REQUirements Engineering
Support Technique
(REQUEST)
A Market Driven Requirements Management Process

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ABSTRACT

Prior to consuming resources for product development, whether for a new product or enhancements to an existing product, the requirements of the product must be determined. This Requirements Process must be "market driven" allowing product organizations to capture the "Voice of Customer," and it must describe the requirements in understandable and measurable terms to be analyzed in order to identify solutions for the requirements. It must be a definable, repeatable, and predictable process.

This paper is a synopsis of the REQUirements Engineering Support Technique (REQUEST). REQUEST is a process for use by the planning and product development organizations of IBM Lines of Business (LOBs), which introduces technical and managerial discipline into the requirements process. It transforms systematically the many "Voices of Customers" through various stages to a set of Plan candidates by means of analysis, validation, and prioritization. It tracks and relates original requirements to Plan items and vice versa.

ITIRC Keywords

- Software Engineering
- Requirements Process
- Requirements Planning
- Market Driven Quality in Requirements Management

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The first draft of the REQUEST methodology was available in March, 1988, followed by several additional drafts which culminated in the publication of the first version (Version 1.0) of the "REQUEST User's Guide" in September, 1989. The latest version of the full-length document ("REQUEST User's Guide", Version 2), upon which this paper is based, was produced after one of the original co-authors, Len Orzech, had retired and contains numerous updates and refinements to the earlier version of the "REQUEST User's Guide".

Scope

This document describes the objectives and procedures of the REQUirements Engineering Support Technique (REQUEST).

"Requirements engineering" is a term which has been used for several years (Alford 77). (Note: references are enclosed in parentheses and may be found in Appendix A, "References") and whose definition (IEE 81) has been standardized as "the application of engineering principles which address the technical and management aspects of generating software requirements;" this document describes such a requirements engineering process which, in the IBM product planning context, spans the time from which requirements are gathered from their sources until their inclusion as Line Items (LIs) in an Operating Plan. The Operating Plan, or Plan, specifies to development organizations those requirements which are to be implemented. There are many problems inherent in the process of determining requirements: Who and where are the sources of requirements? What are they really asking for? Given resource, market and schedule constraints, how much can be done? How much should be implemented? The task of resolving these questions within IBM is usually the responsibility of departments or organizations named "product planning," "requirements planning" or "product strategy."

The REQUirements Engineering Support Technique is the description of those objectives and procedures which must be performed to generate a set of quality candidates for Line-Items in the Plan. This Version of REQUEST does not deal with the process for selecting the final Plan Line-Items and, therefore, does not

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address final L/I selection as constrained by schedule, resources and the Build Plan.

If you are an experienced planner, this document describes a set of objectives and procedures for a standardized approach. These objectives and procedures are not new, planners have traditionally practiced them for many years; this document integrates and details the process into a common approach.

If you are a new product planner or just want to learn about the product planning process, then this document can serve as an introduction and training manual.

If you are in product design/development, this document details the information which provides the basis for interfacing with your planning organizations. The REQUEST process does not deal with specific documentation work-products such as the Initial Business Proposal (IBP) or Product Objectives; however, if the REQUEST process is performed as specified, much of the content of this documentation will be available for insertion.

Although REQUEST was initiated in the IBM Communications Programming Lab, the purpose of product planning is not unique to the IBM Planning organizations. The principles of REQUEST are universal and can provide any product planning organization with a requirements planning process.

BACKGROUND

Background

Motivation

Definitions: A requirement, in the context of the REQUEST process, is defined as the discrepancy or a gap between what we (IBM) provide or supply, both current and/or in the foreseeable future, and what customers want or need. This, in comparison to the alternative definition, i.e., a capability needed for an IBM product, program or service, is thought to be a more "customer oriented" definition which emphasizes the "market driven quality" aspect of the proposed approach. Requirements Planning for our purposes is defined to be the TIMELY collection, analysis, validation, management, communication, prioritization and selection of requirements for promotion as Plan candidates. Initial Business Proposals (IBP), Objectives, and Specifications are the subsequent steps that follow the requirements planning phase.

Problems in Requirements Planning: The following is a summary of problems in Requirements Planning:

• No formal process

Today, unlike many of the other disciplines in the realm of software engineering, Requirements Planning Process is probably the least understood and formalized, and most ignored. That is, tasks, verification/control, and inputs/outputs are not clearly defined. The approach often used is unstructured, not repeatable and crisis driven.

Parallel to this phenomenon, is the lack of automated tools to support and enforce the process. At best, there are various home-grown tools which are not well documented and maintained, not easily transferable and extendable. More often than not, the ‘process’ used is supported manually, a paper/note/foil process.

Frequently, because of lack of a formal process, when it comes to prioritizing requirements and deciding which Line Item candidates to be included in Plan, the approaches used are subjective and inconsistent. Examples are the loudest voice approach, the pet projects approach, the best design approach and/or the "big elephant" approach. These kinds of approach are costly in the long run by not responding objectively to the real market requirements at the time.

• Lacks traceability

It is difficult to trace and track ALL the requirements that come from a dozen or more sources. Furthermore, we would like to know not only all the requirements at a given time, but also a host of important facts such as where the requirement comes from, the response status, and its evolution into a potential Line Item in plan. One would also like to know, e.g., once a Line Item becomes in plan which requirement(s) does it satisfy, etc.

• Impedes accountability

When requirements and persons responsible are not properly recorded, it is difficult to have accountability. In addition, as the requirement evolves and possibly becomes a Line Item, much intervening data are collected which require accountability as to the validity of the data that helped to make the final decision. For example, one of the important piece of data is the resource estimate (KLOC sizing) to implement the solution in order to satisfy the requirement. It is important to be able to track and account for this data as it is evolved through the process.

• No centralized, common repository

Without a centralized, common repository, we do not easily know where, what and the status of all our requirements are. It will be difficult to main-
tain, to update and to control. It impairs visibility, accessibility, and timeliness in our response.

- **Restriction of "range"**
  Related to the idea of a lack of a common repository is the "bias" inherent in our response to requirements because not all requirements are captured. Requirements come in many forms, including verbal comments made by customers in Executive briefings, comments made by participants in usability tests, etc. Much of this information remains in a few people's heads or desks. We don't have a process for assuring that this valuable information is captured, recorded, evaluated and integrated into a formal requirements process. The result is that we often "recognize" only a biased set of requirements, systematically ignoring, in effect, certain sets of requirements because no one is responsible to capture those.

- **Not properly analyzed**
  Requirements come from all kinds of sources and in all kinds of shapes and colors. Many of them are stated ambiguously and/or in "solution" format. It is paramount before one proceeds to address this "raw requirement," to properly analyze and to gather sufficient amount of related data such as user environment, customer impact etc. We do not have a tool that can help to facilitate and enforce such rigorous analysis.

- **Product dependency mis-match**
  The satisfaction of requirements from customers is often dependent on multiple components/products which are developed, located or managed across organizational, lab and site boundaries. There is a constant need in such cases to communicate and to understand each other's dependencies for the matching of schedules and functions. Today such tasks are largely done "manually" and take up a great deal of time from productive work. Because of this, mismatch of schedules and functions are not always discovered in time resulting in even greater loss. This situation is aggravated because requirements tend to change over time due to competition, technology and resource constraints.

- **Above problems will get worse with time**
  As a product/program grows in importance and size, as market condition changes more rapidly, it is becoming increasingly difficult to manage the growing list of changing requirements. And not managing well this fundamental phase of our Product Development cycle can result in inferior and non-responsive products and affecting the success of our products and wasting of scarce resources.

**Solutions for Requirements Planning:** It is obvious that a well structured requirements planning process with clearly defined tasks, controls, and work products is needed. In addition, a set of supporting tools and a common repository are needed to facilitate as well as to enforce the timely collection, the rigorous analysis (description, evaluation, and prioritization), standardized documentations, and the continuous tracking of requirements.

**Justification**

**Importance:** It is a well known fact that Requirements Planning is the most important activity in the entire product development process. The results of requirements planning have major, if not disastrous, implications for all subsequent development efforts. Former IBM President, J.R. Ope1 equated quality to "conformance to requirements." More recently, IBM Networking Systems Line of Business (NS LOB) General Manager, E.M. Hancock, stated in the Market Driven Quality vision for the LOB, that "The overriding goal of the Networking Systems LOB is to delight our customers. We will listen, define their communications needs, and commit ourselves to providing solutions that meet their needs: defect-free solutions that are on time, every time."

The success of this phase directly affects the success of all the subsequent development phases: design, development, test and service. It affects the strategy and direction of our products, marketing effectiveness and ultimately our bottom line cost/expense/revenue. It is the phase that drives our product plan. "Do it correctly now or correct it later" is particularly significant during the requirements planning phase and will be tremendously painful later if it is not strictly followed.

The complete and accurate collection, analysis, validation, prioritization/selection and communication of requirements can have a significant positive impact in many areas such as:

- optimization of market opportunity,
- correct function selection and placement,
- minimization of rework and schedule slippage (plan stability)
- reduced testing,
- customer satisfaction,
- technical advantage,
- all of the above.

**Cost/Benefits**

**Process/Productivity Group Studies:** Studies conducted recently by Process & Productivity organization have shown that when a well defined Requirements Planning Process supported by a tool is used, substantial saving in both the Planning and Development resources can be
realized. According to this study, the minimal potential reduction in Planning resource is estimated at 3 to 5% and in Development resource at 3%. This number at first may not seem overly large, but when considering the TOTAL number of people resource involved in Planning and in Development in the entire corporation, the potential saving is very significant. The actual saving of each individual organization will of course be dependent on what kind of the existing "process" being used by the individual organization. But perhaps more significant is the fact that Customer satisfaction and IBM's responsiveness to the market place will be improved. In addition, there are benefits such as database sharing across multiple product areas in terms of both sourcing activities and better communications.

**General Benefits:** With a structured approach and a tool to enforce and facilitate the approach, product areas should greatly enhance their ability to respond in a timely fashion to customer requirements, the fast dynamics of the changing market place, and in producing more quality products as defined by better matching with customer needs. The process should also enhance our credibility with our customers because of our more timely and effective responses. The following is a summary of more detailed description of benefits to management as well as to planning personnel:

- **To Management**
  - More effective and consistent evaluation of Plan candidates.
  
  With proper analysis and the Prioritization Algorithm, each Line Item candidate would be justified and trade-offs made based on objective criteria. The Prioritization Algorithm may also be used to pay special attention to small and high value Line Items as well as 'internally generated needs' to focus on product quality. The process should reduce the amount of time, number of meetings and resource currently expended in achieving Plan Line Item resolution (spinning) with improved stability of that resolution. As it is today, much valuable management time is spent during what seems to be long drawn out Plan Cycles.
  
  - Visibility and control of requirements/Line Items
  
  All requirements and Line Item candidates will be accessible on line and their status tracked. Furthermore, a requirement can be traced from its source through various stages to a potential Line Item and vice versa. The designers/developers will know what requirements they are designing for and the management will know what requirements have been satisfied and which ones haven't.
  
  - Accountability

- **To Planners**

  With each requirement tracked as to its responsibility and the subsequent stages as to its analysis, we will know who does what and why. Much of the data are also kept as history, meaning that we will be able to detect the evolution of a given item if something changes along the way, e.g., the sizing.

  - Skills transfer enabling

  With defined work products, input and output, and a data base which records the information, it will be easier to transfer work to new planners and facilitate training of new planners.

- **To Designers**

  The RIQUESI process will be of benefit to designer in the following ways:

  - A more consistent, complete and correct definition of the requirement to be implemented will be provided.
  
  - Direct access to all information generated during the process will be available.
  
  - Traceability back to the original requirement will be possible.
  
  - The interface between planning and design will be more clearly defined.

**Other studies:** The following is a compilation of results from past studies related to the economics of requirements engineering:

- About 47% of a product life cycle is devoted to detection/correction of errors. About 2/3 of all errors originate in requirements/design (Alberts, 1976)

- The average project experiences a 25% change in requirements during development (Climis, 1979)

- Some large projects with frequent redirection have experienced productivity penalties of factors greater
than four due to requirements volatility (Boehm, 1981).

- In one IBM location, the relative cost-to-fix of error is 1 to 2000 (Crandall, 1984).
- Poor requirements planning (unplanned, poorly defined, overlooked, late) contributed, with other factors, to a 3+ year slippage of product X (Mays, 1988).
- Past studies on productivity and quality have shown that we should spend about 20% of total resources upfront in requirements planning during the Development Process yet we are only spending 5%. As a comparison, Japan spends about 20 to 30% (Musto, 1988).

THE REQUIREMENTS PLANNING DOMAIN

The Requirements Planning Domain

The purpose of this Section is to establish the boundary of the requirements process, define some basic terminology and relate REQUEST to other requirements processes both internal and external to IBM.

The Requirements Planning Mission

The mission or goal of the requirements process has been stated as (NMP 87):

- The timely collection, analysis, validation, management, communication, prioritization and selection of requirements for promotion as Line Item candidates in a Plan.

This mission statement identifies the primary work-product of the requirements planning process as being a set of Line-Items (L/I’s) candidates which have been selected for consideration in a final Plan. A L/I is the smallest item of work to be performed which has specific resources allocated and an associated schedule. A L/I may consist of one or more original requirements. A list of candidate L/I’s is not necessarily the only work-product of the requirements planning process; L/I’s are, however, the primary concern of this document. Other work-products may include the Initial Business Proposal (IBP) and/or the Programming Objectives (PO); the relationship of the IBP and PO to the REQUEST process will be defined below.

A critical point in the requirement planning mission statement is that the preparation and selection of L/I candidates be performed in a timely fashion. Timeliness implies the maximization of a set of criteria such as Return On Investment, market position, or customer satisfaction. The mission statement identifies the primary tasks in the process as the following:

- Collection - all requirements at any given time must be known and captured.
- Analysis - the requirements must be understood and complemented by additional information as necessary.
- Validation - the results of analysis are validated with the source and other market factors.
- Prioritization/selection - given that not all requirements can be implemented, only those which maximize return are chosen. A systematic approach such as a prioritization algorithm should be used in the selection process.
- Communication - process results, intermediate and final, are made available and conveyed to those with a need to know in a complete, unambiguous and understandable form.
- Management - all the above tasks are controlled and tracked.

The Requirements Planning Context

The requirements planning process environment is illustrated in Figure 1. Requirements planning is the first process of the entire product development process.
Requirements sources provide requirements as input to the process. Requirements sources include customers and non-IBM end-users of products, but may also be internal IBM organizations such as other product areas having dependencies, internal end-users, development, management, consultants, research and marketing. The REQUEST process requires that interaction with the source of a requirement be established at various points from first receipt of a new requirement to validation and verification of subsequent analysis.

The requirements planning process receives support and directions from other internal organizations such as business and technical strategy constraints, high-level design and resource estimates from product development, competitive analysis, etc.

Line-items are selected for consideration in the final planning process which produces the Plan of Record or Operating Plan, an itemization of those product enhancements/changes or new products which are to be implemented within a defined schedule and a fixed set of allocated resources (people, equipment, ...). The Plan of Record is forwarded to higher level management, development and other interested organizations to be used for future planning, resource management, schedule management, etc.

A L/I is not a detailed technical description of the intent of the requirements grouped within it. Rather, a L/I contains a cursory description of each requirement along with their associated planning information such as estimated KLOC, schedule dates such as ESP and/or FCS, dependencies and follow-on plans.

The technical detail behind requirements included within a L/I is given in the IBP and/or PO; product development uses the IBP and PO for subsequent implementation specifications.

**REQUIREments Engineering Support Technique Overview**
REQUEST Overview

The context of the REQUIREments Engineering Support Technique was illustrated and described in "The Requirements Planning Context." The purpose of this Section is to give an overview of REQUEST which is illustrated in Figure 2.

REQUEST is a four stage process whose objective is to collect all known requirements from sources and, through analysis and filtering, produce a set of Line-Item Candidates for the next Plan cycle. During these stages all information collected and produced is stored in a "Planning Repository," a database from which "Reports" can be produced for various purposes and audiences.
Although each distinct requirement would be processed sequentially through the stages of REQUEST, each stage is really performed concurrently with each other because of the continuous arrival of requirements, the importance of some requirements over others, and the lack of resources to batch at each stage.

The following is a brief overview of each of the four stages. The details for each stage are given in subsequent sections in the full-length documentation of REQUEST, (not contained within this paper.)


Given that all potential sources of Raw Requirements are known and are accessible, the objective of this stage of REQUEST is simply to collect complete statements of the requirements from sources and to store that information in the Planning Repository. The objective of this stage is not to perform analysis or selection. Raw Requirement data is captured "as is" from the sources.

The major tasks in gathering Raw Requirements are:
- Monitor sources of the requirements such as User Groups, Customer Councils, competitive analysis and marketing groups.
- Collect or extract requirements and record a complete description in the repository. Reiterate, if necessary, to get a complete description.
  - A complete description should include at least the customer source (who), the requirement statement (what), date required for the solution (when), and relative importance (priority) to the source.
- Assign tracking and control information.
  - Submitter's information, key words, short title...etc.

2. Define Problems.

If the goals of the previous stage are met, then the planning organization can be assured that the set of unprocessed Raw Requirements are timely and complete. However, since these original statements may be ambiguous, incorrect, a design or implementation as opposed to a requirement, etc., it is necessary to perform analysis to arrive, perhaps, at a restatement of the requirement in terms of a customer/end-user "problem". The resulting problem statement reflects the real customer/end-user need which is hereafter viewed by the planning organization as a potential Line-Item. Problem statements, as opposed to Raw Requirements, are well understood and stable items about which conclusions such as solution sizings, market postures, priority, etc. can be objectively determined through further analysis.

The major tasks in the Problem Definition stage are:
- Prioritize/Select Raw Requirements for problem analysis.
- Assign responsibilities for analysis and validation.
- Describe the environment from which the requirement originates: enterprise, hardware/software and customer/end-user profiles.
- Describe the customer/end-user tasks which they are trying to perform or in which the potential problems arise (Problem Scenario.)
- Identify each distinct problem based upon the environment and task descriptions. These problems are expressed as a 'problem statement'. One Raw Requirement may result in more than one problem statement.
- Categorize each problem statement (usability, availability, etc.) and correlate (duplicates, contradictions, etc.) with all other problem statements.
- Validate the problem statement with the source to check that it is an accurate reflection of the original intent.
- Analyze the problems in terms of market and competitive posture.
- Assess the value, to IBM and to the customers/end-users, of implementing the problem.
- If necessary, provide the source of the original Raw Requirement with a response (Under Study, ACCEPT, REJ, etc.) which reflects IBM's current intentions for the problem.

3. Define Solutions.

Before problems can be considered as Line-Items in a Plan, it is essential that their feasibility of solution and potential impact upon resources and schedules be understood. Line-Items and Plans are constrained by technology, business strategies and resource availability. Therefore, the objective of this stage is to provide a sufficient set of data to evaluate and weigh these constraints.

The major tasks in this stage are:
- Prioritize/Select problems for Solution Definition.
- Assign analysis and validation responsibility.
- Define the solution(s). Solutions may involve hardware, software, service, and/or customer/end-user enhancements or modifications. This task is normally performed by "Product Design." However, at this stage, the
solution is a very high level description of the
needed functions, data flow and/or environ-
mental enhancements, not a product specifi-
cation. Solutions should also state any
recognized external dependencies.

- Provide resource sizings for each solution.
  These sizings are also usually derived by
  "Product Design."
- Validate the solution with the original source
  of the requirement.
- Validate the proposed solutions and their asso-
ciated problems against the Technical and Busi-
ness strategies. These strategies define product
and/or Corporate directions which may con-
strain potential Line-Items.
- Select the "best" solution among the defined
  alternatives.
- Reassess the value of solving the associated
  problem statements given the solution context.

4. Select Line-Item Candidates.

The final stage of REQUEST is to select a set of
Line-Item Candidates which are potential items in a
Plan. Given that the previous analysis and filtering
in Stages 1, 2, and 3 have been adequately per-
formed, the Line-Item selection process should be
facilitated.

The major tasks of this stage are:

- Prioritize/Select problems/solutions for L/I
  Candidates Selection.
- Assign L/I Selection responsibility.
- Synthesize problem/solution statements into
  potential Line-Items. A Line-Item may consist
  of several problems having some affinity which,
  if implemented as a group, provide benefit over
  individual implementation. One such affinity
  may be to group some problem statements
  which deal with "usability."
- Prioritize the Line-Items using a defined
  prioritization algorithm. The algorithm is not
  intended to produce a final ranking but to
  provide initial, common, consistent, complete,
  visible and debatable rational.
- Identify any issues or dependencies.
- Plan initial schedules especially with Line-Items
  having dependencies.
- Validate the Line-Item with the original
  source(s) of the requirement(s).
- With closure of the Plan, provide the original
  source with an updated response (ACCepted,
  REJected, Future OBjective, ...) if necessary.
Appendix A. References


Appendix B. Prioritization Algorithm

Given the numerous sources of requirements, the rapidly changing and competitive environment and limited resources, prioritization is one of the most crucial and at the same time difficult task that faces the decision makers. The state of art that exists today by and large ranges from the "loudest voice" approach to some informal way of criteria selection and ranking from low to high. These approaches have yielded inconsistent and subjective rankings of requirements / Plan items and sub-optimized the competitiveness of our products.

To address this problem, a six-step Prioritization Algorithm is described below that has the following characteristics:

- The algorithm formalizes what an experienced market/product planner does more or less intuitively and embodies the critical steps in such decision process in a simple and straightforward way.

- The algorithm transforms intuitive, qualitative judgments into tangible, quantitative numbers that are easy to understand, manipulate and communicate.

- The algorithm enforces its users to be more rigorous and objective in their decision making process.

- The algorithm is flexible and easy to implement.

The following summarizes the six step algorithm:

1. Determine a set of criteria (attributes), C1, C2, ... Cn, which characterize the overall business goals of the product.

   For example, criteria such as Potential Revenue Growth, Technical Strategy, Competitive Positioning, etc. are key attributes to attain the business goals of a product. The criteria should be selected based on their critical importance and be as independent (non-overlapping) of each other as possible.

2. Assign relative weights (CW1, CW2, ... CWn) to the criteria.

   The criteria are evaluated against each other as to their relative importance to the product manager in view of the business goals and are assigned a corresponding "weight." For example, the criterion, "Revenue Growth," may be assigned a weight of "9" and a weight of "1" may be assigned to the criterion, "Company Resource Required." See the following table for an illustration of the above two steps.
Table 1. Criteria and Relative Weights (an example)

<table>
<thead>
<tr>
<th>Category #</th>
<th>Criteria Description (C)</th>
<th>Relative Weights (CW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Correcting mal-functions</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Value to IBM</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Value to Customer</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Competitive positioning</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Global (IBM) technical strategy (e.g. SAA...)</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Local (product specific) technical strategy (e.g. AUTOMATION...)</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Required to support other products (dependency)</td>
<td>5</td>
</tr>
<tr>
<td>S1</td>
<td>Internal design direction (e.g., productivity, quality...)</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Customer environment: Who the customer is (e.g., leading edge...)</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Customer request frequency (# of sources with same request)</td>
<td>2</td>
</tr>
<tr>
<td>S2</td>
<td>Resources Required</td>
<td>1</td>
</tr>
</tbody>
</table>

The above two steps of the algorithm may be accomplished by consensus within an organization (such as the Requirements Management Board) that is responsible for managing the requirements.

It is important to note that there can be different "sets of criteria" such as: a) produced and used by different organizations (e.g., a marketing organization) and/or different levels (Lab vs. LOB) with their own relative weights. This enables the representations of additional views on the product contents under consideration; b) produced and used at different stages of the Requirements Planning Process, depending on the data availability and relevance at each stage.

If necessary, for better understanding, a given criterion may be "sub-divided" into several sub-criteria and each sub-criterion is assigned a proportional weight of the "parent" criterion according to their relative importance within the group. For example, the criterion "Revenue growth" may be sub-divided into two sub-criteria: 1) revenue growth as measured by the product itself; 2) revenue growth as measured by other associated products because of this product.

3. For each criterion, assess the relative value, i.e., the MAGNITUDE or RATING, (CM1, CM2,...CMn), of the contribution, if any, of the item under consideration as it affects the business goals of the product.

For example, the values of relative contribution for the "Value to IBM" criterion may be described as "high, medium, low or none;" they represent potential high, medium, low or no values to IBM if the requirement is satisfied by the product plan. The "magnitudes" are equated with numerical values (e.g., 5, 3, 1 or 0), which correspond to high, medium, low or no value.

The value of magnitudes may be negative to describe representation of a negative impact on the product as in the case of "Revenue Required."

This step can be performed by several persons either individually with multiple iterations or jointly by a committee to assure added accuracy. Guidelines for assigning magnitude values may be established to enhance consistency. For example, given the criterion of "Revenue Growth," the guideline may be stated as follows: Assign a "high" value if the growth is over 50%, a "medium" if over 30%, and a "low" if it is 10% or below.

4. Calculate the total score (T) for a given item using the formula:

\[ T = (CW1 \times CM1) + (CW2 \times CM2) + \ldots + (CWn \times CMn) \]

5. Rank items under considerations according to the total score, and normalize if necessary.

6. Adjust ranks, if necessary, depending on special considerations.

Examples of final adjustments needed may be due to:

- Inter-dependencies between item candidates (e.g., pre-requisite, co-requisite...)
- Special internal priorities (e.g., criteria, S1 & S2, may require some special considerations.)
- Management directives based on Executive's judgement
- Legal requirements

"magnitudes" are equated with numerical values (e.g., 5, 3, 1 or 0), which correspond to high, medium, low or no value.
Appendix C. A Market Driven Requirements Management Tool

Summary of Tool

A Market Driven Requirements Management Tool (abbreviated MDREQ) is a VM/SQL based application designed to assist planners with requirements management. In addition to planners, users may include product designers/developers, product/process managers, database support personnel, etc. The tool is based upon the REQUEST (Requirements Engineering Support Technique) methodology, a market driven requirements process, and supports the IBM Programming Process Architecture (PPA).

MDREQ provides a structured approach for capturing raw requirements (the "Voice of Customer") in a well-defined, on line repository via a menu driven user interface. The tool allows for the entry, copy, subset, browse, update, report, and prioritization of requirements stored in a relational SQL database. Also provided is a function for importing requirements from another IBM requirements database, i.e., IONI (SHARE/GUIDE and PASR requirements) into MDREQ. Once the requirements are captured, MDREQ takes the user systematically through the various stages of analysis, validation and prioritization of the Requirements Process until candidates (Line Items) for a plan are generated.

Administrative Authorization Functions: The following capabilities are provided:

- Authorize/revoke users to their assigned roles: Primary/Secondary Project Managers, MDREQ DBA, or General Users.
- Create and maintain logical views for each user.
- Provide user with the capability of selecting (toggling) between the user’s primary logical database and up to five secondary logical databases residing on the same physical database.
- Authorize/revoke access levels for each user. The access level is defined by stages of the process and within each stage by different access modes such as ADD, UPDATE, BROWSE, PRIORITIZE, TRANSMIT, etc.

Database to Database Communication: The following functions are provided:

- The user can transmit a raw requirement to a designated database.
- The user can request a status of the transmitted requirement.
- The user designated by the destination gets a notification that a new requirement is added.

These functions enable users to route requirements to the intended destinations as well as to manage dependencies more efficiently among organizations in different locations.

Remote Access: An authorized user can access up to 8 remote MDREQ databases as if they are local without having to LOGOFF from the user’s MDREQ or LOGON to the remote nodes.

Note: this function is implemented in MDREQ by means of TSAF (Transparent Services Access Facility) which is available on VM/SP or VM/ESA systems. It requires that the VM nodes involved be defined in the same TSAF "collection" (cluster). Only eight such nodes are allowed in the same collection. Therefore, before this function can be used, the user has the responsibility to ascertain with the local IS organization whether these conditions are met.

Highlights

MDREQ contains the following capabilities:

- Four-stage Requirements Process Support
- Administrative Authorization Functions
- Database to Database Communication
- Remote Access
- Prioritization sub-process (Full Spin Management)
- Miscellaneous Usability features

Process Support: MDREQ supports the full Requirements Process as defined by the REQUEST methodology. In addition to the Requirements Gathering stage, the tool supports the Problem Definition, Solution Definition and Plan Item Selection stages. Some of the features included at each stage are:

- ADD, UPDATE, BROWSE, and REPORT capabilities
- Required and optional data
- Load files from CMS or the database for Long Variable Character fields as well as XEDIT
- Standard or user definable reports
- Validation capability
- Prioritization capability

The fourth stage of the process also contains a sub-stage called Plan Commit, which allows the user to create a plan with "in-plan", "out-plan" or "pending" Line Item status and generate standard plan reports.
Prioritization Sub-process (Full Spin Management):
Capabilities are provided for the use of the Prioritization Algorithm and Spin Management as follows:

- More than one criteria set per database
- A "spin" may specify more than one participant
- Subcriteria within a criterion
- Create a new spin from an old spin ("copy")
- Set/reset spin availability status
- Generate various spin reports including "rolled up" scores and ranks from multiple participants
- Mapping of generated priority score to Assigned Priority field
- Integration of prioritized items into the database

Miscellaneous Usability Features

- Multiple sources capability for the same requirement
- General comments field
- Process Status field
- Provide total hit count for standard summary reports
- Allow multiple keywords to be selected at one time from a Selection List
- Provide description and sorting for Selection List values
- View/Browse all data in one operation
- Allow multiple "Prints" in one operation
- Multiple User Definable Reports generated will be appended together rather than replacing the previously generated report on user's A disk