Warehouse

ERP: Enterprise Resource Planning

GPR: Global Procurement Reporting

IT: Information Technology

NGFM: Next Generation Factory Materials

OLAP: Online Analytical Processing

OLTP: Online Transactional Processing

PO: Purchase Order

R2S: Requisition to Settlement

ROLAP: Relational Online Analytical Processing

ROO: Record of Origin

ROR: Record of Reference

SBS: Source Business Solutions

SDA: Supply Demand Analysis

TQdM: Total Quality data Management

VCC: Value Cost Chain

APPENDIX A

BI Requirements-Engineering Workflow

Figure 1 depicts an in-depth BI Requirements Engineering Workflow, with seven primary stages identified. The objectives for each of these sections are described in more detail below.

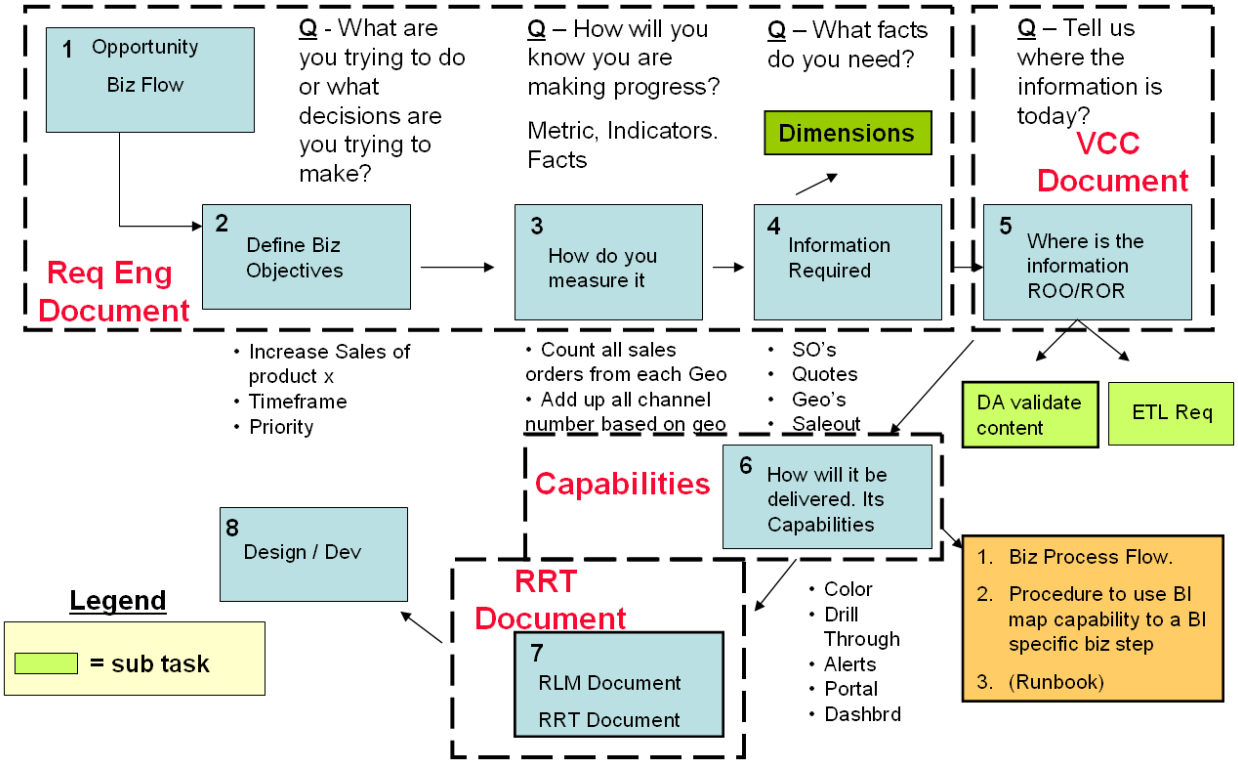


Figure 1. Business Intelligence requirements-engineering workflow.

Stage 1 (Identify the Opportunity) sets the stage for the rest of the project by means of three objectives:

- Understand how a BI solution will benefit the customer.
- Align the customer with past projects or similar business efforts.
- Understand how this opportunity benefits others within the same business group, in order to identify others who can take advantage of the solution

Stage 2 (Define Business Objectives) have three objectives:

- Understand the set of business objectives and goals.
- Identify, at a high level, a timeframe for the delivery of business objectives.
- Identify what decisions can be made from the business objectives.

Stage 3 (Define Success Metrics) sets up the means by which the progress of the project can be measured. This stage has two objectives:

- Understand what business measurements are (or should be) in place or used to track business results. Potential examples include sales orders, purchase orders, and distribution reports.
- Determine what additional business measurements could benefit a required set of business objectives.

Stage 4 (Identify Information Requirements) sets out the facts that the team needs to proceed. This stage has four objectives:

- Identify what supporting information is required.
- Determine what information is recorded and documented.
- Understand the format and value of the data captured.
- Capture the frequency with which each piece of data is updated.

Stage 5 (Identify Information Sources – ROO and ROR) identifies where the information is located in the pre-transformation environment. This stage has five objectives:

- Determine whether a current design is in place.
- Understand the value of the existing design.
- Determine whether the existing design meets performance and growth guidelines.
- Understand the existing ROO and ROR.
- Determine how closely the current design meets the DSS design principles.

Stage 6 (Identify Capabilities and How Information Will Be Delivered) defines the extent and capabilities of the target information-delivery mechanism. This stage has three objectives:

- Define how the business information and measurements be delivered.
- Define the interface look and feel factors that flow across the entire solution.
- Develop a mock up or prototype to confirm customer expectations.

Stage 7 (Document Reporting Structure) involves documenting the reporting structure that will be employed in the solution. This stage has four objectives:

- Document report-specific business objectives.
- Document data requirements.
- Document how a report will be configured.
- Clearly capture what’s required within a single report.

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