Design of a Methodology to Support Software Release Decisions

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10 REVIEW AND PROPERTIES OF THE METHODOLOGY

"Problems prevented are problems solved."
-- Harrison (1987, p.63) --

10.1 Introduction

The **Release Decision Methodology** introduced in Chapter 5 is used as a reference to design a supporting methodology for strategic software release decisions, introducing four process areas. In Chapters 6 through 9, the four process areas are explored, and for each process area, underlying practices are identified. For each of the derived practices the following issues are formulated: rationale; primary responsible stakeholder(s); other stakeholder(s) involved; timeframe in which the practice is applicable; and the identification of any supporting methods.

In Section 10.2, some general review remarks on the designed methodology are given. The different styles of decision-making behaviour are discussed. How the methodology implements all inter-related functions of managerial decision-making, and conditions for strategic decision success, is reviewed, and the extent to which additional requirements are met is discussed. In Section 10.3, two assumed properties are formulated for the characteristics of the methodology. These properties are the basis for validation of the methodology in a practical context. The Chapter ends with a summary and conclusions in Section 10.4.

10.2 Review of the Methodology

In this Section, the methodology designed is reviewed, and how the process areas match the six functions of managerial decision-making is summarized (Section 5.3.1). Requirements formulated for the methodology are reviewed.

10.2.1 Maximizing, Optimizing or Satisficing?

Three styles of decision-making behaviour are presented in Chapters 6 through 8.

- ❖ In a maximizing approach, the decision-maker chooses the action whose consequences are best for the case at hand, defining 'best' according to values the decision-maker holds (Chapter 6).
- ❖ Where the best action, relative to constraints, is chosen, accounting for the direct and opportunity costs of information, the approach is called optimizing rather than maximizing (Chapter 7).
- ❖ The concept of bounded rationality is introduced, asserting that cognitive limitations force decision-makers to construct simplified models to deal with the real world. This principle, combined with the potential presence of sources of group conflict, leads to satisficing behaviour, rather than maximizing or optimizing, and decision-makers choose a satisfactory outcome from among possible outcomes (Chapter 8).

Differences between these three styles give rise to ongoing debates on the assumed contradictions. It is argued here, however, that, at least for strategic software release decisions, differences are marginal and only stem from different viewpoints. For such decisions, the following cannot be denied: a price for information exists, uncertainty, instead of risk, will always be present, the concept of bounded rationality leads to a simplification of the real world, and bounded rationality, as well as sources of conflict, will, potentially, give rise to different

aspiration levels among stakeholders involved. So, as Witteloostuijn (1988, p.309) notes, whether human beings maximize or satisfice, is the wrong question to ask; behaviourism and choice theory are just two different ways to model and analyse similar phenomena.

Without neglecting the ideas and value of other economic perspectives [and thereby giving rise to another dispute], it is concluded that in this study a Post-Keynesian perspective must be adopted. Post-Keynesian economics is a school of thought, based on the ideas of John Maynard Keynes. It differs from the interpretation of Keynes' ideas offered by mainstream Keynesian economics, such as the new Keynesian economics, emphasising in particular (Davidson 1994):

❖ Uncertainty, historical time, and non-ergodicity [as opposed to risk,[90] logical time,[91] and ergodic processes[92]], and especially uncertainty as a result of information scarcity, play an important role.[93]

❖ The concept that money matters for the 'real' economy [output, employment] in both the short-term and long-term.

❖ A rejection of neo-classical general equilibrium models, assuming perfect rationality of individuals, complete information about all prices, both now and in the future, and the conditions necessary for perfect competition.

10.2.2 Compliance with the Process Model

The methodology does not prescribe a model of choice but offers a process model embodying the inter-related functions of managerial decision-making. Using Harrison's framework, as introduced in Section 3.4.1 and further discussed in Section 5.3.1, the methodology implements all the functions identified:

❖ *Setting Managerial Objectives*. The decision-making process starts with setting of objectives, and culminates on reaching the objectives. This function is addressed in the *'Release Definition'* process area by the 'P-A1: Project Objectives' and 'P-A2: Project Control' practices. The Project Steering Committee involves constituencies of Marketing, Development and Maintenance & Exploitation. The methodology stresses continuous identification and reduces possible differences in aspiration levels [controversial issues] between stakeholders: a clear and commonly-accepted product development strategy [the project's objectives, including priorities] is seen as an important and critical success factor. Strategic decision success requires that formulated objectives should be attainable. It was found during the exploratory case studies, that the availability of documented and commonly accepted product development strategy [including project priorities] is an exception (Section 4.4.1). By bringing together the different stakeholders during the project proposal phase, possible differences in aspiration levels can be identified in time to be effectively addressed, thus bringing initial positions of the stakeholders, prior to the release decision, closer.

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[90] Risk, under a probabilistic hypothesis, can be reduced to certainty, while uncertainty cannot. Even when it is possible to assign probabilities, rational use by decision-makers can be questioned. Several studies show people either insufficiently utilise probability information when made available, or ignore it altogether (McClelland *et al.* 1993; Huber *et al.* 1997; Oberholzer-Gee 1998; Clarke and Varma 1999).

[91] This is a context in which economic agents decide future actions on the basis of statistical series analyses, or beliefs justified by past experience.

[92] In mathematics, a measure-preserving transformation *T* on a probability space is said to be *ergodic* if all T-invariant sets have measure zero or their complements have measure zero. For group decision-making, ergodicity means that regardless of the initial values of different aspiration levels, a unique limiting distribution will be reached, and the future is merely a statistical reflection of the past.

[93] The question that may arise here is whether uncertainty is equal to bounded rationality. Dunn (2000) points out that bounded rationality refers to behaviour that is *'intendedly rational but only limitedly so'.* It takes into account the cognitive limitations of the decision-maker regarding knowledge and computational capacity. In this sense, it relates to the behavioural characteristics of a decision-maker, whereas uncertainty relates to lack of knowledge of the future.

❖ *Searching for Alternatives*. In the decision-making process, search involves scanning the internal and external environments of the organization for information. This function is addressed in the *'Release Information'* process area by all derived practices P-B1 through P-B4. The exploratory case studies reveal that products are often released without knowing their exact behaviour [reliability, maintainability] and without appropriate supporting artefacts [e.g. user and development documentation] (Section 4.4.2). The methodology therefore introduces explicit attention for defining and implementing verification activities, and the identification and acquisition of artefacts, to have proper information available as input to the release decision-making process. The availability of a clear and commonly-accepted product development strategy facilitates this process, as input for the information search process.

❖ *Comparing and Evaluating Alternatives*. Alternatives represent various courses of action that singly, or in combination, may help attain objectives. By formal and informal means alternatives are compared, based on the certainty, or uncertainty, of cause-and-effect relationships, and the preferences of the decision-maker(s) for various probabilistic outcomes. This function is addressed in the *'Release Definition'* process area by the 'P-A3: Uncertainty Management' and 'P-A4: Selection of Alternatives' practices.

❖ *The Act of Choice*. Choice is a moment in the ongoing process of decision-making when the decision-maker chooses a given course of action from among a set of alternatives. This function is addressed in the *'Release Decision'* process area, by the P-C1 through P-C4 practices. These practices underline important issues in group decision-making: sufficient information at hand, minimal differences between aspiration levels, involvement of all stakeholders and consensus as a decision rule. The prescription of a model of choice is felt unnecessary, as the exploratory case studies reveal that, in a practical context, such models are not, or seldom, used (Section 4.4.3) and the approach chosen is to focus on process steps (Section 5.3.1). Strategic decision success further requires an open decision-making process, a judgmental strategy and a *satisficing* outcome.

❖ *Implementing the Decision*. Implementation means the chosen course of action is carried out within the organization. It is that moment, in the overall decision-making process, when the choice is transformed from an abstraction into an operational reality. This function is addressed in the *'Release Implementation'* process area by the 'P-D1: Maintenance Budget' and 'P-D2: Product Rollout' practices. Decision-makers should provide a fall-back plan; the means to monitor whether the expected results really materialize, and the means to implement corrective actions if the actual results are not congruent with expected results.

❖ *Follow-up and Control*. This function is intended to ensure that the implemented decision results in an outcome in keeping with the objectives that gave rise to the total cycle of functions within the decision-making process. This function is also addressed in the *'Release Implementation'* process area by the 'P-D2: Product Rollout' practice. The 'P-D3: Project Discharge' practice emphasizes the importance that Development can only be discharged from its responsibilities when the product is sufficiently stable and other constituencies involved approve all supporting artefacts. To increase the organization's capabilities in decision-making, the appraisal of the project is made explicit by the 'P-D4: Project Appraisal' practice, as the last activity before dismantling the project. This appraisal activity was seldom found in the exploratory case studies (Section 4.3).

The designed methodology implements all inter-related functions of managerial decision-making and meets the conditions for strategic decision success. The methodology for strategic decisions should ensure that all relevant stakeholders are actively involved before a project is started [proposal phase] and stay involved until the released product functions well in its operational environment, as in Figure 10-1.
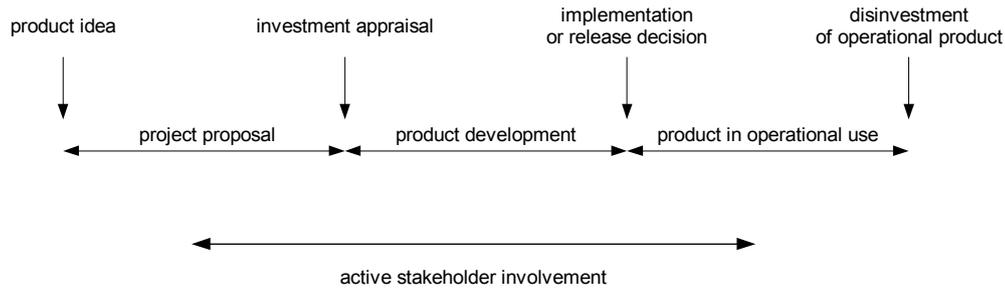
Figure 10-1: Active Involvement of All Stakeholders

This is an important property of the methodology, as it ensures product development is continuously discussed among stakeholders representing different perspectives. This multi-perspective approach enables the sharing of knowledge among stakeholders and, where problems arise, all perspectives are represented in evaluating an alternative course of action. Specific advantages are illustrated by examples:

❖ Involving Maintenance & Exploitation during the project proposal phase helps define a product development strategy that includes important post-release requirements of the product. The involvement of Maintenance & Development, an important stakeholder in the release decision-making process, is considered crucial, as they are responsible for the decision implementation.

❖ All stakeholders [Senior Management and Project Steering Committee] remain involved once the release decision has been made. This is especially important for Development, which is only discharged from its responsibilities when the product is proven stable. This prevents the organization from assigning development resources to other projects before the actual outcome meets the expected outcome.

❖ Senior Management is assigned both responsibility and involvement during the various stages. This is important as the release decision and its successful implementation are of strategic value to the organization and requires the involvement of higher management.

10.2.3 Compliance with Additional Requirements

In this thesis, several requirements for the methodology are formulated, and met as follows:

1. *Pro-active Nature.* In Section 1.5, it is stated that the methodology should be pro-active to help avoid preventable surprises late in the project when costs of any revision are high. A review of the methodology shows that most identified practices should be implemented for the release decision itself. Exceptions are the corrective actions after product release (P-D2), project discharge (P-D3), and project appraisal (P-D4) (Section 9.4), although associated activities should be foreseen and planned for up-front. That most practices should be already implemented during the project proposal phase and the product development phase emphasizes the pro-active nature of the proposed methodology, a requirement stated before in formulating the primary research question (Section 1.6).

2. *Software Manufacturer Type.* It is a requirement in Section 1.7, that the methodology should not restrict itself to specific software manufacturer types. A review of the methodology indicates no software manufacturer specific practices. The product requirements influence the search in the information process area, but not the methodology itself. All derived practices need proper implementation, independent of the characteristics of the software manufacturer type. How, and the extent to which, the practices are implemented should follow from the specific circumstances. It is concluded, that, at least in theory, no major obstacles exist to applying the methodology successfully in different software manufacturer environments.

3. *Role of the Customer/End-user*. It has been [implicitly] assumed that the software manufacturer takes the software release decision without direct involvement of its customer(s) and/or end-user(s). It is stated in Section 1.7 as an additional requirement for the methodology that this situation should be taken into account. Reviewing the practices of the methodology reveals that in each practice, the customer or end-user might be involved or even be responsible. This depends strongly on the relationship between the software manufacturer and the customer/end-user. When the product to be developed is written on contract, the customer/end-user might play a very prominent role. Their representatives might be involved in defining the product development strategy, in verification activities, in the decision-making process as important stakeholders, and during implementation to operational use. Where a product is developed for a mass-market, a group of customer/end-user representatives might be selected to conduct beta tests. The results of their tests and their perceptions of the product will then be put into the release decision-making process. No generally-applicable statements can be made, other than that, for each situation, the extent to which the customer/end-user plays a role in each practice should be decided.

4. *Adoption*. In Section 4.6, it is stated that the rate of adoption of a methodology is positively related to perceived trialability, observability, relative advantage and compatibility, and is negatively related to perceived complexity of such a methodology. These issues are described:

   - Trialability. It is argued that this requirement is fulfilled. This methodology can be tried on one or more projects, before considering organization-wide adoption. It is also possible to limit a try-out to limited process areas or practices.

   - Observability. Whether the application of the methodology will offer observable results depends on the specific circumstances in which it is applied. In a chaotic manufacturer environment, it may be that fire-fighting will prevail and the methodology cannot prove its usefulness. In stable environments in mature organizations, the effects observed may be small. Put differently, the methodology will probably show the best observable results in organizations that have a certain capability regarding project management, but suffer, for example, from an unclear product development strategy, barriers between different organizational authorities and/or the absence of a formal decision-making process.

   - Relative Advantage. Application of this methodology is not necessarily mutually exclusive with other innovations; it may even support or accelerate them. Suppose a software manufacturer organization embraces a process improvement program at software or at system level (Section 1.3.2), this methodology might help enforce certain project management issues and coordination across different departments. Whether application of the methodology offers advantages for the *status quo* depends on the specific circumstances in which it is applied. Where an organization has not implemented all practices of the methodology, it has the potential for improvements. In more mature organizations, the relative advantages are likely to be smaller than in less mature organizations.

   - Complexity: The methodology is not overly complex. All practices address common sense issues and especially the practices of the *'Release Definition'* and *'Release Information'* process areas can explicitly, or implicitly, be found in most existing project management methodologies. Important differences are the explicit involvement of stakeholders throughout the entire project [from proposal phase until after successful implementation], the recognition that information is not free [an acceptable uncertainty level should be sought], and the attention for behavioural aspects stemming from individual and group behaviour in the decision-making process.

   - Compatibility. It depends on the specific circumstances in which the methodology is applied as to whether the methodology is compatible with existing practices and

values. For immature, reactive organizations, it may be a major step to implement a formal process. However, where certain project management processes are already in place, the process areas of this methodology can probably be easily integrated.

It is concluded that the designed methodology meets all additional requirements: a pro-active concept, independence of software manufacturer type, possibility of incorporating and involving the customer/end-user as a stakeholder, and the factors considered important for a high rate of adoption.

10.3 Properties of the Methodology

In Chapter 6, attention is given to the financial aspects of a software release decision. If a software product is released 'too early'; a software product with less functionality and/or significant defects is released to intended users, the software manufacturer incurs post-release costs of fixing resultant failures. If a software product is released 'too late', the additional development cost and the 'opportunity cost' of missing a market window could be substantial. The NPVI-method is introduced to support the comparison and evaluation of different release alternatives.

In Chapter 7, the economics of information are discussed with the conclusion that a software manufacturer organization should increase the information level to within the zone of cost effectiveness, where the marginal yield is near zero, and uncertainty is reduced to an acceptable level. Increasing the information level beyond this zone leads to additional costs that outweigh the benefits [law of diminishing returns]. How does this affect pre-release and post-release cash outflows? If the information level is below the zone of cost effectiveness the pre-release cash outflows [development cost] will probably be lower, as less effort is spent on verification activities and implementing identified artefacts. As this incurs high 'uncertainty' for product quality and product maintainability, the expected post-release cash outflows [maintenance cost] are likely to be higher. When the information level for product quality and product maintainability is increased, this incurs an increase in pre-release cash outflows. However, as the information obtained offers the possibility of removing defects on product quality and product maintainability, post-release cash outflows are likely to decrease. As discussed in Section 7.2, improving information perfection can lead to transforming a decision with complete uncertainty [zone of cost effectiveness to the left] to a decision with informed uncertainty [zone of cost effectiveness moving to the right] or, at least in theory, even a decision with certainty [zone of cost effectiveness completely to the right]. Software manufacturers with mature product development processes are assumed to move their zone of cost effectiveness to the right: valuable information is obtained in less time and probably against less cost. This enables them to make strategic software release decisions with less uncertainty, where the decision-making process is characterized by sharing of convincing information. It is argued in Section 7.3.2, that moving the zone of cost effectiveness to the right is likely to make the NPVI-method, as introduced in Section 6.4, a better candidate for evaluating different release alternatives, as the number of scenarios to be considered might be reduced, and the chance of occurrence of each scenario can be better quantified with probability, or possibility, values. Mature development processes also enable software manufacturers to analyse collected historical data from different projects, and use the results to obtain better predictions for the pre-release reliability (see Section 3.3.2 discussing software reliability prediction models) and the post-release maintenance cost.

In Chapter 8, focus is on the decision-making process itself, by applying the theory of Stokman *et al.* (2000) to collective group processes and strategies. 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. When the information level is decreasing, the presence of 'challenge' processes/strategies is expected to increase. Vice versa, when the information level increases, the presence of 'management of meaning' processes/strategies is expected to increase as well, as in Figure 10-2. It must be understood however, that the information level within or above the zone of effectiveness does not necessarily imply a high presence of 'management of meaning' processes/strategies and a low presence of 'challenge' processes/strategies. In case of for instance immature development processes, the zone of cost effectiveness may still be characterized by a high presence of 'challenge' processes/strategies and a low presence of 'management of meaning' processes/strategies due to high uncertainty. In such cases, the software manufacturer is faced with a high price in time and/or cost to increase information, outweighing the value of additional information.
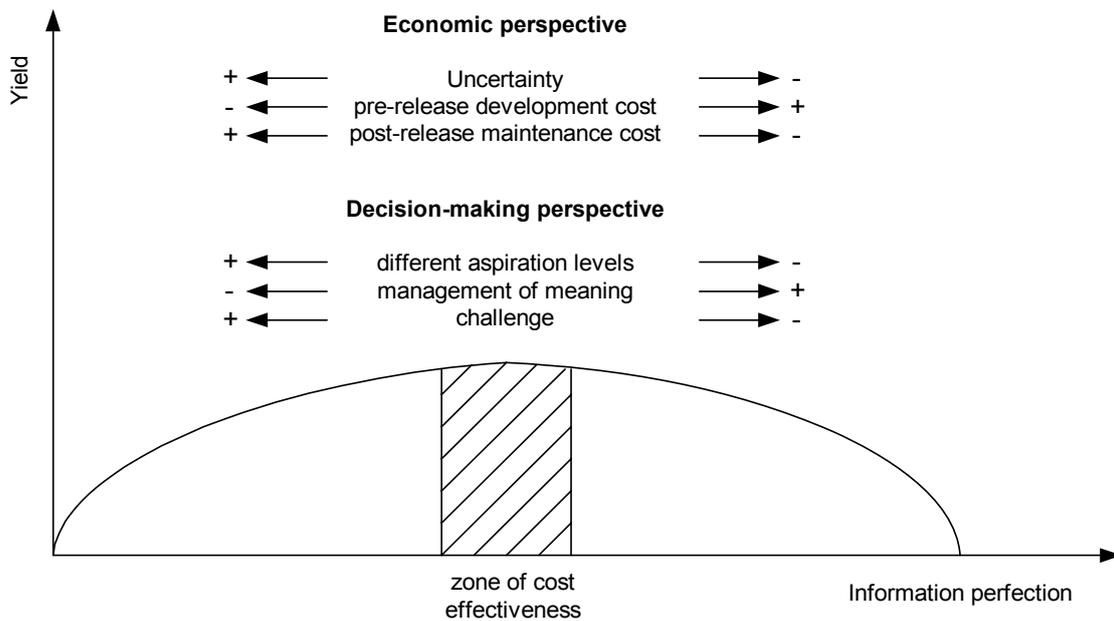

Figure 10-2: Economic and Behavioural Components as a Function of Information Perfection

A final remark is reserved for the role of *intuition* in decision-making. According to Dijksterhuis (2004), intuition is understood as a mental process that is subconsciously informed by emotional impulses. When a thought process has been initiated the mind often continues to work on it outside of the person's awareness and the result is often far more influenced by an emotional input that the person has not consciously considered. Dijksterhuis advises to involve the conscious mind in minor decision making and leave the more complex, impactful decisions in life to the unconscious. [94] It is argued here that although intuition is considered important, care must be taken. In the first place, the focus in this study is on a collective decision-making process, taking into account the different perspectives of all stakeholders, not the perspective of one individual. A formal process offers a structured mechanism to provide visibility of threats from different perspectives to release decision success. Secondly, intuition on its own is not sufficient for strategic software release decisions [being complex and impactful], where large prospective financial loss outcomes to a software manufacturer and its customers/end-users of

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[94] Dijksterhuis (2004) found that the unconscious is more likely to take into consideration those emotional aspects that are really important to the individual, whereas a purely mental decision making process tends to be unsustainable, leaving the decision-maker dissatisfied after some time, because the criteria that were closer to his heart had not been considered.

the software are present and even people's life may be at risk in for instance safety-critical products.

Summarized, the methodology combines an economic and a decision-making perspective and applies them in the context of software management. With this multi-disciplinary approach an understanding of strategic software release decisions is obtained. The methodology has a *descriptive character* for strategic software release decisions. This property is important as it is formulated as one of the outcomes of this study (Section 1.6). This assumed property will therefore be validated in a practical setting.

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1st Validation Question:

Can the methodology be used to describe strategic software release decisions?

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The primary research question in Section 1.6 is formulated as: *How to improve strategic software release decisions?* Another property of the methodology should be the possibility of determining the strengths and weaknesses of the release decision-making process and the release implementation. If the methodology with its underlying practices has this *judgmental character* for strategic software release decisions, a software manufacturer can, pro-actively, aim for decision success by implementing the described practices. This property is important as it is formulated as one of the outcomes of this study, as in Section 1.6. This assumed property will therefore also be validated in a practical setting.

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2nd Validation Question:

Can the methodology identify improvement areas for strategic software release decisions?

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10.4 Summary and Conclusions

In this Chapter, the methodology is reviewed from different perspectives. It is first discussed how the methodology offers a multi-perspective view on strategic software release decisions. It is reviewed as to how the methodology implements all inter-related functions of managerial decision-making, and conditions for strategic decision success. The methodology meets the requirements: for a pro-active action, its general nature of the methodology [independent of software manufacturer type], the possibility of involving a customer/end-user as a stakeholder, and factors considered important for a high rate of adoption.

Two potential properties of the methodology are identified for validation in a practical context. In the first place, it is assumed the methodology has a descriptive character for the important issues in strategic software release decisions, by combining an economic and a decision-making perspective and applying these perspectives in the context of software management. It is noted that when the information level in the decision-making process increases, thereby reducing uncertainty, pre-release cash outflows [development cost] will increase, due to increased verification activities, and post-release cash outflows are likely to decrease due to higher product reliability and product maintainability. At the same time, for collective group processes, the presence of 'management of meaning' processes/strategies increases, and the presence of 'challenge' processes and strategies decreases. Secondly, it is assumed the methodology has a judgmental character for strategic software release decisions, enabling a software manufacturer to identify areas of improvement, and to aim for increased decision success by implementing the practices of the methodology.

In the next Chapter the validation results for the assumed descriptive and judgmental character of the methodology is described. The results of three further case studies are presented and used to validate the assumed properties of the methodology. Conclusions are thereafter drawn on the validity and reliability of the results obtained.