A Structured Method for Specifying Business Intelligence Reporting Systems

Cyril Brookes

CEO, BI Pathfinder

Abstract

BI systems are more difficult to specify than to build. The support available for determining the information business executives need and want falls far short of the sophistication of the tools available to implement BI query, reporting, modelling and data analysis.

Yet the long term success and customer satisfaction of BI reporting systems depends completely on creating an effective specification that embodies user needs. Many executives are unhappy with their BI systems, but are unable to articulate specific deficiencies or missing elements. There is no standard benchmark to assess BI system quality.

It is proposed that more structure needs to be brought into the process of evaluating existing BI systems and specifying enhanced or new ones, in order to improve system effectiveness and user satisfaction.

The author has spent several years researching this issue. He has concluded that the main reason specifications of BI reporting systems are inadequate is that the key questions "What is wrong with your BI system" and "What information do you want?" are impossible to answer directly – they're too big, conceptually. Answers are therefore unreliable. Adding structure to the requirements elicitation process is essential if the resulting system is to be satisfying, effective and complete.

1. Introduction – Development of BI systems

Historically, Business Intelligence (BI) software originated with products released progressively from 1975 onwards. The first such products were financial planning based. Spreadsheets became very popular from the 1980s and these applications made the provision of both raw data and processed information more available. Transactions processing systems, for applications such as inventory management, order processing, costing, etc. became widely available in corporations, creating new databases as a by-product. Systems to report from the new data resources then made their first appearance. IBM's Structured Query Language (SQL) and Query by Example (QBE) retrieval packages were novel approaches to retrieval.

Innovative style products evolved based on sophisticated statistical and retrieval algorithms, initially described as Decision Support Systems then Executive Information Systems, then Knowledge Management, Business Intelligence Systems, and more recently, Corporate Performance Measurement. Specialisation and segmentation followed into complex data retrieval, data modelling and, now, "data mining". In this paper I use the term Business Intelligence Systems to cover all the above terminology.

The Internet and the merging of the importance of text data with numeric has recently spawned the growth of the Corporate Portal, offering the same service for the corporation as "Yahoo!" and Google do for personal users of the web.

All these developments have progressively and greatly increased the reporting and retrieval capabilities of BI systems. However, technology based support for the task of specifying the information executives want, or need, out of all the available data has not evolved to nearly the same extent. Nor has there been any real improvement in the general understanding of this process – with or without technology to assist. This is apparent from the discussion in the next section of the paper.

2. Approaches to specification of BI System requirements

It is axiomatic to state: "*Before implementation of any information access and reporting system, the data/information to be displayed, its format, granularity and the frequency of reporting must be specified by the executive(s) who will use the system*."

It is a major premise underpinning the subject of this paper that this specification task is both difficult and usually poorly executed. The highly regarded text book "Building Executive Information Systems" summarises this situation as: [1]

> "*Because executives perform highly unstructured work, it is difficult to identify their information requirements.*
>
> *What information to include in an EIS is critical. If the users do not find the system's contents to be helpful in performing their job responsibilities, they have no reason to use it. The challenge is in finding what information to include. Getting executives to specify what information they want is the primary worry of EIS developers."*

The different approaches adopted by many BI system developers are summarised as in Table 1 below. Some techniques are duplicated if they can be adopted in more than one way. [1]

The "Discussion with Executives" approach is critical to the system's success. However, it is not simple to apply. [1]

> "*Simply asking the executive what information is wanted rarely results in a comprehensive description of information needs. Answers will be influenced by what information the executive has seen recently, the contents of existing reports, current problems and the executive's limited understanding of what can be done with information technology.*
>
> *Some analysts are able to get little or no time, while others have good access to the firm's executives……noting that the amount of time an analyst gets is often related to how well the analyst knows the business.*"

	Non-Computer Related	Computer Related
Direct Executive Interaction	● Discussions with executives ● EIS planning meetings ● Volunteered information ● Examinations of non-computer generated information ● Critical success factor sessions ● Participation in strategic planning sessions ● Strategic business objectives method ● Tracking executive activity	● Examinations of computer generated information ● Examinations of other organizations' EIS
Indirect Executive Interaction	● EIS planning meetings ● Discussions with support personnel ● Examinations of non-computer generated information ● Attendance at meetings ● Examination of the strategic plan ● Tracking executive activity	● Examinations of computer generated information ● Examinations of other organizations' EIS ● Software tracking of EIS usage

Table 1. Categorizing the methods for determining information requirements

One of the widely practiced approaches to the implementation of BI and EIS systems is the Balanced Scorecard developed by Kaplan and Norton. Their concept focuses on ensuring that executives and system designers adopt a "balanced" approach to

the implementation of systems. They state that executive reporting systems should have four reporting component perspectives: [2]

- Customer
- Internal business
- Innovation and learning
- Financial

The balanced approach also is intended to address the need for experience and knowledge of the business on the part of the consultant analyst. Executives need to be confident that the interaction and specification processes are worthwhile, and likely to be productive.

The various approaches listed earlier in Table 1 are all operationally possible. However, they suffer from deficiencies. Specifically, they:

- Overlap, and the resultant specifications require substantial culling, to remove duplicate items
- Require skilled, experienced, consultants
- Do not easily allow for the experience in earlier projects to be communicated or used by executives and consultants in later ones
- Contain a mix of information required for "routine" regular reporting with that needed to solve problems that rarely arise – requiring further analyses/interviews
- Are often confusing and frustrating for executives, who see them as inefficient and unproductive

Although the four information reporting perspective categories of Kaplan and Norton are useful in defining segments of a BI system requirements study, they remain broad concepts. The analysis techniques required to determine specific measures required by executives are still the same as described in Table 1. This process is described in a later paper by Kaplan and Norton. [3]

The problems with the conventional approaches in Table 1 make it clear that more structure is needed in the process to remove duplicate analyses, define the scope of the task and ensure that expertise is embedded to empower less experienced facilitators to achieve good results.

It is postulated that the question "What information do you want?" is cognitively too large for most, or even all, executives. It is easy to ask, but impossible to answer adequately. Yet the answer has to be found, otherwise a useful, beneficial, system cannot be built. This is the subject of the next section.

3. How do we add structure to this requirements elicitation process?

The question "What information do you want?" is considered to be unworkable as an approach, because it is too comprehensive and is impossible to answer in one response. It is a big question. The obvious solution is to seek to ask a series of

smaller questions, ones that can be answered easily, without excessive analysis or consideration by the executive or facilitator.

The common approaches to creating smaller questions or analyses were described in Table 1. They have the deficiencies outlined earlier, particularly the extensive overlap and narrowness of scope. These must be removed if a better method is to be devised.

The major objective of the research that underpins this paper was to find a set of small questions for consideration by the executive and facilitator that are independent of one another. The resulting BI system specification will contains requests for information and data analysis that are built from cumulative responses. Therefore, the answer to the big question "What information do you want?" will be the logical sum of the answers to the independent small questions.

An appropriate set of independent small questions has been determined through considerable research and analysis. It has been proven effective in a number of large corporations. The assessed optimal decomposition process involves three or four levels, each one involving narrower concepts than its parent. The first two levels are depicted in Figure 1. A more detailed description is presented in the next section and on the Internet at http://www.biready.com.au/bi-pathfinder-requirements-methodology.htm.

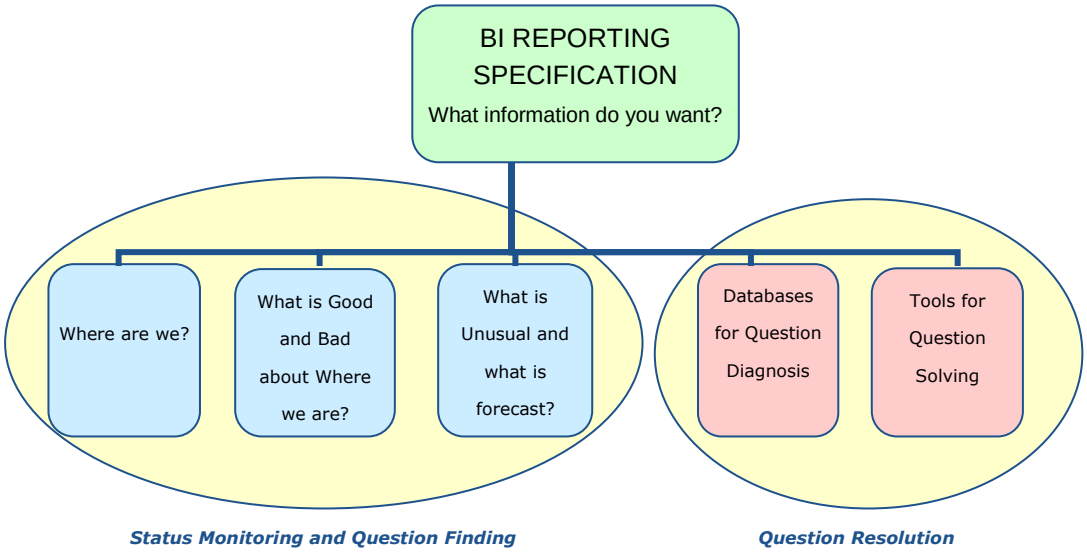

Figure 1. A structured architecture for BI system specification

4. More details on the method for BI requirements elicitation

The research identified four categories of BI information that are commonly useful in pre-formatted reporting to executives and managers. Obviously, it is not possible to specify, or implement in advance, information reports applicable to problem situations that have not yet occurred. This requires extra-sensory perception!

The focus, therefore, must be on specification of reporting for routine and ad-hoc reports that can be pre-formatted. These types of report have three basic objectives; paraphrasing the pioneering work of Stafford Beer and his concepts of attenuation and amplification: [4]

- Comfort –the status of the relevant environment is measured and reported, including, but not restricted to, a set of key performance indicators
- Benchmarking – the status parameters are compared against relevant benchmarks that represent expected or target performance
- Alerting – any situations that are unusual or forecasts that are out of limits are highlighted

There are, however, some problem situations that can be anticipated in advance; for example, an accounts receivable department will expect that debtors will occasionally not pay their accounts on time, and some form of action will be required. Reporting and data collection relating to these situations can be pre-specified even though the specific debtors and circumstances are not yet known.

Based on this analysis, an initial decomposition model was developed. This divided the requirements determination process into four modules as in Figure 1.

- Where are we? A set of questions directed at the status indicators of the target environment.
- What is good and bad about where we are? Questions directed at determining useful comparisons of status with benchmarks
- What is unusual and forecast? Highlighting any unusual trends or unsatisfactory forecasts
- Resources needed to solve (foreseeable) problems fast

Lower levels of the decomposition are not within the scope of this paper. However one unique feature is the inclusion of tacit information sources in the specification process – for example, reporting on what people are saying about the business, the products, the service, staff morale, etc. Additional details are available on the website http://www.biready.com.au/bi-pathfinder-requirements-methodology.htm.

At the lowest level is a set of project or corporation specific BI elements that are specifically selected to prompt the executives and their facilitators with the complete range of information categories that could be utilised and the data resources that are available. Initial proving of the concept was using a “paper” based methodology. More recently PC software with multiple synchronised databases has been created. This software automatically records the information element selections made, and any customization created, during the project. It also creates the interface with system developers who must implement the actual BI system.

The basic model of the elicitation methodology, called BI Pathfinder, is a generic set of questions that define BI information elements. These are grouped into sets aligned to business process elements: any grouping can be used, but the normal implementation employs Porter’s Value Chain model, specifically: [5]

Support Activity Processes:

- Procurement
- Technology Development
- Human Resources

- Infrastructure

Primary Activity Processes:

- Marketing
- Inbound Logistics
- Operations
- Outbound logistics
- Services

The end result of the research project has been the creation of a generic template of BI information elements that span all business process groupings as above. It includes both factual and tacit information sources. The generic template is not useful for specific BI projects as the terminology is inappropriate for a specific industry or corporation.

Adaptation of the generic template for use in a specific project requires 1 to 3 person days of effort. The project templates for similar businesses are obviously nearly identical, and can be created quickly. The scope of the project also has a major effect, for example a Human Resources BI system will only have minimal specified content from the other business process areas.

The end result of a BI Pathfinder project is the preparation of the BI system Specification Report. This is a project specific document that collates all the selected BI elements, comments and customizations that have accumulated during the executive/facilitator interview and analysis sessions. This report segments the requirements into report format types, and records the desirable frequency of presentation. Particular attention is given to the data source and data dimensions required to build each stage of the BI system.

5. Results from using the BI Pathfinder structured method

There is limited experience with the methodology to date. Approximately 10 major projects are complete, but the detailed results are not able to be presented due to the commercial sensitivity of the projects. It is not claimed that the results to date are statistically significant, but they do point the way to the need for further analysis as more projects are completed.

5.1 The validity of the basic approach

All executives interviewed agree:

- They do not know enough about their information use to answer direct questions relating to the totality of their needs
- The break-up of questions into the four BI Pathfinder modules of Figure 1 is appropriate, effective and efficient
- The method does stimulate them to identify information needs that were not obviously useful at the start
- The method is best used in stages, with an initial review of the utility of existing BI systems, including identification of major deficiencies and then moving to more specific needs at a later interview – usually after some assessment of data resources has been made

5.2 The project template

The template used during interviews is critical to success. The basic model clearly works well, and the structure it creates is essential; but the specific questions, their scope, terminology and relevance to the target environment must be correct or the interviews lose the executive's support; and the resulting specification elements are not complete. It is important to decide what topics must be omitted, since executives quickly tire of being asked irrelevant (to them) questions. The division between stimulating creativity in specification, and developing managerial impatience, is fine.

This highlights the importance of the original research template. It is central to the overall success of the method. Creating a customised project specific template from the generic one is relatively trivial.

As experience develops, the original research developed template is being adapted. One innovation is the automatic propagation of performance indicators throughout the Pathfinder project template. This greatly speeds up the interviewing process and ensures complete coverage of the potential BI capabilities of available tools.

5.3 Technical versus business issues in BI specification

Another recurring conclusion from completed projects is the need to manage the technical input. In particular, there is often conflict between data source availability and the need for certain reports. If the required data isn't available at the required granularity or accuracy, then clearly the project will fail.

On the other hand, if data availability is considered too early in the project cycle, many high value reporting needs may be left out.

Results to date indicate it is far better to determine information needs without considering data resources. The adequacy of the data becomes part of the BI Pathfinder method once the initial review is complete and high value information elements are identified.

6. Conclusion

The task of specifying BI systems requirements is non-trivial. Most systems are specified in an unstructured manner and this is a common reason for user dissatisfaction. The central reason why the specification is faulty is that executives are unable to answer adequately the question "What information do you want?"

Research has identified a means for introducing the required level of structure into the BI specification process. This structure involves decomposing the questioning of executives and the analysis of other data into four modules. A further essential element is the creation of an appropriate set of project specific questions. This also has been the subject of considerable research and trial and error.

The results to date are embodied in a software based system called BI Pathfinder. Benefits observed to date include:

- The requirements specification task becomes structured and visible to both executive and facilitator
- It offers a unified, cumulative and logically sequenced approach that replaces, or augments, most other methods
- More use is made of advanced features of BI software tools
- It is more efficient in the use of executive and analyst time
- The information needs are linked to the data resources available and required
- Intellectual property is created during the specification process, making subsequent interviews and designs more efficient since less repeat questioning is needed
- Experience is “inbuilt” with the questions that form the project template, therefore, less experienced consultants achieve good results

References

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[3] Robert Kaplan and David Norton, Putting the Balanced Scorecard to Work. Harvard Business Review, Sep-Oct 1993, p 128
[4] Stafford Beer, Brain of the firm. 2nd Edition, Chichester John Wiley 1972
[5] Michael Porter, “The Value Chain and Competitive Advantage”. In: Competitive Advantage: Creating & Sustaining Superior Performance. N.Y.: N.Y. Free Press, 1985.

About the Author

Dr. Cyril Brooks was the first CIO of BHP, and the founding professor of information systems at the University of New South Wales. He developed grapeVINE which he subsequently sold to Sun (now Oracle). He was the founder and CEO of EIS Pathfinder in 2004. His life was cut tragically short in 2007.

About BI Pathfinder

BI Pathfinder was to be a software product to manage the process within Cyril’s methodology. We don’t have the software, but Cyril’s methodology certainly lives on, and is perfectly valid and suitable for eliciting accurate requirements from business users for any BI project. For more information, visit www.biready.com.au