

# *Requirements Management: Solutions Review*

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PLM Integration/Product Definition

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## **CPDA: Collaborative Product Development Associates, LLC**

CPDA's Product Lifecycle Management (PLM) research programs target the critical decisions in Product Lifecycle Management challenging Design, Engineering, Manufacturing, and Information Technology managers and executives. CPDA's PLM collaborative research programs provide in-depth analysis of strategies, products, issues, processes, technologies, trends, case studies, and surveys for assessing technology, business goals and objectives, and implementation road maps.

The cohesive suite of collaborative programs clarifies and evaluates new capabilities, standards for frameworks, and development issues; it highlights the most advanced uses of leading technologies, and it links the technical effort to the realization of business value. The four collaborative research programs include:

**Design Creation and Validation:** A bottom-up view of engineering requirements from the desktop across the enterprise. Advanced computer-aided design (CAD), engineering analysis, manufacturing technologies, collaboration, and visualization software serve as springboards for gaining a competitive advantage. The Design Creation and Validation service applies CPDA's structured methodology to the evaluation of new products and processes as well as to current projects in client organizations. A critical focus, the emerging technology of knowledge engineering with templates and rule-based architectures focuses on delivering the needed tools into the hands of product developers to capture knowledge, and to formalize its use. The use of direct geometry access and manipulation, data translation technology, XML alternatives, and JT options are also assessed for their ability to deliver interoperability across the diverse and disparate business and technical applications.

**Design/Simulation Council:** The Council promotes a standard framework employing common terminology to integrate and optimize the diverse and divergent specialist activities currently fragmenting design efforts. CAE must fully integrate with design, up front, to close the chasm between design and analysis. Analysts must actively participate continuously in design decisions and enter the mainstream. The impending breakthrough in CAE will rest on knowledge reuse, process capture, and streamlining.

**PLM Integration / Product Definition:** A top-down view provides a conceptual framework for collaboration across different product development perspectives, bridging customer needs, systems engineering and tradeoffs, design solutions, and fulfillment and manufacturing. Integration and interoperability in complex PLM environments pose substantial hurdles. The rapid transition to cross-enterprise collaboration, at all levels of design and supply, intensifies the pressure on existing, inwardly focused IT architectures to support and enable new modes of doing business.

**Product Value Management:** Common processes for design, development, and product introduction across the supply chain may be validated with reference models such as SCOR (Supply Chain Operational Reference model), or VCOR (Value Chain Operational Reference model). The first step, business process modeling (BPM), facilitates the building of consensus around a common understanding and terminology, across organizations and functional silos. Mapping BPM to a service-oriented architecture based on open standards represents a critical second step. An IT integration infrastructure in a Federated Enterprise Reference Architecture™ (FERA) supports a loose coupling between enterprises extending across the supply chain.

Collaborative Product Development Associates was formed by the PLM research team of D.H. Brown Associates, Inc. (DHBA).



# Requirements Management: Solutions Review

*Michel Vrinat, PLM Research Director*

## EXECUTIVE SUMMARY

Collaborative Product Development Associates (CPDA) has completed a systematic and thorough analysis of eight requirements management solutions, based on over one hundred functional criteria weighted according to customer-assigned importance, and rated after detailed demonstration and review with the vendors. The functional criteria characterize nineteen main functions, grouped into five categories, representing major process steps needed to support requirements management:

Requirements Capture: gathering, elicitation, and qualification

Requirements Flow Down and Across: allocation, decomposition, and validation

Requirements Structure and Relationships: dependencies and traceability

Change Management: impact analysis, history, and baselines

Report Generation: automatic report generation, filtering, and views

Among the eight solutions analyzed, none demonstrate major weaknesses in the core functions necessary to support requirements management. With over one hundred functions reviewed across all offerings, only six functions not well supported. Most of the solutions offer advanced functions that may be applied immediately without undue technical effort.

Driving requirements from the high level of system engineering down to detailed design and simulation is not a mainstream approach today. Any prospective company must complete a careful analysis to evaluate the tradeoffs on applying a requirements management solution, and determining the most appropriate approach and solution.

The set of eight solutions covered in this analysis provide tools for requirements management solutions that are ready for broad use. They are straightforward to implement, and bring clear and significant benefits.

Cradle, from 3SL, a small company based in the UK, leads all others across almost the whole set of functions, with an average rating of **2.86** out of 3. Cradle shows special strength in the ability to dynamically generate traceability matrices

with several levels of cross references, supported by a very simple and pleasant user interface. Cradle provides extensive functional coverage for document import, requirements flow down and management, change management, configuration management, metrics, and report generation.

KollabNet, a new comer in this area, has excellent ratings on most criteria, even though requirements management does not represent the main focus of the product. Bridging requirements management with process design and execution for product development is KollabNet's primary objective.

Telelogic, the leader in the requirements management market with 47% market share, has particular strength in the importing and exporting of documents, project organization, and report generation.

SmarTeam CSE incorporates an excellent vision, benefiting from the feedback of Dassault Systèmes users in the electronics industry in adapting the product to a Systems Engineering approach. In particular, the handling of multiple conformity matrices that deal with the allocation of requirements to functions, and functions to parts, as well as the ability to manage changes both top-down and bottom-up through dependencies, make the product very attractive. Unlike all other vendors, however, a live demonstration of the product was not available to assure that the company successfully and fully implemented the concepts and vision in the product.

The next phase in our critical analyses of requirements management will concentrate on interviews with leading-edge users to validate the capability in applying the software, to uncover barriers to successful adoption, and to size the payoff.

## INDIVIDUAL HIGHLIGHTS

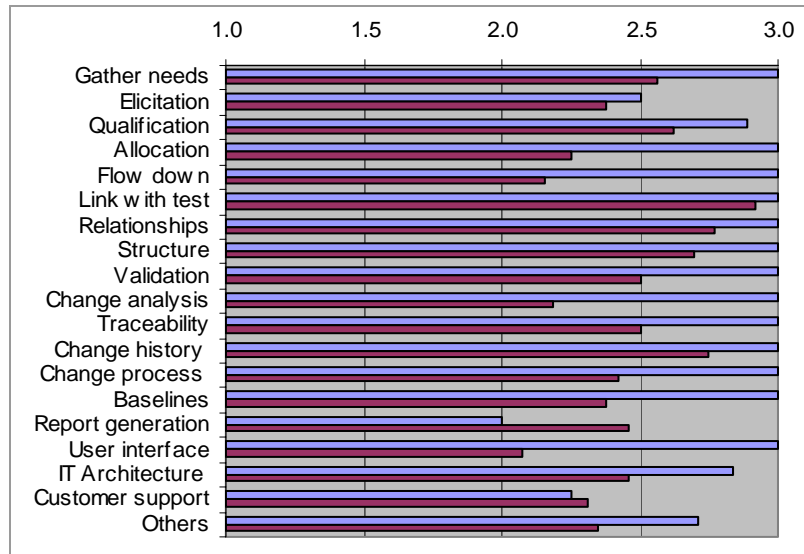
### 3SL/CRADLE

3SL provides advanced techniques to automate requirements identification, to automatically build a list of requirements, and to organize them in a structure with a unique identifier and pre-defined attributes according to rules, context, and user profile.

Cradle supports different types of links, with attributes. Rules can be applied to dynamically change the requirements configuration depending on the conditions set to generate specific views of the requirements structure. It supports the analysis of the impact of changes based on conditions such as what has changed, what is new, and what has been removed. Traceability matrices are easily created and used to track down changes, validation, and fulfillment.

As summarized in the chart below, 3SL leads the average rating in seventeen of nineteen categories. It shows lags in report generation, and as a small company provides limited support globally.

**FIGURE 1**  
 3SL/Cradle Rating  
 Compared to Average;  
 Darker Bars Represent  
 Average

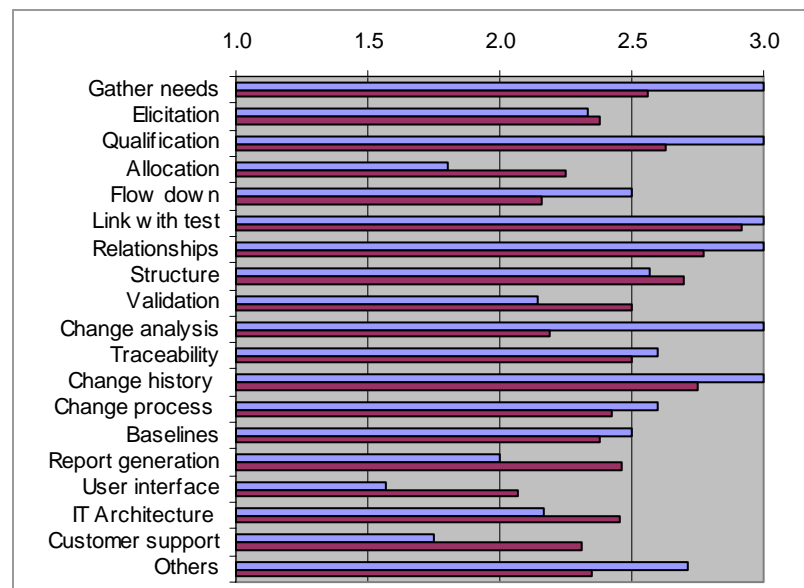


**KOLLABNET**

KollabNet provides automated requirements identification, based on a text style and key words. It has the unique capability to structure the requirements in a nested network with conditional links and rules. It can automatically recognize numerical values in a text string and use them as parameters in design or simulation. KollabNet is able to automatically inherit attributes and to create the necessary links when refining or deriving requirements. The whole structure can be reorganized by changing the root node.

While KollabNet leads the average ratings in eleven categories, it lags in functional allocation and report generation. The user interface, quite attractive in terms of graphics, is cumbersome with a number of actions.

**FIGURE 2**  
 Kollabnet Rating  
 Compared to Average

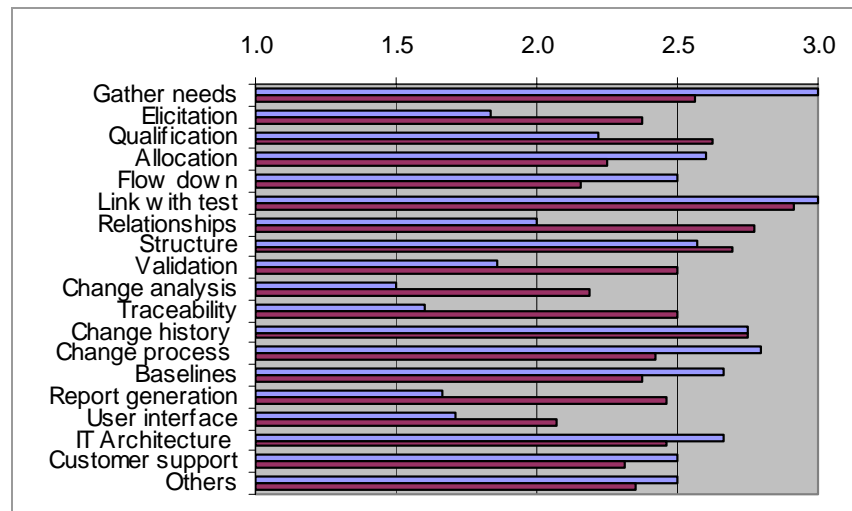


**MATRIXONE/PRODUCT CENTRAL**

MatrixOne, through a cooperative agreement with Telelogic, offers direct import of the Doors requirements structure, with bi-directional links and attribute synchronization. Product Central supports options and variants management with rules that are applied to filter requirements, based on attribute values. MatrixOne proposes a change management process with associated workflow.

With many areas of weakness in requirements management, Product Central better serves the needs of document management.

**FIGURE 3**  
 MatrixOne/Product  
 Central Rating  
 Compared to Average



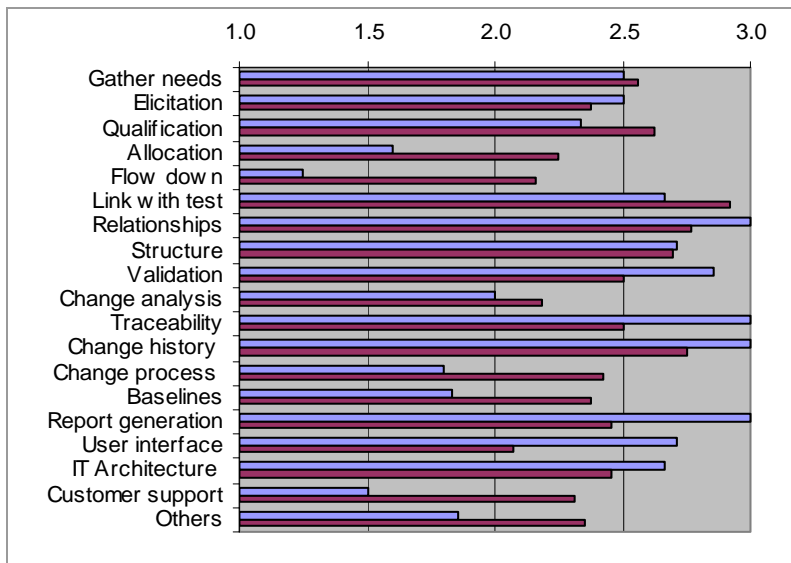
**RATIONAL/REQUISIT PRO**

Rational provides advanced techniques to automate requirements identification and organization. Requisite Pro supports the recognition of specific information in a source document based on the text style, key words, or the document structure as defined with an XML template. Using this information, it may automatically build a list of possible requirements and organize them in a structure with unique identifiers and pre-defined attributes according to rules, context, and user profile. Requisite Pro supports consistency checking and functional allocation based on rules.

Rational provides traceability matrices to track down fulfillment, changes, and validation. It also has an excellent report generation.

Rational does not offer sufficient functionality for deriving requirements or adding new ones. It requires the manual definition of the relationship with the parent, and the re-selection or re-definition of values for attributes.

**FIGURE 4**  
*Rational/Requisit Pro Rating Compared to Average*

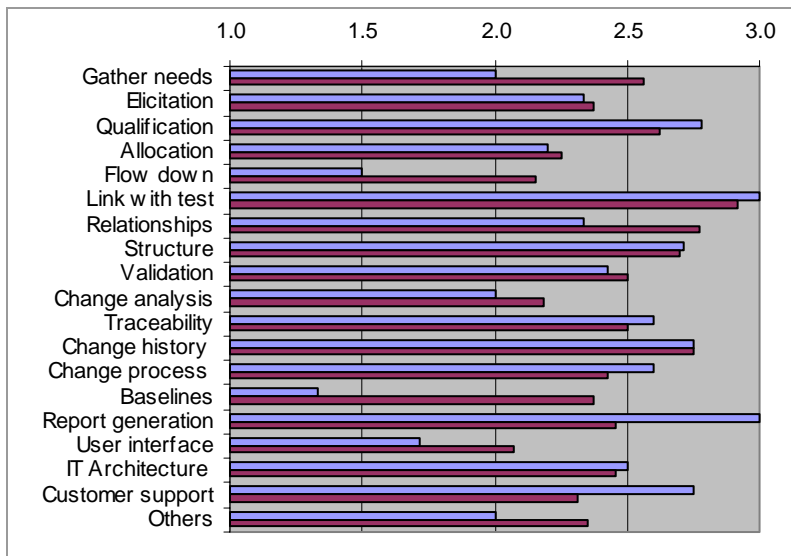


**SERENA/RTM**

Serena supports conditional links based on rules, external calls or constraints, and multi-level structures with recurring classes. RTM report generation provides advanced functions, representing a major point of differentiation. These may involve query definition and execution through the requirements database, advanced search functions, automatic report assembly and production, or multiple output formats such as spreadsheets, texts, and graphs, as well as excellent response time.

RTM shows weaknesses in general for requirements flow down, change process, and baselines management.

**FIGURE 5**  
*Serena/RTM Rating Compared to Average*



**SMARTEAM/CSE**

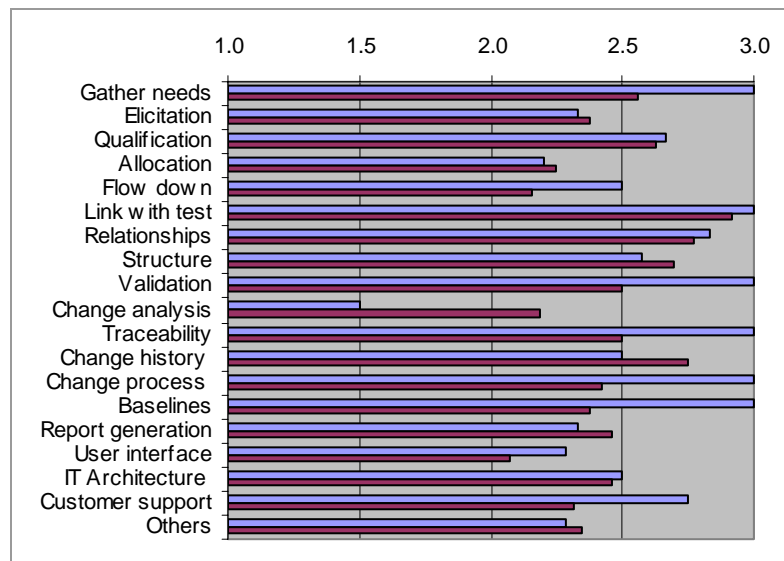
It is important to note that our analysis of SmarTeam from Dassault Systèmes was based on discussion, slides, and AVIs. Unlike all other vendors reviewed, a live demonstration was not available.

SmarTeam may automatically inherit attributes and create the supporting links when refining or deriving requirements, avoiding a cumbersome task encountered with nearly all other vendors that do not offer equivalent capability. CSE supports the allocation of requirements to functions and components by capturing this information from external sources such as the description of logical schema, functional analysis, or product breakdown structures. It also offers a Visio interface.

CSE ensures consistency of the requirements and rules for compatibility. It provides multiple traceability matrices to track down changes and validation. SmarTeam has a change management process with associated workflow. CSE uses Microsoft’s InfoPath to organize and format reports.

SmarTeam shows weaknesses in change analysis process, and the overall rating is subject to verification with a live demonstration.

**FIGURE 6**  
*SmarTeam Rating  
 Compared to Average*



**TELELOGIC/DOORS**

Telelogic supports the largest set of import formats – Word, Excel, MS Project, Interleaf, and FrameMaker. It also interfaces with specific tools such as MatrixOne, SmarTeam, Matlab, or Simulink. It supports a series of functions representing dependencies such as *satisfy by*, *tested by*, or *responds to*.

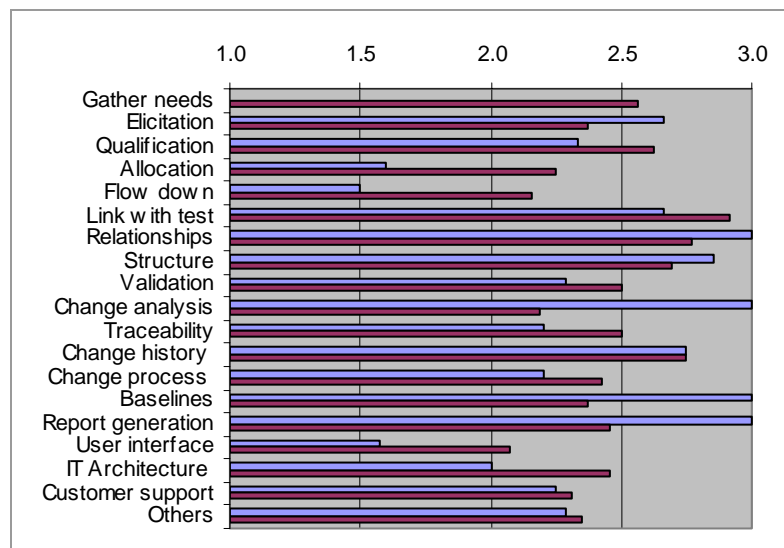
Doors makes it very easy to manage changes when re-entering requirements from a new version of the source document by locating the requirements text in the

document and showing a direct comparison matrix on screen, coupled to a manual approval process.

The analysis of the impact of changes is well supported through powerful functions to browse requirements and to identify which one may be impacted depending upon conditions such as what has changed, what is new, and what was removed. Telelogic also supports a report covering the full specifications from the requirements database.

Telelogic does not offer sufficient functionality for deriving requirements or adding new ones. It requires manually defining the relationship with the parent and re-selecting or defining values for attributes.

**FIGURE 7**  
 Telelogic/Doors Rating  
 Compared to Average



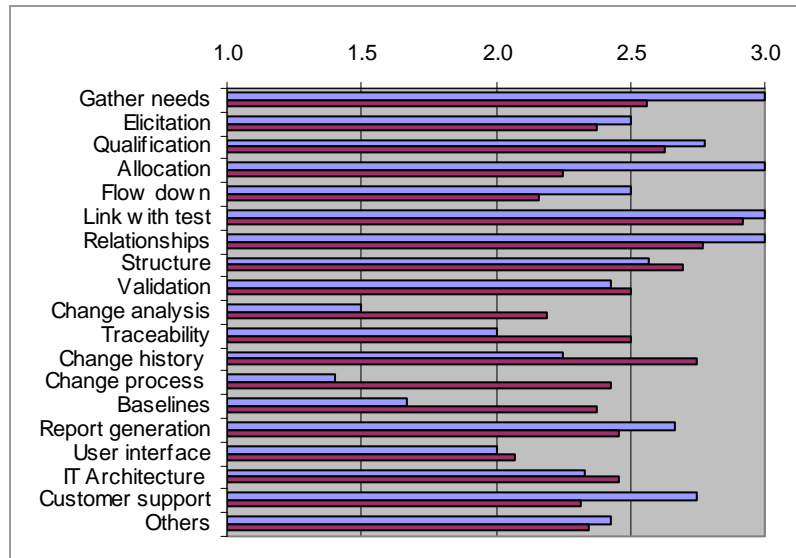
**UGS/TEAMCENTER SE**

The UGS solution, originally based on SLATE, an SDRC acquisition, has been re-architected to be Web compliant, and is currently being moved to Teamcenter as a database technology. Teamcenter SE is replacing SLATE at many customers' sites.

UGS provide advanced techniques to automate requirements identification and organization. It supports the recognition of specific information in the source document based on the text style, key words, or the document structure as defined with an XML template. Teamcenter SE may automatically inherit attributes and create the necessary links to refine or derive requirements. It supports the allocation of requirements to functions and components, by capturing this information from external sources, such as the description of the logical schema, functional analysis, or the product breakdown structures. UGS has a Visio interface.

UGS proposes a change management process with associated workflow that will fully benefit Teamcenter SE when the integration is delivered.

**FIGURE 8**  
*UGS/TSE Rating  
 Compared to Average*



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# *Requirements Management: Solutions Review*

## **REQUIREMENTS: DETAILED FUNCTIONAL REVIEW**

The functional analysis covers more than one hundred criteria. While the executive summary highlights the strengths and weaknesses of the vendors in nineteen categories, this functional review covers the findings for the detailed criteria grouped into five major functional areas:

- Requirements Capture: gathering, elicitation, and qualification
- Requirements Flow Down and Across: allocation, decomposition, and validation
- Requirements Structure and Relationships: dependencies and traceability
- Change Management: impact analysis, history, and baselines
- Report Generation: automatic report generation, filtering, and views

## **REQUIREMENTS CAPTURE**

The basic task of initial requirements management capture consists of a simple copy and paste of a text string from a document or a spreadsheet, to a record in the requirements database. More advanced functions reduce the manual work and make that task more reliable and repeatable across projects and for updates.

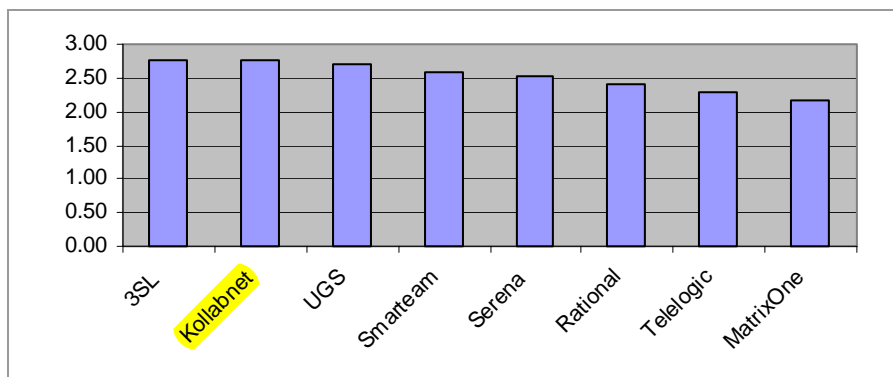
All vendors score above 2.00 for this category that is the very basic process step in requirements management.

To best understand the specific tasks that may be addressed with requirements capture, it is helpful to consider the detailed criteria evaluated for the functional area:

- Store source document in a database.
- Build a tracking list of all source documents.
- Import requirements from multiple source documents (Word, Excel, Access, PDF, Matlab, Simulink).
- Import requirements from another project for re-use.
- Manually create requirements (text or values).
- Automatically parse requirements (e.g., code, tags, key words, style).
- Execute repetitive tasks in batch mode.
- Support of multiple export formats (e.g., Word, Excel, PDF, CSV).
- Generate a unique identifier for each requirement on the entire database.
- Customize identifier (prefix).

- Share requirements across projects.
- Define attributes list and default values (e.g., template, wizard).
- Manage and assign attributes value automatically (script or rules).
- Classify requirements automatically based on attributes value.
- Inherit attributes list and values.
- Allocate a performance value (e.g., weight, risk, cost).
- Check compatibility of attributes (rules to detect contradictions, overlaps).

FIGURE 9  
Requirements Capture



#### DIFFERENTIATING FUNCTIONS DEFINING LEADERSHIP

3SL, KollabNet, Rational, and UGS provide advanced techniques to automate requirements identification and organization, as summarized earlier in highlighting the results for each vendor. They support recognition of specific information in the source document, based on a text style, key words, or document structure defined with an XML template. Using this information, they automatically build a list of possible requirements, organize them in a structure, and associate unique identifiers and pre-defined attributes according to rules, context and user profile.

3SL has the most powerful set of functions to extract, organize, and visualize the source information with extremely fast response time and ease of use. A rules-based function, *frame*, automatically maps the text, graphs, or tables identified as requirements with the set of attributes.

KollabNet has the unique capability to structure the requirements in a nested network with conditional links and rules. It can recognize numerical values in a text string automatically as parameters for further use in design or simulation.

#### GENERALLY SUPPORTED FUNCTIONS

All vendors have a way of describing either templates or scripts to create pre-defined sets of attributes with default values that can be assigned to requirements or a group of requirements.

The capability to manage all the source documents in a database and to maintain a live link from the requirement to the source document is a key differentiator between vendors. Almost all vendors have the capability of tagging the source file to locate the text string or the cell that contains the original requirement, allowing later comparison and update when a change is requested.

Unique identifiers for requirements, with customized format (prefix), are also generally supported.

#### **ADDITIONAL FEATURES**

Several vendors have helpful features that merit specific comment. Serena has a catalog of default classes and links that can be applied as a schema before loading requirements from documents.

MatrixOne, through a cooperation agreement with Telelogic, offers direct import of Doors' requirements structures into Product Central, with bi-directional links and attributes synchronization.

Telelogic offers the largest set of import formats, including Word, Excel, MS Project, Interleaf, and FrameMaker. Interfaces with several specific tools include MatrixOne, SmarTeam, Matlab, or Simulink.

## **REQUIREMENTS FLOW DOWN AND ACROSS**

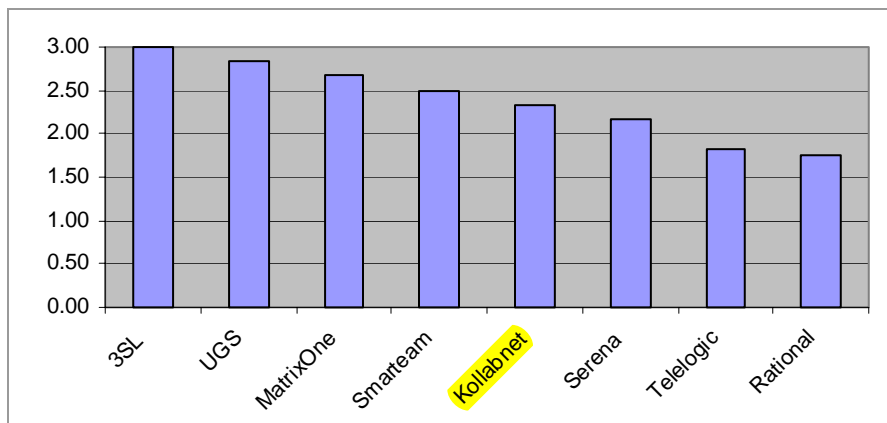
Initial requirements have to be detailed, refined, and allocated to a functional design structure and physical product structure. They also have to be enriched by the company knowledge and best practices derived from earlier projects or established standards, and comply with regulations. Requirements management becomes highly valuable when it successfully coordinates and facilitates flow-down.

Detailed criteria that may aid in understanding the scope of requirements flow-down include:

- Capture functional analysis.
- Capture system architecture and product structure graphically, by text or external link to a PDM system.
- Allocate requirements to function, manual or semi-automatic.
- Inheritance of the function and requirements.
- Inheritance of the components and requirements.
- Refine or derive requirements with automatic linking and inheritance of attributes.
- Automatic creation of links and attributes for inheritance when manually inserting a new requirement.
- Automate the refinement of a group of requirements to support norms and standards as a repetitive task.

- Document justification and reason for refinement.
- Specify external references to acceptance test description and results.
- Link requirement and test documents.
- Document test documents' status and follows up, as *not defined, defined, not realized, passed, or failed*.

FIGURE 10  
Flow Down and Across



#### DIFFERENTIATING FUNCTIONS DEFINING LEADERSHIP

3SL, KollabNet, SmarTeam, and UGS are able to automatically inherit attributes and to create the necessary links when refining or deriving requirements. With those solutions that do not support automatic inheritance and linking, this frequent and repetitive task becomes very cumbersome.

#### GENERALLY SUPPORTED FUNCTIONS

The link to external documents such as acceptance test definition or test results is generally well covered by all vendors. The allocation of functions or components to requirements is done manually by linking one to the other.

#### ADDITIONAL FEATURES

The capabilities of the solutions reviewed vary significantly. Telelogic and Rational do not offer sufficient functionality for deriving requirements or adding new ones. They require the manual definition of the relationship with the parent, and the re-selection or re-definition of values for attributes.

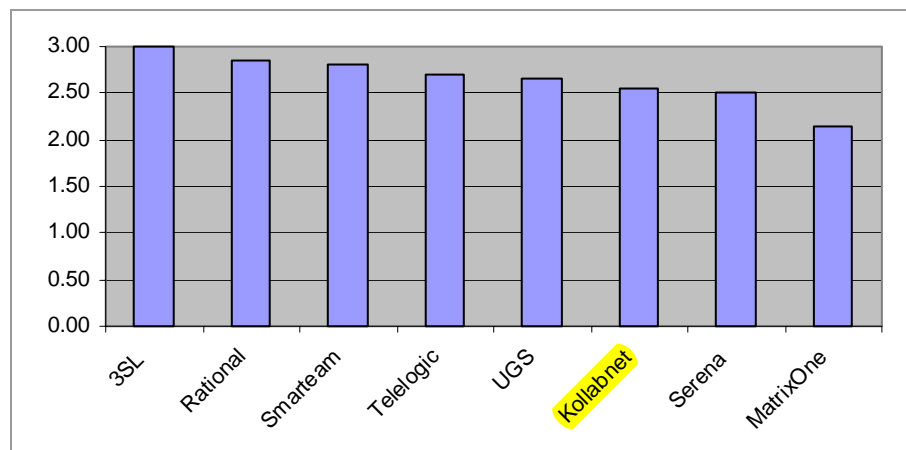
### REQUIREMENTS STRUCTURE AND RELATIONSHIPS

The ability to organize requirements in a variety of ways, with multiple views and conditional links, is a key factor impacting both the quality and applicability of the solution. The requirements structure needs to be mapped and synchronized with other structures during the development cycle. That might include the product structure from design or manufacturing, or from simulation and test. The solution must represent the requirements in such structures, compare them, and maintain their history and versioning with the appropriate relationships or external references designated across items.

The detailed criteria applied in this area include:

- Define many-to-many bi-directional links between functions and requirements.
- Define many-to-many bi-directional links between components and requirements.
- Create links by simple drag-and-drop action.
- Maintain a link between a requirement and its source document.
- Maintain references to external documents.
- Create a requirements structure according to the structure of a source document.
- Organize requirements in tree structures with views.
- Import structure from external tool such as PDM or a logical schema.
- Provide default structure templates.
- Browse and search requirements structures.
- Create bi-directional links across requirements.
- Group requirements according to criteria or attributes.
- Select and display requirements in multiple views based on filters and the type of display such as a list, tree, or table.
- Check consistency (e.g., isolated items, lack of attributes, un-allocated requirements, un-justified functions).
- Check that requirements have been met, how, and when.
- Link requirement and associated documents (e.g., tests, specifications).
- Verify requirements coverage for logical checks and conformity matrices that cover functions such as *as allocated to*, *responding to*, *satisfied by*, *verified by*, and *compliant with*.
- Customize, display, and follow up requirements status as defined, draft, or validated.
- Support validation process and workflow.
- Create and store customizable views.

FIGURE 11  
Structure and Relationships



### **DIFFERENTIATING FUNCTIONS DEFINING LEADERSHIP**

The most advanced solutions support different types of links, with their attributes. Rules can be applied to dynamically change the requirements configuration depending on the conditions set, which may allow variances or options, apply conditional links, or generate a specific view of the requirements structure. 3SL offers the best capability, supporting multiple representations as a tree, cascading, or table structure. It also generates links based on rules.

The allocation of requirements to functions and components requires capturing this information from external sources such as description of the logical schema, functional analyses, or product breakdown structures. Both UGS and SmarTeam offer very good capabilities with their Visio interface.

Checking the consistency of the requirements, their allocation, and applicable rules for compatibility is another key aspect that is best addressed by 3SL, Rational, and SmarTeam. Telelogic has good dependencies representation covering criteria such as *satisfy by*, *tested by*, and *respond to*.

### **GENERALLY SUPPORTED FUNCTIONS**

In general, all vendors provide good support for this area. Relationships are used to browse the requirements database, either graphically by exploring the structure and its branches, or by applying filters based on attribute values, requirements type, or link types. All vendors have good capabilities here.

### **ADDITIONAL FEATURES**

Of note, KollabNet can reorganize the structure by changing the root node. Both KollabNet and MatrixOne support options and variants management based on rules that are applied to filter requirements according to the value of attributes.

Serena supports conditional links based on rules, external calls, or constraints, as well as multi-level structures defined by recurring classes.

## **CHANGE MANAGEMENT**

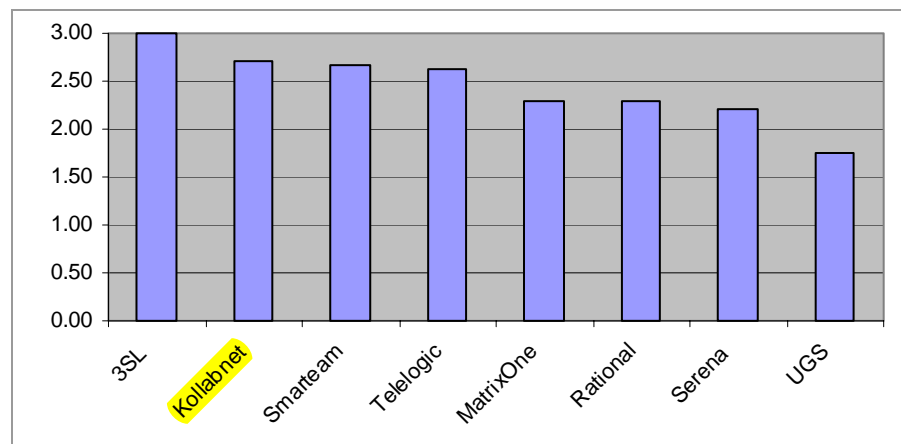
The requirements management solution has to be able to keep track of the history of all items it manages, who made a change, when, and why. It has to maintain baselines that can be re-activated when needed.

The criteria applied in this area include:

- Simulate a change to analyze the impact.
- Identify changes in requirements when re-importing source files as new, changed, or deleted.
- Manually select changes to be applied.
- Identify and flag suspect links.
- Visualize and control dependencies as *where used*, *satisfy by*, *depending on*, *responding to*, or *refer to*.
- Browse and search dependencies with a multi-level follow up function.

- Query on dependency's criteria.
- Create traceability matrices for requirements in a matrix or tree format.
- Support concurrent review, markup, and comment or discussion.
- Keep requirements change history covering when, why, what, and who.
- Support requirements versioning.
- Propagate change either manually or semi-automatically.
- Compare versions of requirements.
- Initiate a change management process to define roles, steps, and the associated data.
- Circulate requirement baselines and documents according to defined roles.
- Check the feasibility of proposed changes.
- Document reasons for changes.
- Define and execute a validation workflow.
- Create and save a requirement's baseline.
- Maintain history of the baseline.
- Re-import or re-activate baselines with links and versions.
- Support the impact analysis on an imported baseline.
- Compare baselines.
- Maintain baseline status as current, draft, or WIP.

FIGURE 12  
Change Management



#### DIFFERENTIATING FUNCTIONS DEFINING LEADERSHIP

3SL, Telelogic, KollabNet, and SmarTeam all support excellent functionality for this category, with 3SL in the lead. In particular, these offerings facilitate the management of changes when re-entering requirements from a new version of the source document by locating the requirement's text in the document and showing on screen a direct comparison matrix, together with the manual approval process.

Change impact analysis is best supported by 3SL, Telelogic, and KollabNet. They provide powerful tools to browse requirements and identify which may be

impacted depending on conditions such as what has changed, what is new, or what was removed.

Traceability involves multiple forms. Top-down follows the decomposition and refinement of requirements. Traversing across structures identifies related items from disparate disciplines and activities. Bottom-up singles out the original need, which helps to synchronize external sources of information with acceptance tests and results. Traceability matrices are used to track down changes, validation, and fulfillment. 3SL, Rational, and SmarTeam provide the best implementation for these specific functions. 3SL in particular has a fast and dynamic response with multiple levels of matrices supported across any links and attributes.

#### **GENERALLY SUPPORTED FUNCTIONS**

All vendors provide a history of changes with versioning and pedigree, and all vendors have the capability to highlight suspect links to identify the possible impact of a change. Only KollabNet drills down to the actual design parameters in the CAD or other authoring tool.

Nearly all vendors provide for the creation of baselines creation with the exception of Rational. Almost all can compare baselines to highlight changes or differences, except UGS, and Serena.

#### **ADDITIONAL FEATURES**

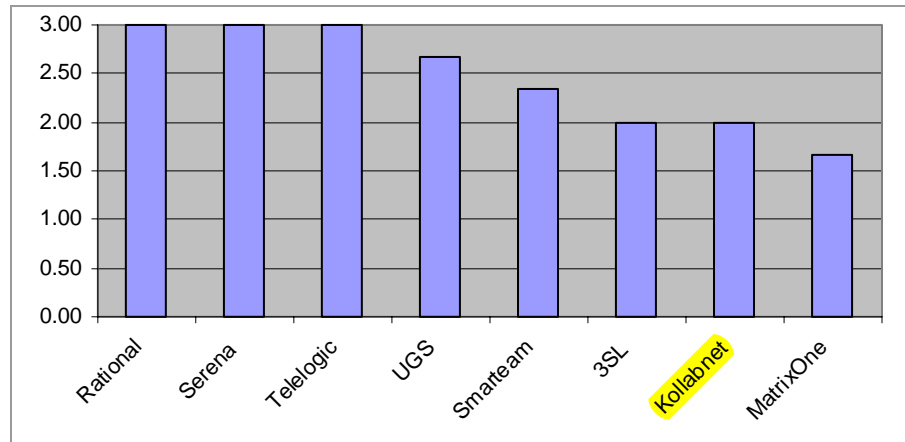
Some vendors, such as UGS, MatrixOne, and SmarTeam, propose a complete change management process with associated workflow, based on their core product capabilities. Others, including 3SL and Telelogic, do not have such a complete set of features and offer a basic validation workflow.

## **REPORT GENERATION**

Generating reports automatically enables those managing requirements to access tangible and directly usable feedback, and avoid working in isolation. A number of functions need to be available for extracting information about requirements for reporting:

- Customer needs, which may be represented in contractual documents describing a common understanding of the product attributes and performance
- Management guidance that synthesizes a view of those needs
- Procurement cost analysis and breakdown
- Engineering views of the requirements by domain and at different levels of system decomposition
- Project management information regarding requirements coverage, the definition and execution of acceptance tests, issues raised, and change impact
- Feedback from development engineers concerning work to do, issues raised, or changes approved

FIGURE 13  
Report Generation



### DIFFERENTIATING FUNCTIONS DEFINING LEADERSHIP

Report generation requires advanced functions, representing a major point of differentiation among the solutions. These relate to query definition and execution through the requirements database; advanced search functions; automatic report assembly and production; or multiple-output formats such as spreadsheets, texts, and graphs; as well as excellent response time. Telelogic, Rational, and Serena clearly lead the pack here. Telelogic allows for the creation of a report on the full specifications out of the requirements database. Rational and Serena have rich document-generation capabilities, associating pre-defined templates and queries and ensuring proper formatting with current data for reports.

### GENERALLY SUPPORTED FUNCTIONS

All vendors provide Word and Excel output format with links to information from their databases.

### ADDITIONAL FEATURES

3SL can extract metrics based on queries, calculations, and export in Word or Excel formats. SmarTeam uses Microsoft's InfoPath to organize and format reports.

## EMERGING NEEDS AND AREAS FOR IMPROVEMENT

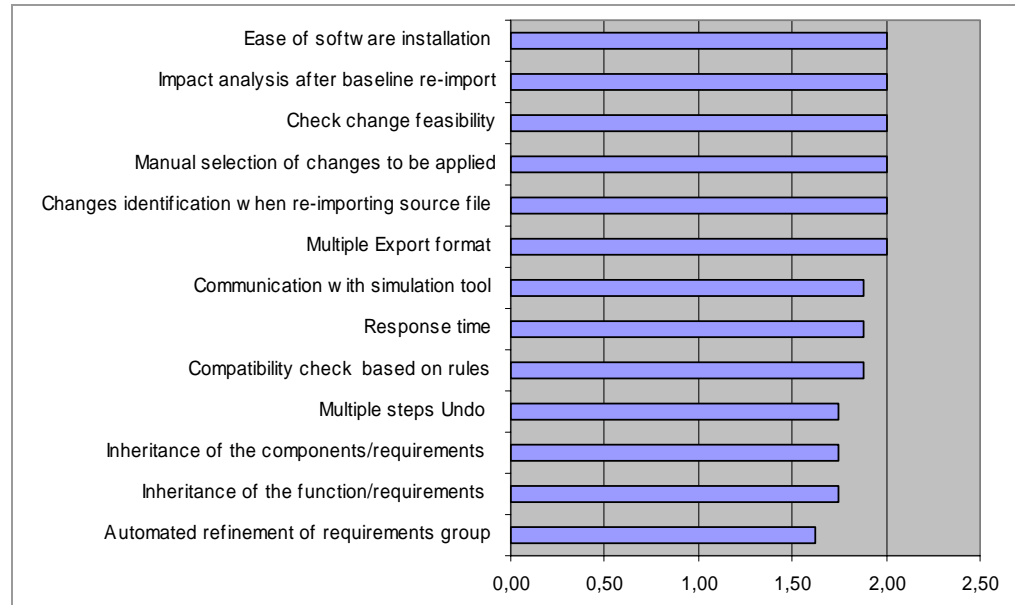
Several functions are not well covered by the solutions reviewed:

- multiple undo
- allocation inheritance (when a requirement is further refined, the allocation of the parent has to be re-defined)
- multiple import/export sources and format
- ease of software installation, which often requires a database and application server
- consistency checks for isolated items or un-allocated requirements
- requirements refinement, which often involves the redefinition of links and the re-selection of attributes

Several more advanced functions are covered only by a few vendors:

- rules-based compatibility checks
- impact analysis when re-importing a baseline
- links with system logic simulation tools
- identification of the changes when a new version of the source file is delivered

**FIGURE 14**  
 Worst-Rated Criteria



On the architectural side, nearly all solutions use a commercial relational database (mainly Oracle and SQL). UGS is still using Versant with its current implementation based on the heritage of the SLATE product, but is migrating to the Teamcenter architecture, that supports the main commercial databases (Oracle, SQL, DB2). 3SL currently relies on a proprietary database, CISAM files, and plans to migrate to a commercial database. Telelogic is also currently migrating from a file-based system to Oracle.

Finally, the response time in general across most offerings should be systematically improved, except for two vendors with excellent responsiveness – 3SL and Rational.