Chapter 7 : A Portfolio of Requirements Techniques

Objectives

- To discuss how the reader might develop a portfolio of requirements techniques
- To introduce a number of alternative relationships between the customer and the supplier
- To introduce a number alternative models of the requirements engineering process
- To identify the characteristics of the customer supplier relationship and of the requirements engineering process
- To consider the relationship between the contents of the portfolio, the customer supplier relationship and the requirements engineering process

7.1 Introduction

A portfolio is described in the Penguin English Dictionary as a "large flat case for carrying papers, drawings etc". A sales representative may carry a portfolio of product descriptions. Depending upon the needs of a potential client the appropriate product descriptions may be drawn from the portfolio and discussed with the client. The portfolio may contain a large number of product descriptions but in a given situation the sales representative may use only four or five.

It is in this sense that the term 'portfolio' is used. A requirements engineer (and associated co-workers) may need to have a large number of requirements engineering techniques in their portfolio. Depending on the given situation appropriate techniques will be drawn upon.

The purpose of this chapter is to discuss the basis upon which a requirements engineer might develop a portfolio of techniques.

In chapter two a large number of techniques were introduced and described briefly in terms of their contribution to requirements. The types of contribution which techniques could make were classified according to whether they provided support for the requirements engineering process, knowledge development, the requirements document, or management as shown in figure 7.1.

Requirements Engineering Techniques	
Management	The RE process
	Knowledge development
	The requirements document

Figure 7.1 The role of Requirements Engineering techniques

The underlying assumption of the discussion within this chapter is that not all techniques will be needed for every project the requirements engineer is involved in.

The discussion centres around the question " If all the techniques are not needed, then which techniques are needed and when?"

In the sections which follow an attempt is made to describe a number of requirements engineering scenarios. Each scenario has two major components. First, a description of a customer supplier relationship, and second, a model of an associated requirements engineering process. The thesis being that the techniques needed in the portfolio will depend upon the characteristics of both of these.

Figure 7.2 illustrates the assumption being made throughout the chapter that the nature of the customer supplier relationship will determine the model of the requirements engineering process adopted and that this, in turn, will determine the contents of the portfolio.

Customer Supplier Relationship → will determine → RE Process → will determine → Contents of the Portfolio
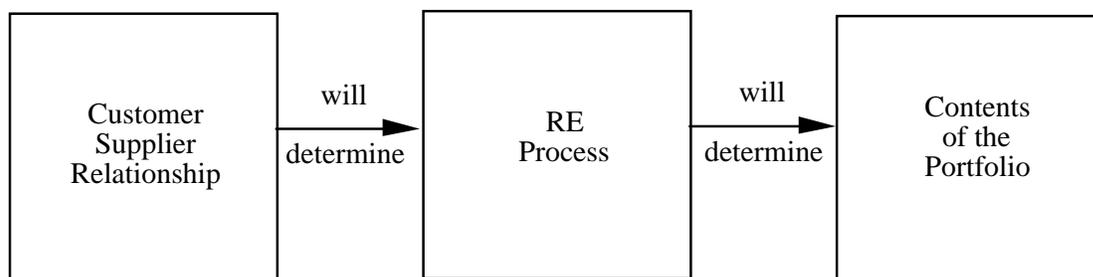
Figure 7.2 Key influences on the contents of the Portfolio

Seven scenarios are considered in total. In the first four the customer and the supplier belong to different organisations:

1. A customer issues an Invitation To Tender to a number of potential suppliers.
2. A specific supplier is asked directly to respond to a specific customer request.
3. A supplier wishes to make a generic product which will meet the needs of a (large) number of customers.
4. A supplier has a generic product which needs to be taloired to meet a specific customer need.

In the next three the customer and the supplier belong to the same company. In this case the customer supplier relationship depends on the internal organisational structure:

5. The business (customer) and the Information Technology (IT) function (supplier) are completely separate and operated as individual businesses.
6. The business (customer) is functionally separate from the IT function but each IT sub-function has clearly defined responsibilities for aspects of the business.
7. The IT function is integrated within the business function, with each business unit having its own IT staff.

Each scenario is now considered in turn. For each scenario a typical requirements engineering task is described. This is followed by a brief description of the customer supplier relationship and an associated model of the RE process. The characteristics of this scenario are highlighted and candidate techniques for the portfolio are suggested.

Please note that feedback loops and iterations are deliberately not shown but obviously they do exist. At this level of detail, the author simply wishes to demonstrate that there are a number of different models of the RE process.

7.2 Scenario One:

A customer issues an Invitation To Tender to a number of potential suppliers.

A typical scenario
The Department of Social Security issues an invitation to tender to a number of major business system suppliers for a new front office system for social security counter clerks.

Customer supplier relationship
The customer supplier relationship is shown in figure 7.3. Here the same invitation to issued to a number of suppliers. The suppliers rely on the written document for their source of understanding what is needed.
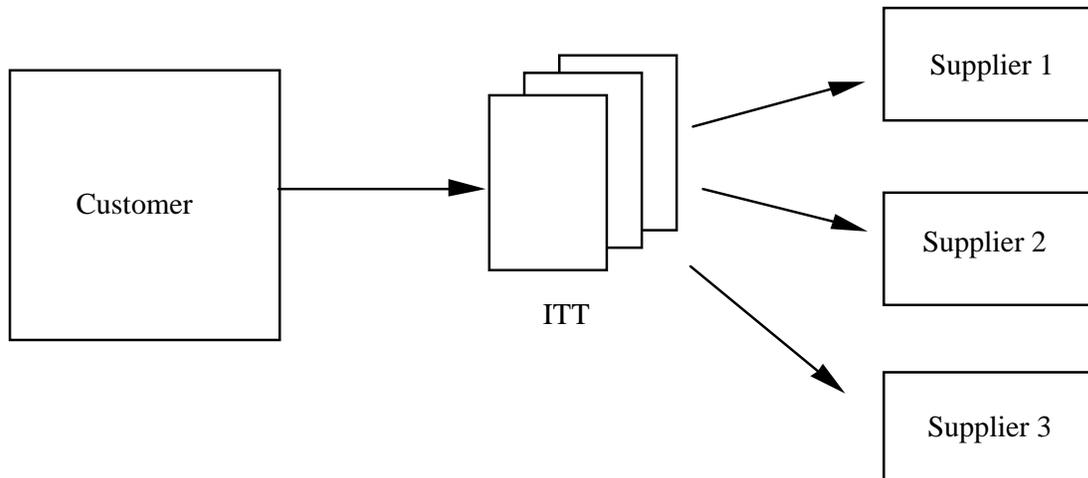
Figure 7.3 Scenario One: A Customer issues an Invitation to Tender (ITT)
to a number of potential suppliers

A typical RE process

The ITT is a formal document and once received by the supplier, typically a contracts team is put together. This team is made up of people who are stakeholders and as such have an interest in seeing the project completed. The team members will be from different areas of the company and their task will be to put together a description of the business opportunity from the suppliers point of view.

The business opportunity will be taken up by the 'bid team' who will write a proposal. The proposal is presented to the customer in order to convince them that the supplier can produce the required product. A proposal could be in the form of a prototype or a slide show describing the finished product. If the customer accepts the proposal then a contract is signed. This contract is the actual requirements statement which contains details of what should be delivered to the customer.

Figure 7.4 gives an overview of the process:

```
┌─────────────────────────┐
│           ITT           │
└─────────────────────────┘
              │
              ▼
      ┌───────────────┐
      │   Formulate   │
      │   Contracts   │
      │     Team      │
      └───────────────┘
              │
              ▼
   ┌─────────────────────┐
   │                     │
   │      Identify       │
   │   the Business      │
   │    Opportunity      │
   │                     │
   └─────────────────────┘
              │
              ▼
      ┌─────────────────┐
      │  Formulate the  │
      │   'Bid team'    │
      └─────────────────┘
              │
              ▼
      ┌─────────────────┐
      │   Write the     │
      │   Proposal      │
      └─────────────────┘
              │
              ▼
      ┌─────────────────┐
      │ Present Proposal │
      │   to Customer   │
      └─────────────────┘
              │
              ▼
      ┌──────────────────┐
      │ Customer Accepts │
      │ Contract is Signed│
      └──────────────────┘
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Figure 7.4 A Model of the RE Process for Scenario One
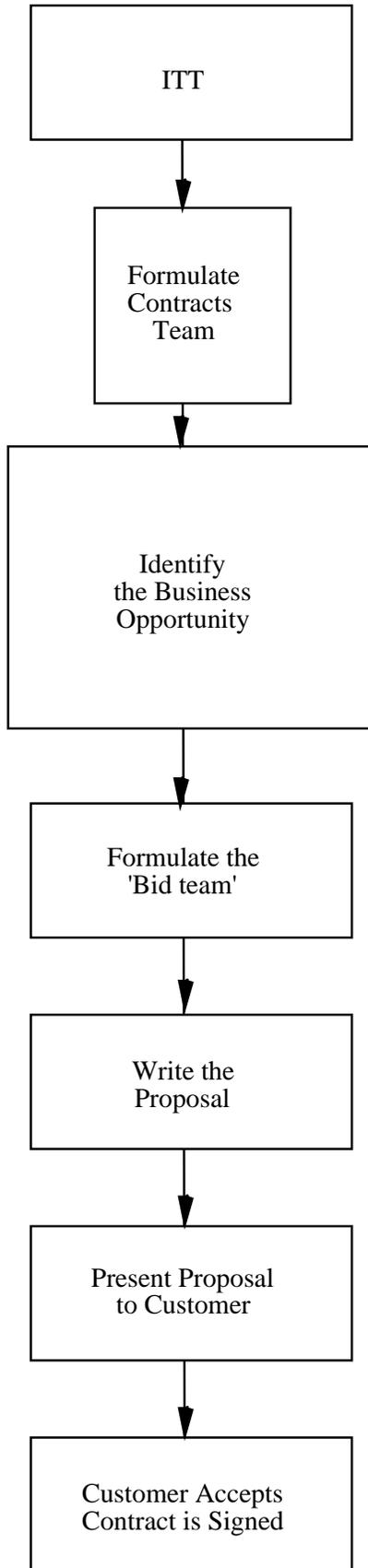
At the next stage the 'solution team' may be put together. The solution team will use the requirements statement and convert it to a functional requirements specification that is in a suitable form for the designers to use. At this stage the customer supplier relationship changes and a more detailed requirements investigation may be possible. The characteristics of this stage become similar to those in scenario two.

Characteristics of scenario one
- competitive
- limited knowledge of the customer
- probably no access to potential users
- the ITT represents the customers own assessment of their requirements
- the process is limited by time, cost and formal contracts
- strategic for the supplier
- many decision makers may be involved
- the requirements reside within a formal contract

Candidate RE techniques for the portfolio
1. prototyping for demonstration purposes
2. design mock-ups
3. competitor analysis (aspects of QFD)
4. cooperative requirements capture workshops for the bid team

7.3 Scenario Two:

A specific supplier is asked directly to respond to a specific customer request.

A typical scenario
A supplier is asked by an international vendor of paper packaging to develop a system which will help to reduce stock levels to a minimum.

The customer supplier relationship
Figure 7.5 shows that in this case there is only one customer and one supplier and that there is two way communication between them. The customer may wish the supplier to assist in the development of a written statement of requirements. The supplier may want a statement of requirements to form the basis of a contract with the customer. Requirements statements should be developed to be of the form "The system shall do xyz". This will enable the supplier to demonstrate that all the requirements have been met.
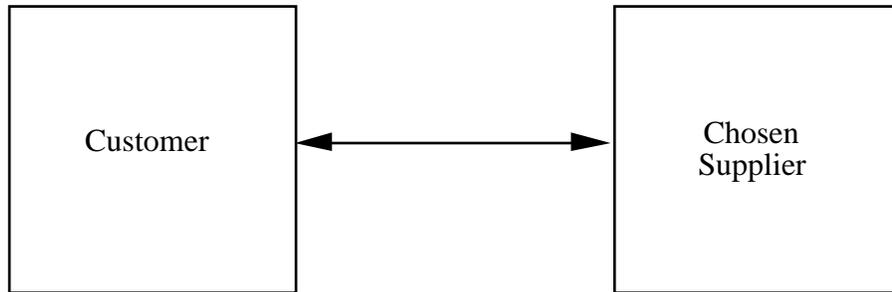
Figure 7.5 Scenario two: A specific supplier is asked to respond
to a customer request

A typical RE process

Figure 7.6 shows a typical model of the RE process for scenario two.

```
              ┌─────────────────────┐
              │     Formulate       │
              │  Requirements team  │
              │  from customer and  │
              │ supplier organisations │
              └─────────────────────┘
                        │
                        ▼
              ┌─────────────────────┐
              │                     │
              │   Investigate the   │
              │      Problem        │
              │                     │
              └─────────────────────┘
                        │
                        ▼
              ┌─────────────────────┐
              │                     │
              │                     │
              │ Explore alternative │
              │     solutions       │
              │                     │
              │                     │
              └─────────────────────┘
                        │
                        ▼
              ┌─────────────────────┐
              │      Assess         │
              │   Feasibility of    │
              │      Change         │
              └─────────────────────┘
                        │
                        ▼
              ┌─────────────────────┐
              │      Select         │
              │      chosen         │
              │      option         │
              └─────────────────────┘
                        │
                        ▼
              ┌─────────────────────┐
              │     Document        │
              │       the           │
              │    requirements     │
              └─────────────────────┘
                        │
                        ▼
              ┌─────────────────────┐
              │   Agree budget      │
              │    timescales       │
              │                     │
              └─────────────────────┘
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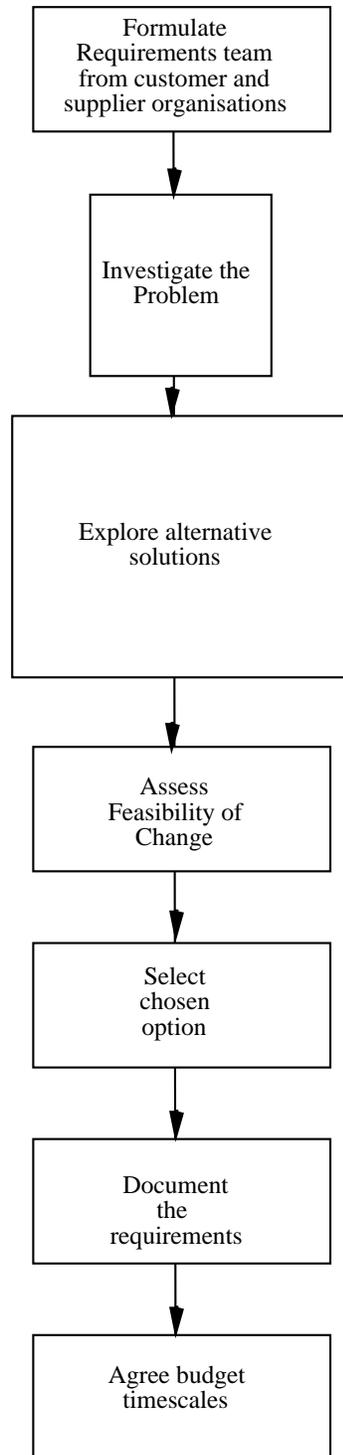
Figure 7.6 A Model of the RE Process for Scenario Two

First a team of senior stakeholders from both organisations formulate a requirements team. The stakeholders would ideally include those responsible design and development,

user support, user managers, user representatives, those with a financial interest and those with a management and strategic interest in the proposed system. (The team members should be empowered decision makers). This team is responsible for agreeing upon which problem needs to be solved, for agreeing on the scope of the proposed system, for exploring alternative solutions, assessing the feasibility of the proposed change and for 'signing' the requirements document.

Figure 7.7 presents an alternative process model for scenario two in which an iterative approach is adopted. In this case a team from the supplier may act a requirements engineers successively identifying customer requirements through a number of iterations. The first iteration starts with the customer stated goal for the system. The supplier identifies the appropriate client set within the customer organisation, develops a system description, identifies objectives and constraints considers alternative routes to the meeting the objectives, develops a model of the requirements in whatever form is appropriate for the client set and finally evaluates the model with the client. The result of the evaluation may be identification of further goals for the system, in which case another iteration occurs.

Goal 1

Establish
Client Set

System
Description

Evaluation

Identify
objectives
and constraints

Model
Construction

Routes to
objectives

Goal 2

Establish
Client Set

System
Description

Evaluation

Identify
objectives
and constraints

Another Iteration

Model
Construction

Routes to
objectives
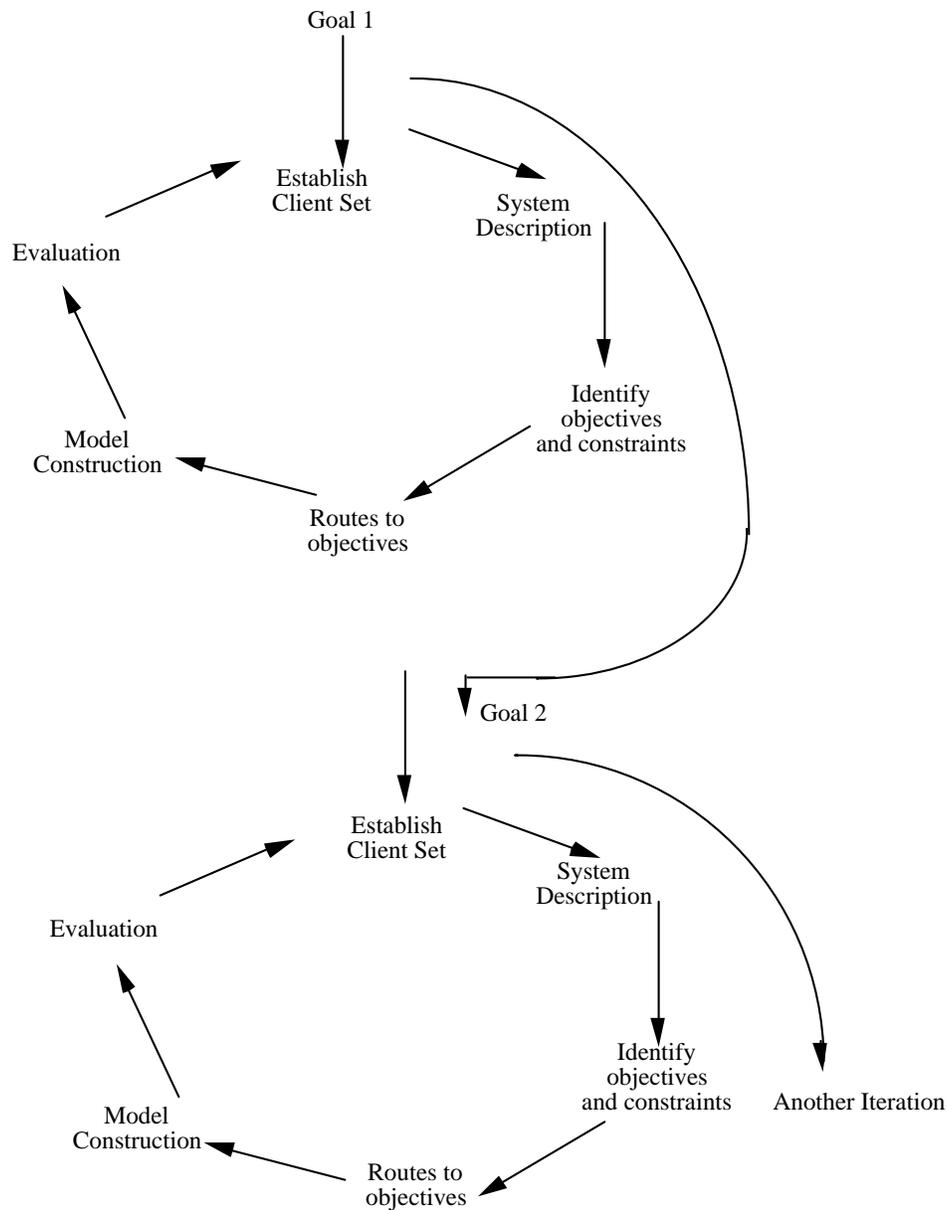
fig 7.7 An alternative process model for Scenario Two

The statement of requirements evolves through a series of system descriptions.

Characteristics of this scenario
- relatively easy access to customers and users
- possible to model requirements
- possible to develop models of the enterprise (if a long term relationship exists between customer and supplier)
- group session approaches viable

Candidate RE techniques for the Portfolio

1. Soft Systems Methodology
2. Enterprise Modelling
3. JAD
4. CRC
5. Eason's cost-benefit assessment of organisational change

7.4 Scenario Three:

A supplier wishes to make a generic product which will meet the needs of a (large) number of customers.

A typical scenario
A large IT supplier wishes to develop a new generation of point-of-sale terminals for use by department stores, supermarkets and other retail outlets.

The customer supplier relationship
Figure 7.8 shows a typical customer supplier relationship for scenario three. The supplier wishes to develop a product which will meet the needs of many different customers. Some customer requirements will be generic to all customers, others will be specific to certain types of customer.
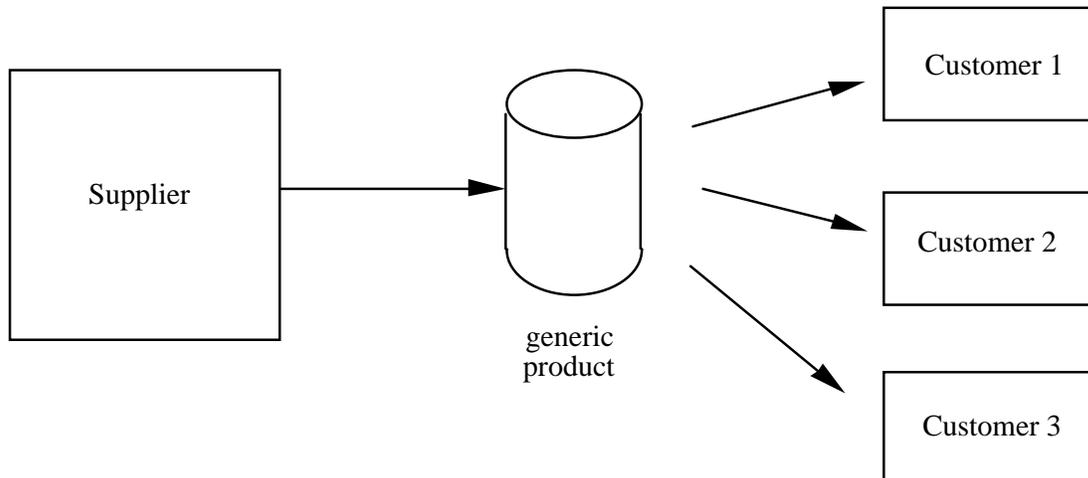
Figure 7.8 Scenario Three: A supplier wishes to make a generic product with
            will meet the needs of a (large) number of customers

In this scenario requirements exist at a number of different levels. At the first level market needs must be considered. Questions such as: is the market for the proposed product a mature market? are there certain features that the market expects fom this product? is there still potential for a substantial market share? what are competitor

products offering? how will the market develop in 5 to 10 years from now? Once a potential market opportunity has been identified and the associated requirements documented, then the needs of customers can be considered. Figure 7.9 illustrates that there are different levels of requirements.

```
┌─────────────────┐                      ┌─────────────┐
│  Market Norms   │                    ╱   Market       ╲          ┌──┐
│  Market Lifecycles│ ──────────▶     │    Needs         │ ─────▶  │  │
│  Competitor     │                    ╲                ╱          │  │
│  Analysis       │                      └─────────────┘           │  │
└─────────────────┘                                                │  │
                                                                   │  │
┌─────────────────┐                      ┌─────────────┐           │  │
│  Analysis of    │                    ╱   Customer      ╲          │  │
│  generic customer│ ──────────▶      │    Needs         │ ─────▶  │  │
│  requirements   │                    ╲                ╱          │  │
│  and variants   │                      └─────────────┘           │  │ Requirements Document
└─────────────────┘                                                │  │
                                                                   │  │
┌─────────────────┐                      ┌─────────────┐           │  │
│  Analysis of    │                    ╱   User          ╲          │  │
│  generic user   │ ──────────▶       │    Needs         │ ─────▶  │  │
│  requirements   │                    ╲                ╱          │  │
│  and variants   │                      └─────────────┘           │  │
└─────────────────┘                                                │  │
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┌─────────────────┐                      ┌─────────────┐           │  │
│  Analysis of    │                    ╱   Developer     ╲          │  │
│  developer      │ ──────────▶       │    Needs         │ ─────▶  │  │
│  oriented       │                    ╲                ╱          │  │
│  requirements   │                      └─────────────┘           └──┘
└─────────────────┘
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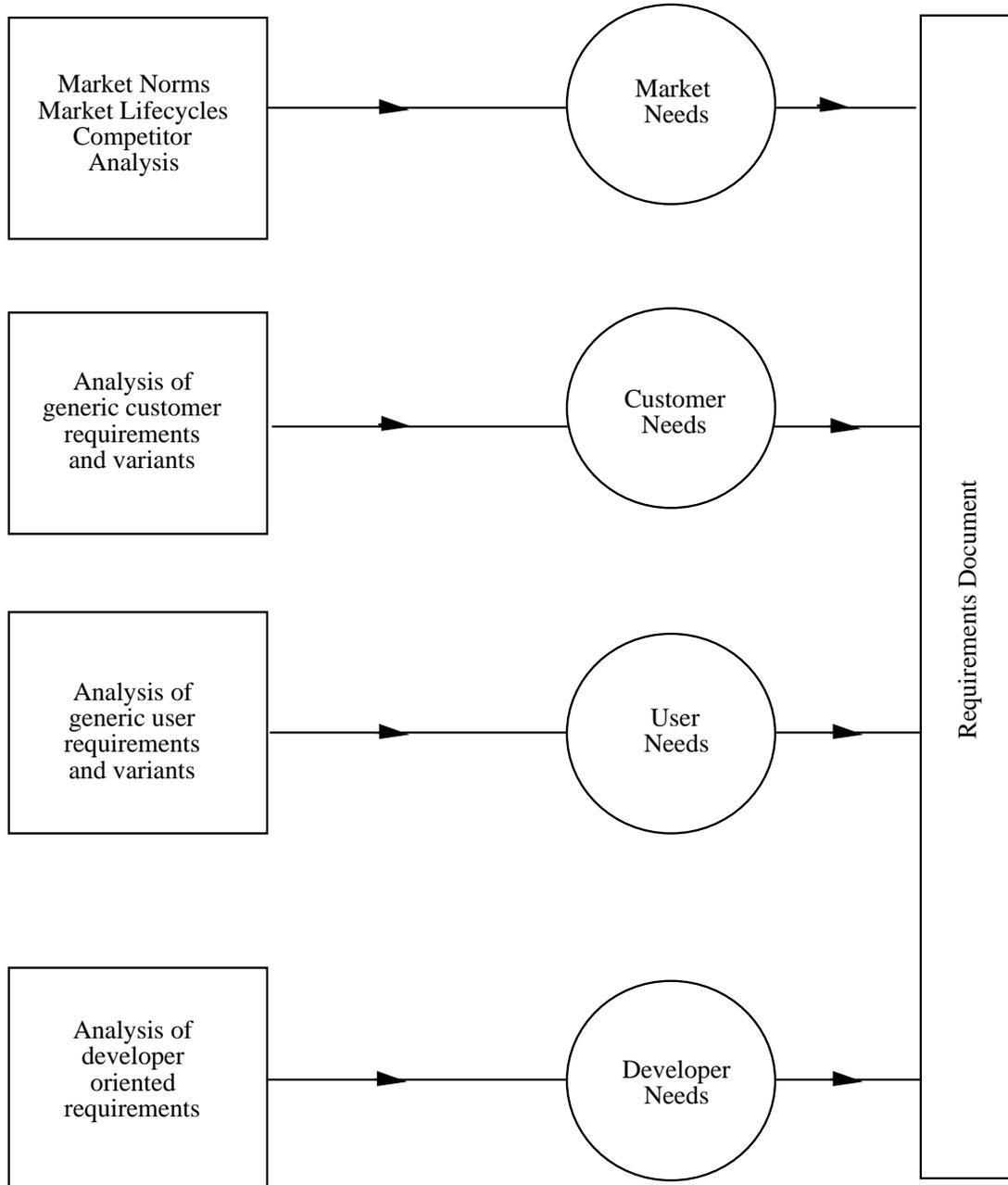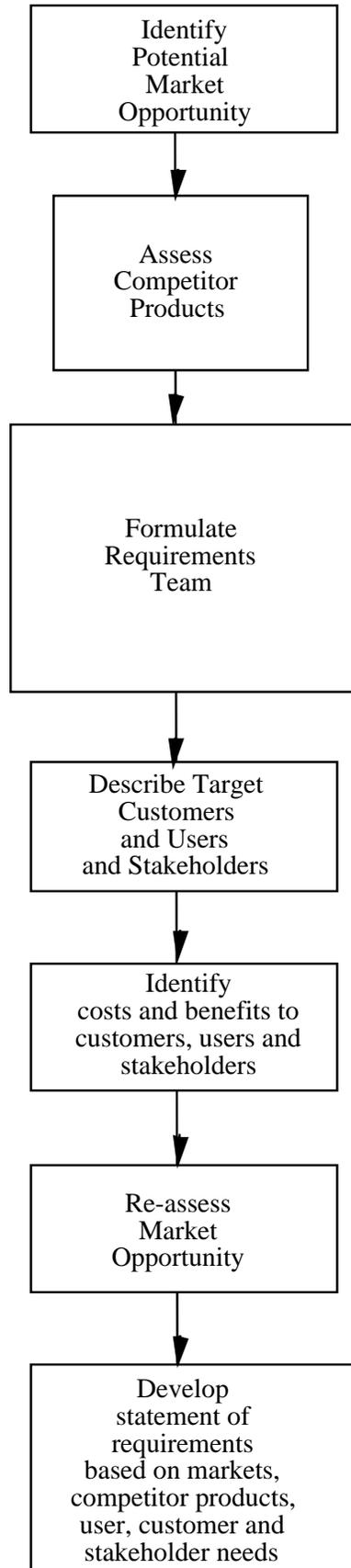
fig 7.9 Sources of Requirements for Scenario Three

Of course these 'levels' are not independent of each other. For example, identification of some future user requirement may lead to a reassessment of market needs.

A typical RE process
Figure 7.10 illustrates a typical RE process for scenario three.

```
              ┌─────────────────┐
              │    Identify     │
              │    Potential    │
              │     Market      │
              │   Opportunity   │
              └─────────────────┘
                       │
                       ▼
              ┌─────────────────┐
              │     Assess      │
              │   Competitor    │
              │    Products     │
              └─────────────────┘
                       │
                       ▼
              ┌─────────────────┐
              │                 │
              │    Formulate    │
              │  Requirements   │
              │      Team       │
              │                 │
              └─────────────────┘
                       │
                       ▼
              ┌─────────────────┐
              │ Describe Target │
              │    Customers    │
              │    and Users    │
              │ and Stakeholders│
              └─────────────────┘
                       │
                       ▼
              ┌─────────────────┐
              │    Identify     │
              │costs and benefits to│
              │ customers, users and│
              │   stakeholders  │
              └─────────────────┘
                       │
                       ▼
              ┌─────────────────┐
              │    Re-assess    │
              │     Market      │
              │   Opportunity   │
              └─────────────────┘
                       │
                       ▼
              ┌─────────────────┐
              │     Develop     │
              │   statement of  │
              │   requirements  │
              │ based on markets,│
              │competitor products,│
              │ user, customer and│
              │ stakeholder needs│
              └─────────────────┘
```

Characteristics of this scenario
- difficult to gain access to customer organisations
- difficult to get access to users
- difficult to access competitors future plans
- involves many decision makers
- strategic for the supplier
- potentially high risk
- interplay between many factors
- requirements exist at many different levels
- requirements reside in many different documents

Candidate RE techniques for the Portfolio
1. CRC
2. QFD
3. Eason's cost benefit assessment of organisational impact
4.

7.5 Scenario Four:

A supplier has a generic product which needs to be taloired to meet a specific customer need.

A typical scenario
..................tbs...................

The customer supplier relationship
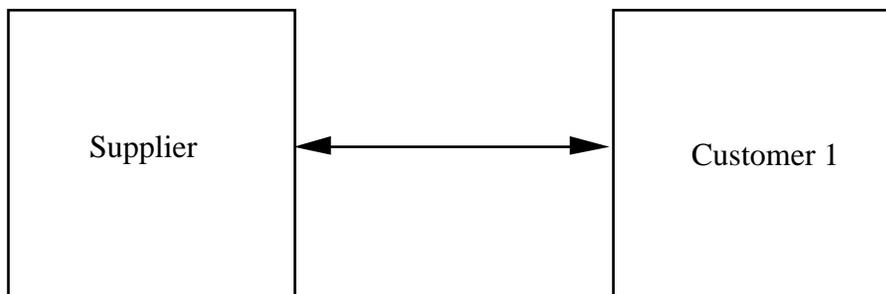
fig 7.11 Scenario Four: A supplier tailors a generic product
to meet a specific customer need

A typical RE process

---figure 7.12 here needs drawing what is it?------------

Characteristics of this scenario

- customer has an idea which needs to be articulated
- easy access to customer
-

Candidate RE techniques for the Portfolio

1. focus groups to find out what customers/users are thinking
2. customer to visit other installations to see what the supplier is offering

7.6 Scenario Five:

The business (customer) and the Information Technology (IT) function (supplier) are completely separate and operated as individual businesses, but belong to the same organisation.

A typical scenario

....tbs.............

The customer supplier relationship
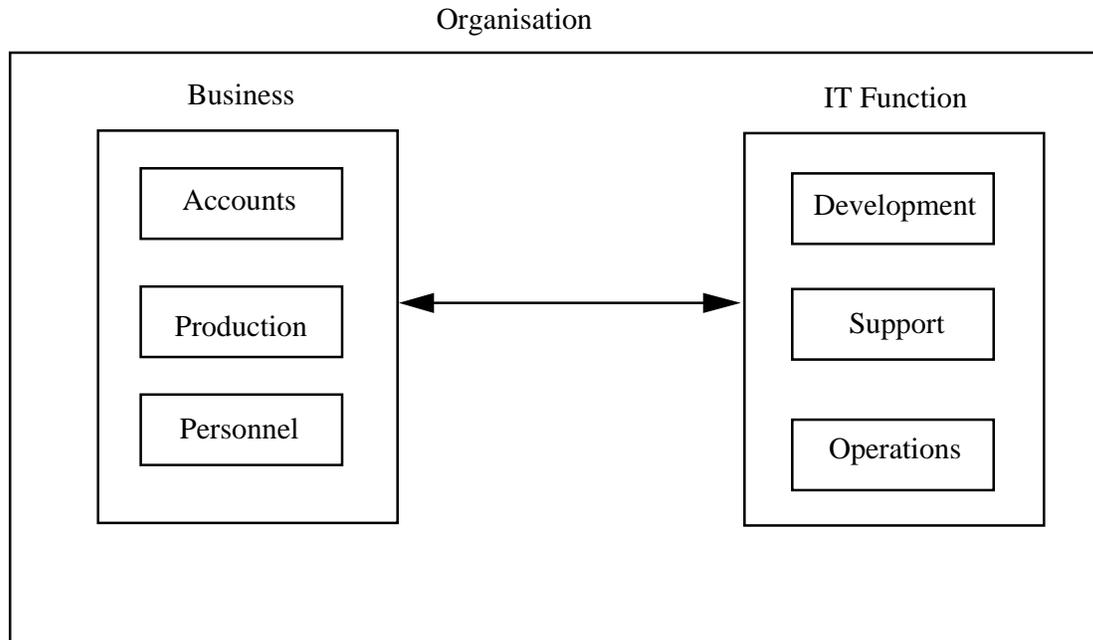
Organisation

Figure 7.13 Scenario Five: The Business + IT function operate as separate businesses within the same organisation

A typical RE process

--------figure 7.14 here what is it?------------

Characteristics of this scenario
- communication between customer and supplier occurs at the level of the business
-
Candidate RE techniques for the Portfolio
1.

7.7 Scenario Six:

The business (customer) is functionally separate from the IT function but each IT sub-function has clearly defined responsibilities for aspects of the business, and belong to the same organisation.

A typical scenario
update of an existing product

The customer supplier relationship

Organisation
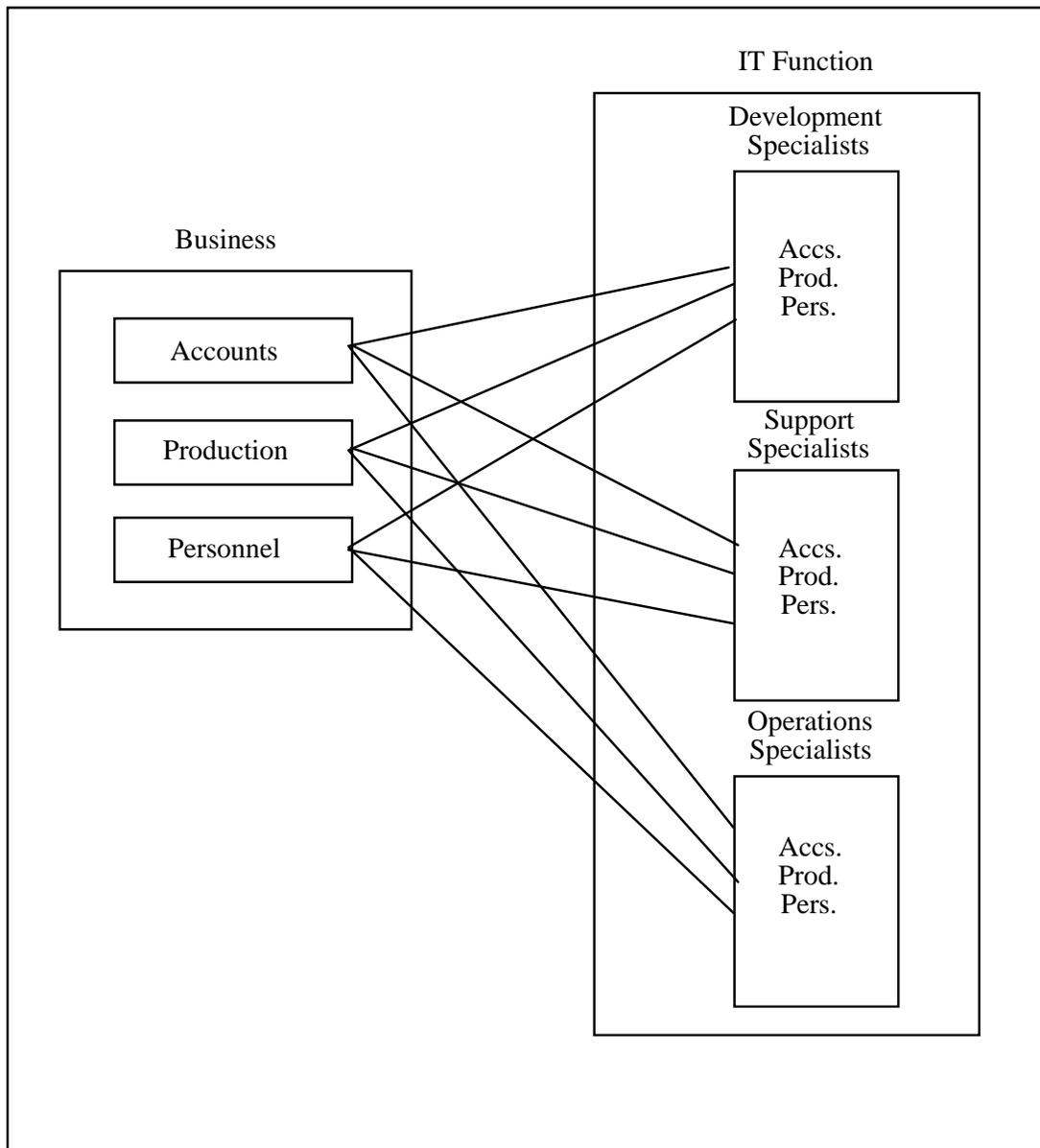
Figure 7.15 Scenario Six: The business and IT function communicate at the level of sub function

A typical RE process-

Requirements   Design
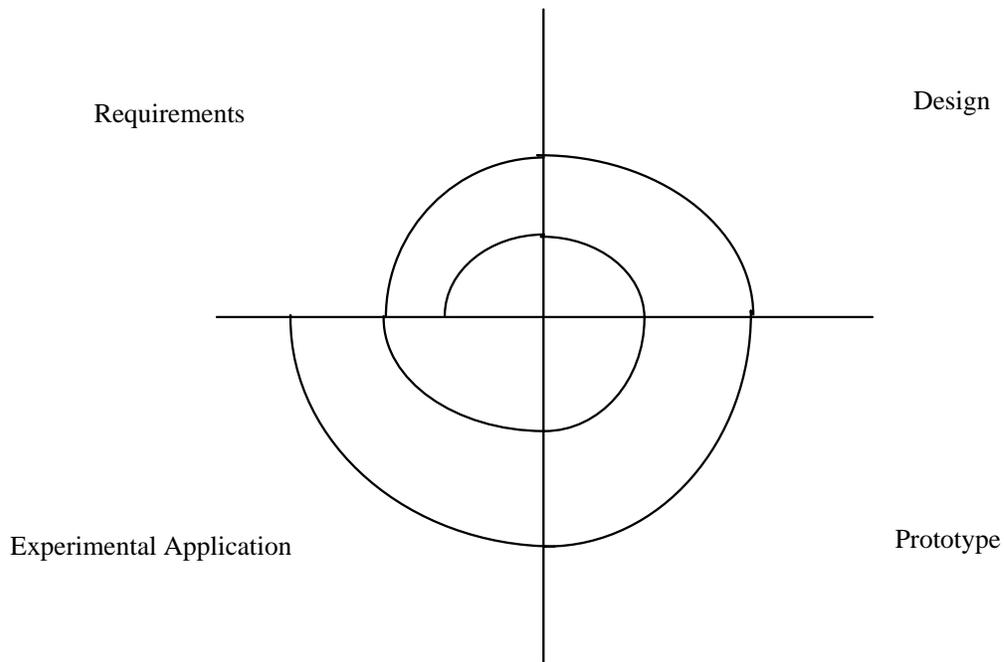
Figure 7.16 A spiral model of the RE Process for Scenario Six

Characteristics of this scenario
- customer and supplier communicate at the level of sub-function
- good working relationships between customer and supplier
-
Candidate RE techniques for the Portfolio
1. Future workshops

7.8 Scenario Seven:

The IT function is integrated within the business function, with each business unit having its own IT staff.

A typical scenario
End-user computing......

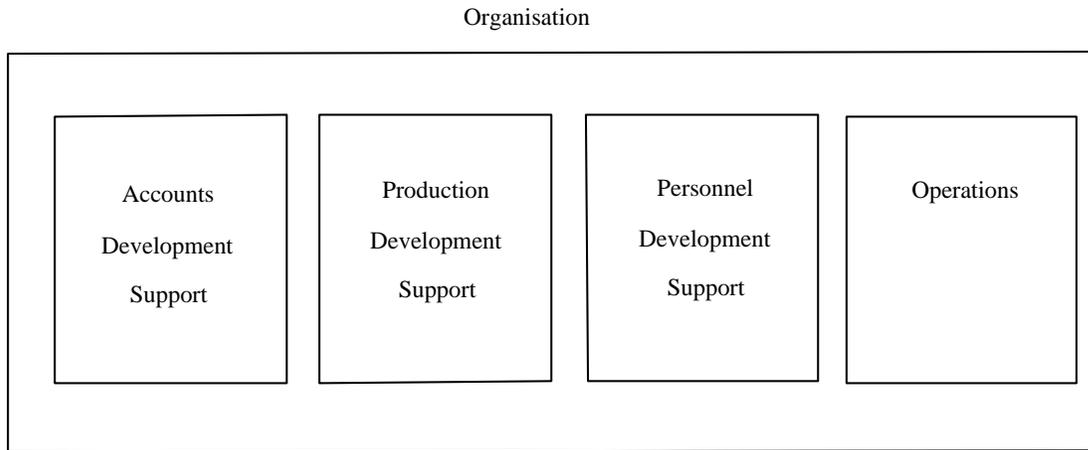*The customer supplier relationship*

Accounts Development Support	Production Development Support	Personnel Development Support	Operations

fig 7.17 Scenario Seven: The IT function is integrated within each business function

A typical RE process

--------see figure 7.18--------what is it? customer change requests?

Characteristics of this scenario

Candidate RE techniques for the Portfolio

7.9 Summary

7.10 Conclusions

References