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Design of a Methodology to Support Software Release Decisions

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8   RELEASE DECISION

"True genius resides in the capacity for evaluation of uncertain, hazardous, and conflicting information."
-- Winston Churchill --

8.1   Introduction

In the previous Chapter, the concept of maximizing behaviour is extended with the notion that the search for information has a price and cost, which can be seen as an economic activity itself assuming the concepts of neo-classical economics. In general, organizations are faced with making trade-offs among alternatives characterized by uncertainties and imperfect information. It assumes that decision-makers calculate the likely costs and benefits of any action before deciding on action, comparing the options on a single scale of preference, value or utility. After making comparisons, people choose to maximize their preferences, values or utilities. It is now well established that many of the psychological assumptions underlying rational choice theory are unrealistic and that human beings routinely violate the principles of rational choice (Tversky 1969; Kahneman and Tversky 1979, 1984; Tversky and Kahneman 1981; Baron 2000). This is a source of potential conflict in the decision-making process, undermining the assumption of average rational self-interest. Intra-individual conflict arises in an individual's mind and can emerge via the influence of others. Group conflict arises from differences between the choices made by distinct individuals in the organization, and, although, in this case, individual participants are not in conflict, the organization as a whole is.

In Section 8.2, intra-individual and group conflicts are discussed thus introducing the concept of *satisficing* behaviour. In Section 8.3, attention is paid to various aspects of group decision-making, including the characteristics of co-operative and effective groups [sociological aspects] and reduction in the influence of power bases [political aspects]. The concepts discussed are then applied to software release decisions in Section 8.4, leading to an answer for the 3rd Secondary Research Question: 'What effects, stemming from individual and group behaviour, play a role in the software release decision-making process?' Based on the clarification of aspects of satisficing behaviour, practices for the *'Release Decision'* process area are derived in Section 8.5. This Chapter ends with a summary and conclusions in Section 8.6.

8.2   Intra-individual and Group Conflicts

8.2.1   Intra-individual Conflicts

Janis and Mann (1977) present seven procedural criteria that characterise the individual making high quality decisions:

1. Thoroughly canvasses a wide range of alternative courses of action;
2. Surveys the full range of objectives to be fulfilled, and the values implicit in the choice;
3. Carefully weighs whatever is known about the costs, and risks, of negative consequences, as well as positive consequences that could flow from each alternative;
4. Intensively searches for new information relevant to further evaluation of the alternatives;
5. Correctly assimilates and takes into account any new information, or expert judgement, even when the information or judgement does not support the course of action initially preferred;

6. Re-examines the positive and negative consequences of all known alternatives, including those originally regarded as unacceptable, before making a final choice;

7. Makes detailed provisions for implementing or executing the chosen course of action, with special attention to contingency plans that might be required if various risks were to materialise.

These criteria reinforce the central concept of gathering and processing information about options and consequences. Other researchers, such as Jepsen and Dilley (1974), also describe decision-making as involving the organization of information obtained, the appraisal of alternatives and commitment to a course of action.

Simon (1957, p.198) argues however that the capacity of the human mind to formulate and solve complex problems is small compared with the size of the problems whose solution is required for objective rational behaviour. He introduces the theory of *bounded rationality* asserting that cognitive limitations force decision-makers to construct simplified models to deal with the real world:

> *Because of the limits of human intellective capacities in comparison with the complexities of the problems that individuals and organizations face, rational behaviour calls for simplified models that capture the main features of a problem without capturing all its complexities.*
>
> (Simon 1958)

Slovic *et al.* (1976, p.169) adds that people systematically violate the principles of rational decision-making when judging probabilities, making predictions or otherwise attempting to cope with probabilistic tasks. These violations can be traced to the strategies or heuristics used to reduce mental effort, which may be valid procedures in some situations, but will also lead to biases that affect decision-making.

Simon (1955, 1956, 1957) suggests an approach to explaining choice that is more cognizant of human cognitive limitations than rational choice theory. Simon argues that the presumed goal of maximization [or optimization] is virtually always unrealisable in real life, owing to both the complexity of the human environment and the limitations of human information processing.

It is difficult, if not impossible, for decision-makers to escape the diverse psychological forces that influence their individual behaviour. These forces lead to cognitive limitations. Examples are:

❖   *Cognitive Syndromes* (Steinbruner 1974). A decision-maker is faced with bounded rationality, because he thinks in certain patterns. Distinction can, for example, be made between *grooved thinking* [routine], *uncommitted thinking* [caused by inconsistent information that different alternatives remain acceptable] and *theoretical thinking* [preference for a specific choice, as a result of conviction and ideology, rather than rationality].

❖   *Subjective Utility* (Lee 1971; Meyer and Hutchinson 2000). The so-called subjective utility of a gain depends on at least two variables; value of the gain and the delay before it is received. There is often a strong negative correlation between delay and subjective utility (Lee 1971). As a consequence, a decision-maker is more strongly influenced by the short-term [current] advantages and disadvantages rather than the long-term [future] ones (Meyer and Hutchinson 2000). Side effects and long-term effects may not even be anticipated (Dörner 1996), and focus might only be on tackling immediate problems, and short-term goals, as they appear (Lindblom 1964).

❖   *Incrementalism.* Braybrooke and Lindblom (1970) describe the strategy of disjointed incrementalism and address eight issues undermining the thought that judgment of a situation is absolute. Instead they claim that a decision-maker judges a situation in a

relative way, often taking into account the additional cost and benefits of the current situation, and not the total cost and benefits. This leads to two important consequences (Huizenga 1994, p.121):

- The valuation of an alternative depends on the current situation. The same alternative might be judged more attractive if the current situation is unfavourable. This is the core of the theory of *framing* and *heuristics* (Tversky and Kahneman 1981; Kahneman *et al.* 1982).

- The fact that only additional cost and benefits are taken into account might lead to *entrapment* (Hill *et al.* 1979). A situation may be created in which, for example, the total cost exceed acceptable limits.

❖ *Personal Value System***.** The values of decision-makers do not have the ideal properties, such as absolute, relevant, stable, consistent, precise and exogenous (March 1978). England (1967) describes a personal value system as '*a relatively permanent perceptual framework, which shapes and influences the general nature of an individual's behaviour*'. Value systems have the following general qualities (England 1967, p.54), they affect:

- the perception of situations, problems and probability,

- the entire process of choice,

- personal relationships,

- the perception of individual and organizational achievement and success,

- the acceptance of or resistance to organization pressures and goals, and

- set the limits for ethical behaviour.

❖ *Distortions under Stress*. High levels of perceived stress characterize many high-stake decisions. If the stress level is not too high, it focuses decision-makers on a selective set of cues when evaluating options (Ben Zur and Breznitz 1981; Kahn and Baron 1995), however, where comprehensive processing is necessary, stress can hamper decisions (Levi and Tetlock 1980).

❖ *Problemistic Search*. Cyert and March (1963) argue that three assumptions underlie the search for information: search is motivated [stimulated by the problem, and depressed by the problem solution], search is simple-minded [organizations look for the simplest solution first], and search is biased [the view of the environment and possible solutions reflect the objectives and training of the people involved] (Greve 2003).

❖ *Intransitivity of Preferences*. Transitive preferences imply that if A is preferred to B, and B is preferred to C, then A is preferred to C. When the result of a preference function depends on more than one variable, intransitivity may occur (Tversky 1969), leading to 'irrational' or, at least, unexpected behaviour by a decision-maker.

Simon (1982) argues that such limited cognitive capabilities in decision-makers lead to simplification. A decision-maker simplifies reality, leaves out information and applies heuristics as a consequence of limited cognitive capabilities. Reasons are, for example, that the decision-maker has limited, unreliable or even too much information, available, or that the search for acceptable alternatives is felt to be too time, and cost, consuming.[76] He suggests that in choice situations, people actually have the goal of satisficing, rather than maximizing, or optimizing, and a decision-maker applies heuristic rules of search in a heuristic frame. The heuristic [or cognitive] frame referring to the representation of the problem and solution space, whereas the heuristic rules of search are the algorithms used to find solutions in this solution space (Simon 1969). Following this approach, an alternative is satisfactory if a set of criteria exists that minimally describes satisfactory alternatives, and the alternative in question meets,

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[76] This problem of computation is classically illustrated by the travelling salesman problem in which the objective is to minimize the travel costs of a salesperson having to visit 50 cities. The 50! calculation is computable but not within a reasonable time horizon.

or exceeds, all these criteria (March and Simon 1958). A general corresponding strategy (Pettit 1984, p.166)[77] is:

1. Set an aspiration level such that any option that reaches, or surpasses it, is 'good enough'. The aspiration level is the smallest outcome deemed satisfactory (Schneider 1992).
2. Begin to enumerate and evaluate the options on offer.
3. Choose the first option which, given the aspiration level, is 'good enough'.

Krosnick *et al.* (1996) describe two different forms of *satisficing* behaviour. *Strong satisificing* omits the retrieval and judgment steps; *weak satisificing* means all steps in the adopted strategy are executed.

How can this approach be integrated into the model (Section 7.2) describing optimizing behaviour? An example is given in Figure 8-1, incorporating *satisficing* behaviour at individual level [aspiration level]. The aspiration level is a horizontal line and reflects the boundary at, or above, which the decision-maker is satisfied. The aspiration level is given by the line $V = V^{*\prime}$, which denotes that a decision-maker will choose the first option reaching, or surpassing, $V^{*\prime}$ for the value function $V(i)$. In the example of Figure 8-1, the resulting point of optimality $(I^{*\prime}, Y^{*\prime})$ does not coincide with the point of optimality (I^*, Y^*) and lies to the left. This is not necessarily the case in general. *Satisficing* behaviour might also lead to setting an aspiration level where the resulting level of information exceeds I^*. In this case, unnecessary costs are incurred, as the resulting cost value exceeds C^*.

The aspiration level can also consist of a lower and upper boundary. A decision-maker will accept the first option for which:

$$V_{low} \qquad \leq V(i) \qquad \leq V_{high}$$
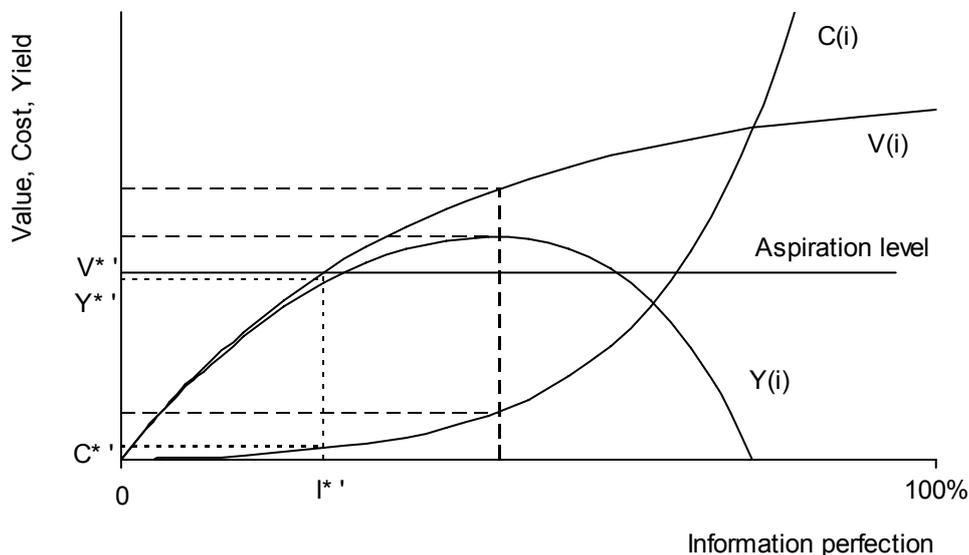
Figure 8-1: Adjusted Model

An aspiration level is not necessarily restricted to the value function $V(i)$. A decision-maker might, for example, set an aspiration level for the information perfection itself, in which case the aspiration level would be a vertical line in Figure 8-1. There may also be aspiration levels for cost and/or time: an upper boundary constraint C_{high} for the cost function $C(i)$ and/or an

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[77] Note the strong resemblance to the 'good enough' quality paradigm, discussed in Section 3.3.2, which is confirmed in the exploratory case studies (Section 4.4.3).

upper boundary constraint T_{high} for the time function $T(i)$.[78] It is obvious that a solution is only possible if the information level at V_{low} is less than, or equal to, the information level at C_{high} and T_{high}:[79,80]

$$V^{-1}(V_{low}) < C^{-1}(C_{high}) \qquad \text{and:} \qquad V^{-1}(V_{low}) < T^{-1}(T_{high})$$

It is concluded here that the notion of optimizing behaviour [imperfect information] as discussed in the previous Chapter, must be extended with the notion of *satisficing* behaviour. A decision-maker simplifies reality, leaves out information and applies heuristics as a consequence of limited cognitive capabilities. Both optimizing behaviour and *satisficing* behaviour are important sources that contribute to uncertainty in decision-making. In the next Section, how different choices, made by distinct individuals in the organization, potentially giving rise to group conflict is discussed.

8.2.2   Group Conflicts

Studies have shown that the collective behaviour of a group is a direct consequence of individual decision procedures with the addition of a process for resolving conflict (Clarkson and Tuggle 1966). Harrison (1987, pp.259-260) names important determinants of conflict:

❖ *Inter-dependence between Individuals or Units*. Normally, the higher the level of inter-dependence the greater the opportunity for conflict over decisions (Pondy 1966).

❖ *Performance Criteria and Rewards*. The more evaluations, and rewards, by higher management emphasize the separate performance of each department, rather than their combined performance, the more conflict (Walton and Dutton 1969).

❖ *Communication Problems*. May result from semantic difficulties, misunderstandings and 'noise' in the channels of communication.

❖ *Role Dissatisfaction*. Frustrating task conditions such as work overload, under-utilisation of skills, and scarcity of resources greatly contribute to role dissatisfaction.

❖ *Personality Attributes*. Research finds that certain attributes, such as high authoritarianism, high dogmatism and low self-esteem, increase conflict behaviour. Differing personal value systems and perceptual differences fall in the same category.

❖ *Divergence in Goals or Objectives*. Pondy (1966) states that the major determinant of perceived inter-personal conflict is differentiation in the participant's goals for the organization.

As stakeholders may apply different heuristics (Section 8.2.1) and one, or more, determinants of conflict may be present, different stakeholders may arrive at different aspiration levels during the decision-making process. This is illustrated in Figure 8-2, incorporating *satisficing* behaviour at group level, and showing the different aspiration levels for three different stakeholders S_a, S_b, and S_c. In the ideal situation, all aspiration levels would be equal and be within the zone of cost effectiveness [or even intersect with the point of optimality]. However, in a practical context, with high uncertainty, this is not a likely situation.

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[78] Theoretically a lower boundary for these functions may exist. However it is assumed that, in practice, these lower boundaries are equal to *0*.

[79] $V^{-1}(V)$, $C^{-1}(C)$ and $T^{-1}(T)$ are the inverse functions of $V(I)$, $C(I)$ and $T(I)$ respectively.

[80] There may even be an aspiration level for the level of information.
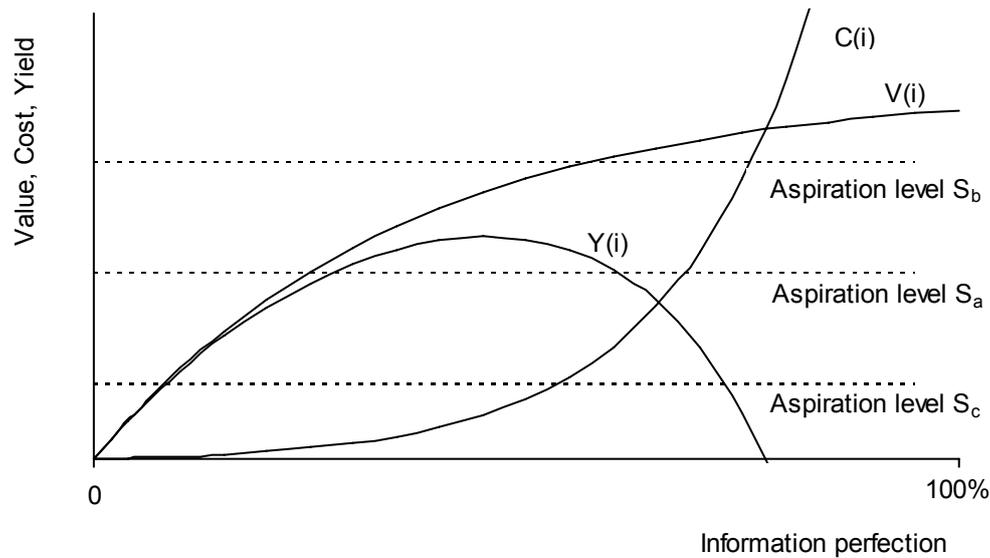
Figure 8-2: Adjusted Model

Stokman (2004) explains potential differences in aspiration levels during collective decision-making in the following way. He makes a distinction between ultimate goals and instrumental goals. Instrumental goals are considered a means through which ultimate goals can be realized. Utility functions for ultimate goals are usually strictly convex [monotonously increasing or decreasing]. Controversial decisions usually concern instrumental goals and have an optimum: too much, or too little, is bad. An example is given in Figure 8-3. The ultimate goals here are economic growth and environmental pollution reduction. The instrumental goal is the size of an 'ecotax'. Too little harms the ultimate goal of environmental pollution reduction, too much would harm the ultimate goal of economic growth. The optimum for the instrumental goal depends on the weighting of all ultimate goals. In collective decision-making, different stakeholders are likely to assign different weights due to different heuristics, and the presence of one, or more, determinants of conflict, leads to different aspiration levels for the decision outcome.[81]

The 3rd Secondary Research Question to be answered is: 'What effects, stemming from individual and group behaviour, play a role in the software release decision-making process?' The sources for intra-individual conflicts and group conflicts are discussed. Intra-individual conflicts arise from the concept of bounded rationality due to imperfect information and cognitive limitations. This leads to satisficing behaviour. Collective behaviour of a group is a direct consequence of individual decision procedures with an additional process for resolving conflict. Several sources of conflict are discussed, with two considered important for software release decisions: the inter-dependence between individuals, or units, and the divergence of objectives. Both the bounded rationality principle and the presence of these sources of conflict are likely to lead to different aspiration levels among stakeholders, prior to the decision-making process.

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[81] The individual aspiration levels of the different stakeholders are considered here, not the aggregated aspiration level value of the group or organization. For the aspiration levels of organizations, much literature can be found on how these levels adjust over time (e.g., Lant 1992; Greve 2002), and how they are formed in the social context (e.g., Levinthal and March 1981; Greve 1998).
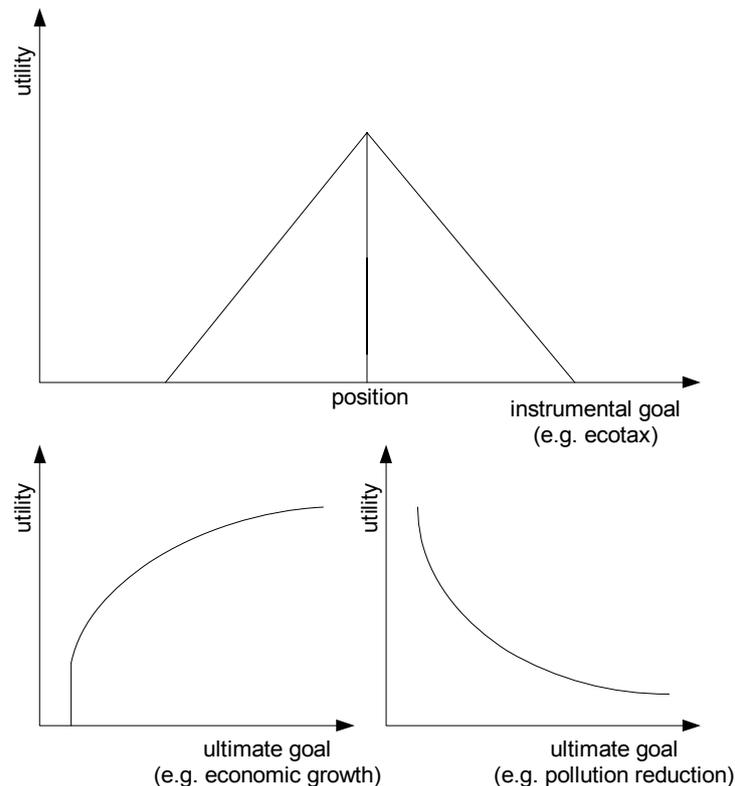
Figure 8-3: Utility Functions ~ Instrumental and Ultimate Goals
(Stokman 2004)

Having identified that different stakeholders are likely to have different aspiration levels, in the presence of uncertainty and one or more sources of conflict, it is of interest to consider collective decision-making, and in the next Section, how different stakeholders arrive at a decision is explored.

8.3   Collective Decision-making

With the understanding that different stakeholders are likely to have different aspiration levels when arriving at a collective decision-making process, there is a need to explore two areas of interest:

  ❖ *Sociological Aspects:* which group decision-making strategies and decision-making group types can be noted: what are the characteristics of effective groups, and which decision rules can be distinguished?

  ❖ *Political Aspects:* which sources, or bases, of power might be present in the decision-making process and which processes/strategies can be distinguished in arriving at a collective decision?

8.3.1   Sociological Aspects

In this Section four issues related to sociology addressing co-operative group behaviour are discussed: group decision-making strategy, decision-making group type, characteristics of effective groups and decision rules.

Delbecq (1967) identifies five different dimensions of group behaviour:

  ❖ group structure [the organization of individual members],

- ❖ group role [behaviour required of participants, to facilitate the decision-making process],
- ❖ group process [manner of attaining the group objective],
- ❖ group style [social-emotional tone of inter-personal relationships among the members], and
- ❖ group norms [standards of conduct among members].

Delbecq (1967) relates these dimensions to three different strategies for decision-making, with the objective of the group as the independent variable:

1. *Routine*: emphasizes specialization, coordination and individual expertise, with a strong commitment to professionalism.
2. *Creative*: based on participative problem-solving techniques in a non-authoritarian, unstructured environment.
3. *Negotiated*: stresses the formalized and disciplined representation of various constituencies, in a context of established rules and procedures for arriving at a choice.

These strategies leave open the question of which group techniques are used to arrive at a group decision. Ven and Delbecq (1972) compared two group techniques:[82]

a. *Interacting Group Technique*. Characterized by group discussion and pooled judgments. Interacting group meetings start with a statement of the problem by the group leader. This is followed by an unstructured group discussion to generate information and pool judgments among the participants. The meeting usually concludes with a majority vote on priorities, or a consensual decision (Harrison 1987, p.237).

b. *Nominal Group Technique*. A method for structuring a group meeting, the purposes of which are to obtain a large number of ideas from the group, and order and prioritize these ideas. When using this procedure, participants assemble in groups, but are told not to speak to each other. Each person is then asked to write down what they view as the advantages and disadvantages of the proposition under consideration. Following the individual listing of the advantages and disadvantages, the group compiles two master lists, one of advantages and one of disadvantages, without allowing any duplicity of items. The individuals then rank the advantages and the disadvantages separately on paper without consulting any other member of the group. The group decision is a pooled outcome of individual votes.

In the case of an interacting group technique, information sharing and discussions are important issues. Allowing the inter-action between participants to arrive at a collective decision, it is important to consider the criteria for effective groups. McGregor (1960) distinguishes twelve characteristics of effective groups:[83]

1. Group atmosphere is informal, comfortable, relaxed and can be described as a working atmosphere of participants who are both involved and interested.
2. The discussions are task relevant and include all participants.
3. The task or objective of the group is well understood. It has been arrived at through discussion and all participants are committed.
4. Participants listen to each other and ideas are freely expressed.

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[82] Not considered relevant here is the *Delphi technique*, characterized by getting a final opinion from a group through sequential surveys where the participants do not meet each other (Brown *et al.* 1969). The Delphi technique consists of group communication among a panel of geographically dispersed participants, who do not to meet face to face for collective decision-making. The technique allows experts to deal systematically with a complex problem or task. It comprises a series of questionnaires sent to a pre-selected group of experts. These questionnaires are designed to elicit and develop individual responses to the problems posed, and to enable the experts to refine their views as the group's work progresses in accordance with the assigned task. The main aim of the Delphi technique is to overcome the disadvantages of conventional committee action, and is characterized by anonymity, controlled feedback, and statistical response.

[83] This closely matches the seven characteristics of effective groups for managerial decision-making, adopted by Harrison (1987, pp.228-229).

5. Disagreement is expressed, not suppressed or overridden by premature group action. Those who disagree do so genuinely and expect to be heard.

6. Decisions are reached by consensus, but the group does not allow apparent consensus to mask real disagreement. Formal voting is minimized, as it tends to be divisive.

7. Constructive criticism occurs and is not of a personal kind.

8. Participants are free to express their personal feelings as well as their ideas.

9. When action is taken, clear assignments are made and accepted.

10. The chairperson does not dominate discussion, rather leadership shifts depending upon the issue under discussion.

11. The group is self-conscious about its own operations. Whether the problem is procedural or inter-personal, the group will try to resolve the problem before proceeding.

12. Power struggles as such do not occur in the group, as the issue is not who controls but how the job gets done.

Decision Rule	Description	When to Use
Majority Vote	The number of votes made for two or more options are counted. The option that has the highest number 'wins'.	The decision is trivial, the stakes are low, options are clear, or the division in the group is acceptable to all stakeholders.
Delegation	One person is appointed to make the decision.	Decision must be made quickly, the delegate has authority for the results of the decision, the delegate has or can obtain expertise on the decision topic, or the decision has little importance.
Negotiation	Compromises to a middle position incorporating the most important positions of the sides. All sides must retract some of their desired choices.	The group is so polarized that no other alternative is possible.
Spontaneous Agreement	Stakeholders quickly and extemporaneously arrive at a decision without considering the decision factors.	Decision has minimal consequences and needs to be made quickly. Discussion and sharing of preferences aren't important to the quality of the decision.
Arbitrary	Decision is made by some arbitrary means [such as flipping a coin].	The decision is unimportant, has no long-term consequences for stakeholders and must be made quickly.
Decision leader decides without discussion	The leader makes a decision without consulting any other stakeholders.	The decision must be made in a crisis, or the decision is not a high-stakes one, and it is made by a competent, knowledgeable leader who is trusted by the people affected by the decision.
Decision leader decides after discussion	The leader makes a decision after consulting stakeholders in the decision.	The decision leader has the knowledge and expertise on the decision topic, wants to make the decision collaboratively and needs to balance quality with speed.
Consensus	A state of mutual agreement among stakeholders is reached; legitimate concerns of individuals have been addressed to the satisfaction of the group.	The decision is important and requires the commitment of all the stakeholders.

Figure 8-4: Decision Rules
(Saint and Lawson 1994)

A given characteristic may not weigh equally in the balance for a particular decision, but in most effective group decisions each characteristic will exert some degree of influence on the group's output. The sixth criteria distinguished by McGregor reveals consensus as the appropriate decision rule. In Figure 8-4, examples of different decision rules are listed, including consensus (Saint and Lawson 1994).

A group has reached consensus when everyone can, and will, support the decision. This does not mean everybody agrees on the best choice, but the stakeholders involved have found a choice they can all support. The process to reach consensus may be slow, but when the group finally reaches consensus, it has developed a solution that will have the support it needs to be implemented. Others confirm consensus as the appropriate decision rule (Maier 1970; Ouchi 1981; Moscovici and Doise 1994). Ouchi (1981) considers that a leadership style focusing on consensus decision-making, can lead to dramatically higher productivity. Moscovici and Doise (1994) note that, while some conflict may be constructive, co-operative groups will, on average, make better decisions, than groups with extensive inter-personal conflicts. Group members may react to an 'acceptable level' of inter-personal conflict by lowering their personal objectives and shifting toward consensus. There is however also a risk involved. Problem-solving groups have a strong tendency to converge on a single solution (Steiner 1982). Once a position appears to have gained the support of a majority, no matter how slight the majority is, other positions are unlikely to be adopted even if they are demonstrably better. Janis (1972, 1982) and others have long warned against the danger of this overzealous concurrence seeking, where conformity pressures, and ensuing self-censorship, can lead to premature consensus in group decisions. Premature consensus occurs when consensus develops for a position before all viable alternative positions have been thoroughly evaluated.

8.3.2   Political Aspects

Differences in aspiration among stakeholders involved, implies that one, or more, stakeholders must change his initial position in order to reach consensus. Stakeholders exert influence on each other, and in this Section, this is discussed from two perspectives: the presence of different sources of power in the decision-making process and the theory of Stokman *et al.* (2000) describing processes through which stakeholders change their position.

Individuals or groups have power if the consequences of their actions can be observed in the behaviour of other people. Power can be formulated as the ability to exert influence; that is, the ability to change attitudes or behaviour of individuals or groups, whereas the employment of power is referred to as *politics*. French and Raven (1959) identify five sources, or bases, of power, which are:[84]

❖ *Reward Power*. Based on one person [the influencer] having the ability to reward another person [the influencee] for carrying out orders or meeting other requirements. One example is the power of a supervisor. It reflects the ability to confer positive rewards of a monetary, or psychological, nature, as perceived by the influencee. The strength of this power varies with the expectation of the potential influencee that a particular kind of behaviour will result in attainment of the reward. It assumes that the reward is of some significance to the potential influencee.

❖ *Coercive Power*. Based on the influencer's ability to punish the influencee for not carrying out orders or meeting requirements. It is based on fear of undesirable consequences if a particular form of behaviour is not forthcoming. The strength of this power varies with the expectation that punishment will follow as a result of non-conformance. It is the opposite of reward power.

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[84] Mulder (1979) discerns four bases of power, combining reward and coercive power as sanction power.

❖ *Legitimate Power.* This type of power exists when an influencee acknowledges that the influencer has a right, or is lawfully entitled, to exert influence and derives, for example, from a position in the organizational hierarchy. Its strength varies with the legitimacy imputed to those who claim such power by those whose behaviour will be modified by its acceptance.

❖ *Expert Power.* Based on the perception, or belief, that the influencer has some relevant expertise or special knowledge. The demand for expertise confers on its possessor power that usually results in the acceptance of advice, or opinions, and compliant behaviour. The strength of expert power varies with others' perceptions of the extent of knowledge or skill possessed by the expert.

❖ *Referent Power.* May be held by an individual or a group, based on the influencee's desire to identify, or imitate, the influencer. It derives from identification with a particular individual or group possessing a high level of attractiveness for the identifier. The strength of this power varies with the degree of attractiveness, which, in turn, elicits a desire to associate with the individual or group. A desire not to associate because of unattractiveness results in negative referent power.

Stokman *et al.* (2000) describe three elements that determine the outcome of a decision: the *positions* of the stakeholders, the *salience* for the stakeholders [the degree to which they are interested in each issue] and the *capabilities* of the stakeholders. The process of decision-making is described as the efforts of stakeholders to realise an outcome of the decision as close as possible to their own position. Stokman *et al.* (2000) distinguish three main processes and strategies whereby a stakeholder changes his position:

❖ *Management of Meaning*: the stakeholder receives convincing information implying that another position reflects his incentive structure better. Important aspects here are:
  - New information is generally more acceptable in earlier stages of the decision-making than in later ones;
  - A substantial amount of trust in the provider of the information increases the likelihood that information is accepted as relevant and reliable.

❖ *Exchange*: a stakeholder is prepared to take another position on an issue in exchange for a reciprocal move by another stakeholder on another issue. Three elements are of importance here:
  - The selection of the issues one wants to include in the exchange process.
  - The change one incorporates into one's own positions.
  - One's prioritisation of the issues.

❖ *Challenge*: other stakeholders challenge the position of a stakeholder who feels more or less forced to change position. This is influenced by:
  - One's own position at the beginning of the decision-making process.
  - The leverage one shows to others.
 - Explicit evaluation of the likelihood of success.

In the next Section, the sociological and political aspects, as discussed in Sections 8.3.1 and 8.3.2, are applied to strategic software release decisions.

8.4   *Applicability to Strategic Software Release Decisions*

As discussed in Section 8.2, different stakeholders will potentially have different aspiration levels as a result of imperfect information, different perceptions of the real world and the potential existence of sources of conflict. For software release decisions, this is also illustrated using the theory of Stokman (2004) as explained in Section 8.2.2.

The instrumental goal of a software manufacturer during product development is to release a product to the market. Ultimate goals may be to capture a high market share by releasing the

product as early as possible [first-mover advantage], or to satisfy customers by delivering a high-quality product [customer satisfaction], turning the software release decision into a dilemma. Too late means market share will be lost, too early means dissatisfied customers due to a lower quality product, as in Figure 8-5. It is likely different stakeholders will assign different weights to the ultimate goals, due to the inter-dependence between stakeholders involved [Section 8.2.2: representatives from different departments]. In a practical setting, there may, further, even be more than two goals, while different stakeholders will not necessarily have identical goals [Section 8.2.2: divergence in goals or objectives].
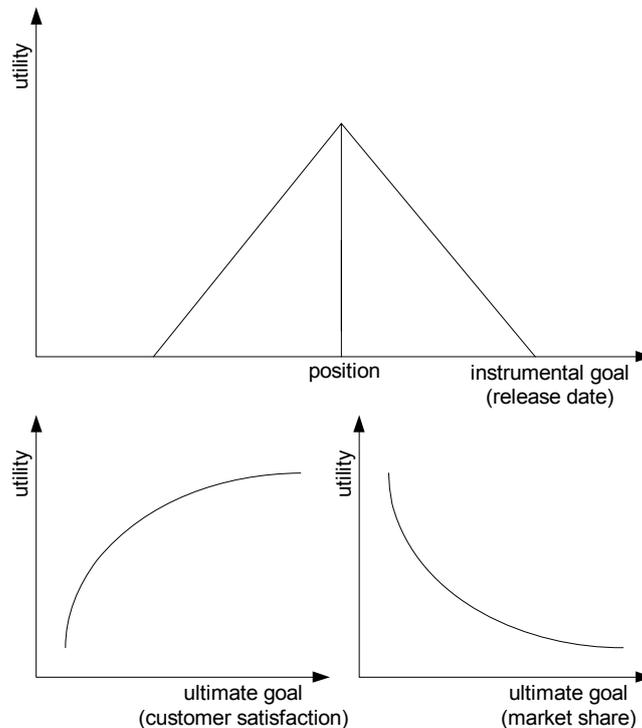
Figure 8-5: Example of Utility Functions of Instrumental and Ultimate Goals
(based on Stokman 2004)

Differences in aspiration, among stakeholders involved, imply one or more stakeholders must change an initial position to reach consensus. In Sections 8.4.1 and 8.4.2 the sociological and political aspects of collective decision-making are discussed, and in the next Sections, these sociological and political aspects are applied to strategic software release decisions.

8.4.1   Sociological Aspects

Interpretations of the sociological aspects discussed follow:
- ❖ *Decision-making Strategy*. For decisions with the presence of strategic value, either a creative decision-making strategy or a negotiated decision-making strategy applies, as these strategies apply to non-routine decisions. The negotiated decision-making strategy is best applicable to strategic software release decisions. Stakeholders will normally represent different organizational authorities [constituencies] and behave accordingly [group structure and role]. Stakeholders will have the desire to reach agreement, have a constructive view of conflict and accept the fact that they have to find a compromise

[group norms]. Stakeholders must be aware of the fact that applying simple, experiential heuristic routines may not work in the context considered.[85]

❖ *Decision-making Group Type*. For decisions with the presence of strategic value the interacting group technique is relevant, as these decisions will normally be characterized by high uncertainty.

❖ *Characteristics of Effective Groups*. For a negotiated decision strategy with an interacting group technique, information sharing and discussions are important issues. The characteristics of effective groups, as described by McGregor (1960), are considered to be relevant.

❖ *Decision Rule*. The most appropriate decision rule is assumed to be consensus, as it applies to a negotiated decision-making strategy, and is an important characteristic of effective groups. Consensus is important when the decision has strategic value and when the commitment of all stakeholders is required. As discussed in Section 8.3.1, this should not lead to situations where the drive to reach consensus at any cost outweighs the desire to adequately assess alternative courses of action, and thus interferes with effective decision-making.[86]

8.4.2   Political Aspects

In Section 8.3.2, the presence of different sources of power in the decision-making process, and the theory of Stokman *et al.* (2000) describing processes through which a stakeholder changes his position are described. The objective of the processes/strategies in the theory of Stokman *et al.* (2000) is: how can the positions of other stakeholders be moved towards one's own position? As such, they can be regarded as processes and strategies that exercise power over other stakeholders. The relationship, between the five bases of power (French and Raven 1959) and these processes/strategies (Stokman *et al.* 2000), is illustrated in Figure 8-6.

Bases of Power	Group Processes/strategies
Reward Power	Exchange
Coercive Power	Challenge
Legitimate Power	Challenge
Expert Power	Management of Meaning
Referent Power	-

Figure 8-6: Relationship between Bases of Power and Group Processes/Strategies

Referent power cannot be assigned to any of the group processes/strategies, and is assumed to be of lesser importance when a negotiated decision-making strategy is chosen, where each stakeholder sees themselves as a *constituency* [representative of a particular organizational authority]. For a creative decision-making strategy, the effects of referent power may however be significant as a result of a less formal group process and style.

The requirement for a high quality decision-making process is the low presence of 'exchange' and 'challenge' processes and strategies. This follows from the characteristics of the decision-making process, namely: negotiated decision-making strategy, interacting group type, effective groups and consensus as the decision rule. If 'exchange' and 'challenge' processes/strategies have a dominant presence, these sociological characteristics are unlikely to be met. Instead a high presence of 'management of meaning' processes/strategies contributes to an ideal negotiation process – full and transparent disclosure of available information on the part of all

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[85] Cohen and Bacdayan (1994) illustrate through experiments that the use of heuristics in different contexts may be inappropriate, using a simple gard game.
[86] Also called *groupthink* (Janis 1982).

stakeholders (Habermas 1984). In this case, possible differences in positions, or aspiration levels, are reduced through the acceptance of convincing information.

8.4.3   Quality of Decision Outcome

In previous Sections, attention is paid to various aspects of collective decision-making:

- ❖ Intra-individual and group conflicts. The sources for these conflicts are uncertainty and the presence of sources of group conflict. They determine the differences in aspiration levels of stakeholders involved prior to the decision-making process, and can be regarded as inputs to the collective decision-making process.
- ❖ Sociological and political aspects. Several sociological issues are discussed and choices made for the collective decision-making process itself: a negotiated decision strategy, interacting group type, characteristics of effective groups and consensus as the decision rule. For the political aspects power bases are mapped for group processes/strategies. A high presence of 'management of meaning', opposed to a low presence of 'exchange' processes/strategies is favourable.

Reducing the presence of intra-individual and group conflicts leads to lower differences in aspiration levels. This is supportive in implementing choices made on sociological aspects, and obtaining a high presence of 'management of meaning' opposed to a low presence of 'challenge' processes/strategies. The quality of decision inputs influences the quality of the decision-making process, and their sum determines the quality of the decision outcome, as illustrated in Figure 8-7, showing a collective decision-making model.
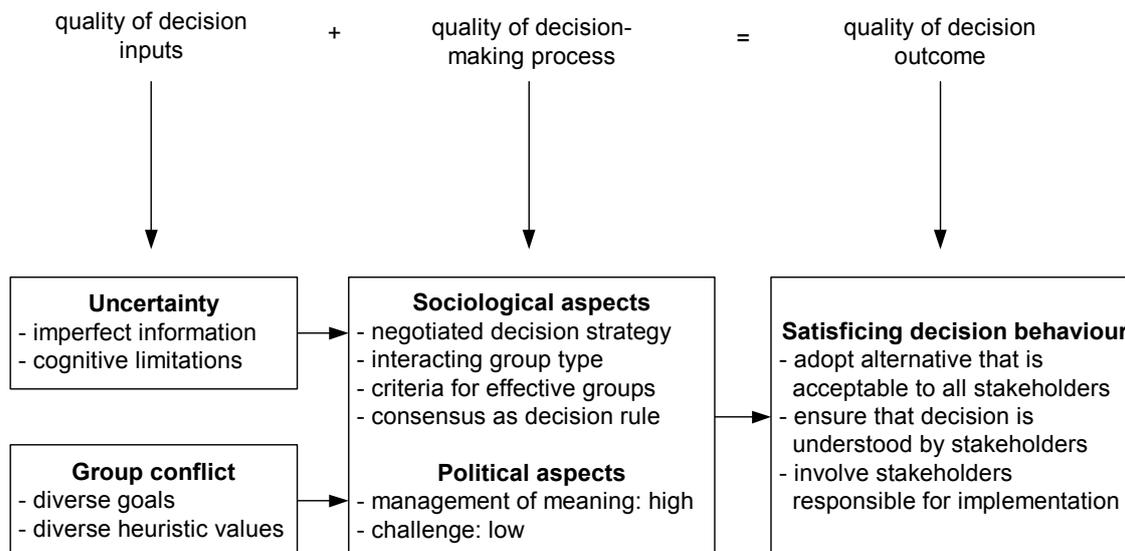
Figure 8-7: Collective Decision-making Model [87]

A valid question is how the quality of decision inputs can be increased. It is assumed the availability of a commonly-shared, and accepted, product development strategy [ultimate goals], which is kept up-to-date during product development, will contribute greatly to increasing the quality of the decision inputs (Section 6.5; practices P-A1 and P-A2). This helps reduce uncertainty by making the information needed in the decision-making process more explicit, thus enabling decision-makers to aim for information perfection within the zone of cost effectiveness. It also reduces the presence of sources of conflict among stakeholders, as

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[87] Note that this model has a strong resemblance to the Carnegie model of decision-making (Daft 1986). This model is based on the work of Cyert, March and Simon (March and Simon 1958; Cyert and March 1963).

they will have common objectives. Remaining differences in positions, or aspiration levels, during the decision-making process can be further reduced through the exchange, and acceptance, of convincing information.

8.5   Practices Identified

In Chapter 5, the *'Release Decision'* process area is introduced reflecting the perspective of *satisficing* behaviour. This process area is concerned with the decision-making process itself. Implementing the perspective of satisficing behaviour in a practical context, thus recognizing that stakeholders involved in decision-making will possibly have different preferences for the decision outcome, leads to the identification of four underlying practices:

1. ***P-C1: Information Perfection***. By reaching the zone of cost effectiveness the information perfection is sufficient to formulate release alternatives within reasonable cost and time constraints. The available information as input to the decision-making process consists of the *release criteria* [input from *'Release Definition'* process area], following the product development strategy, and the *implementation status* [input from *'Release Information'* process area], describing the results of verification activities for product quality and the implementation of identified artefacts for product maintainability. As discussed in Section 8.4.2, sufficient information is likely to increase the presence of 'management of meaning' processes/strategies. Reaching the zone of cost effectiveness minimizes the possibility of overlooking data, whereas proceeding with the search leads to diminishing returns.

   The correct implementation of this practice is the responsibility of the Project Steering Committee at tactical level, which has to ensure information perfection is within the zone of cost effectiveness to enable decision-making.

2. ***P-C2: Aspiration Levels***. In Section 8.3.2, it is noted that the process of decision-making could be described as the efforts of the stakeholders to realise a decision outcome as close as possible to their own position. Managing aspiration levels is not necessarily restricted to the latest project phase prior to the release decision. In fact, it is crucial to identify possible controversial issues as early as possible, preferably during the project proposal phase. This will support the reduction of potential differences, in aspiration levels or initial positions, prior to the software release decision.

   The correct implementation of this practice is the responsibility of all stakeholders involved.

3. ***P-C3: Stakeholder Involvement***. The influence of all stakeholders, and understanding of the decision by those required to carry it out, are important factors for decision success. It is concluded that the organizational authority responsible for post-release activities should be especially involved in the release decision-making process as an involved stakeholder, as further discussed in Chapter 9. This reduces, or even eliminates, potential sources of conflict arising, for example, from the inter-dependence between individuals, or units, and the divergence of objectives, as discussed in Section 8.2.2. Involving stakeholders is not restricted to the latest project phase prior to the release decision. In fact, it is crucial to create a common understanding between all stakeholders as early as possible, preferably during the project proposal phase.

   The correct implementation of this practice is the responsibility of all stakeholders involved.

4. ***P-C4: Decision Choice***. The release decision requires the commitment of all stakeholders and, as concluded in Section 8.4.2, the negotiated decision-making strategy, with consensus as the decision rule, is most appropriate for software release decisions. Consensus is an important characteristic of effective groups, and consensus is important when the decision has strategic value and the commitment of all stakeholders is required. Striving for consensus is not necessarily restricted to the latest project phase prior to the

release decision. In fact, it is crucial to create a common understanding as early as possible, preferably during the project proposal phase. When the decision to release has been made, the *product to be released*, being the output of this process area, is made available to its intended customers/end-users. The product is placed into operational use. If however the reported *product status* [detected faults and failures] exceeds a certain threshold, the release decision may be reversed and the released product withdrawn from operational use. This means this process area stays active after the release decision, for a pre-determined interval to monitor the direct consequences of the decision.

The correct implementation of this practice is the responsibility of all stakeholders involved.

In Figure 8-8, the data-flow diagram of the *'Release Decision'* process area, combined with the *'Release Definition'* and *'Release Information'* process areas is illustrated. In Appendix F, a summary of this process area is given, including examples of supporting method(s) for the implementation of each practice.
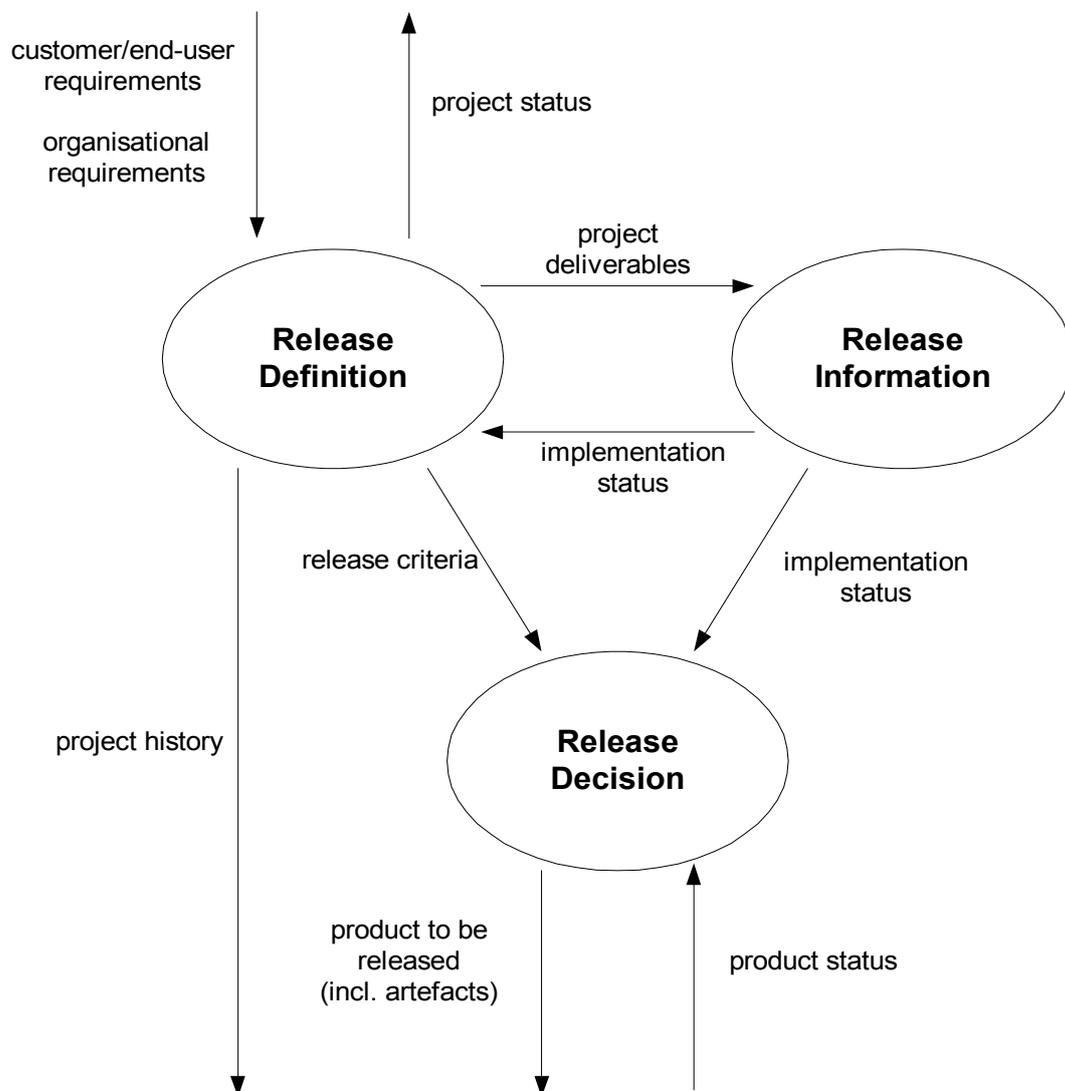
Figure 8-8: Extended Data-flow Diagram with *'Release Decision'* Process Area

8.6   *Summary and Conclusions*

The *'Release Decision'* process area of the framework presented in Chapter 5 is addressed in this Chapter,

On the behavioural aspects of software release decisions the following conclusions are drawn. The 3rd Secondary Research Question answered here is: ***'What effects, stemming from individual and group behaviour, play a role in the software release decision-making process?'*** Intra-individual conflicts arise from the concept of the presence of uncertainty [imperfect information, cognitive limitations] and lead to satisficing behaviour. Several sources of conflict relevant for group decision-making are discussed, with two important to software release decisions: the inter-dependence between individuals or units and the divergence of objectives. The presence of uncertainty and sources of group conflicts determine the quality of the inputs to the collective decision-making process. For the decision-making process itself, both sociological and political aspects are discussed. The negotiated decision-making strategy seems to be best applicable to strategic software release decisions, and a release decision matches well with the interacting group type. The characteristics of effective groups as described by McGregor (1960) are considered relevant.

The most appropriate decision rule is seen to be consensus, as it applies to a negotiated decision-making strategy, and is an important characteristic of effective groups. Consensus is important when the decision has strategic value and when the commitment of all stakeholders is required. For the political aspects of software release decisions, the different bases of power are mapped on the process and strategies, described by Stokman *et al.* (2000). It is argued that a high presence of 'management of meaning' processes/strategies is favourable in software release decisions, as opposed to a low presence of 'challenge' and 'exchange' processes/strategies. A high presence of 'management of meaning' processes/strategies implies that possible differences in positions or aspiration levels are reduced through the acceptance of convincing information. It is concluded that the availability of a commonly-shared and accepted product development strategy, accepted by all stakeholders involved, is an important factor to increase the quality of inputs to the decision-making process.

For the *'Release Decision'* process area, reflecting the perspective of *satisficing* behaviour, four practices are derived. The 'P-C1: Information Perfection' practice addresses the need for collecting sufficient information to reach the zone of cost effectiveness. This enables a high presence of 'management of meaning' processes/strategies, helping to reduce differences in aspiration levels; the concern of the 'P-C2: Aspiration Levels' practice. The 'P-C3: Stakeholder Involvement' practice addresses the need for involving all stakeholders in creating a broad basis for the decision. Finally, the 'P-C4: Decision Rule' practice is concerned with striving for consensus when reaching the decision outcome. This is an important characteristic of effective groups, applies to negotiated decision-making, and is important when the decision has strategic value and when the commitment of all stakeholders is required.

In the next Chapter, attention is given to issues important towards increasing the likelihood of a successful implementation of the software release decision, once made.