

CHAPTER III

Research design and Methodology



The research is separated into four phases:

1. Theory building where literature review as well as competitor analysis and case company's current practice and business objective is studied.
2. Detailed model where a new decision making model is proposed based on case company's best suitable practice.
3. Verification and validation is done to confirm the new decision making model and process.
4. Results are analyzed, sensitivity analysis is done and the final model is proposed.

Not only that the new decision making model is designed to make new product decision in product planning phase faster but it should also increase the transparency and consistency of the decision process.

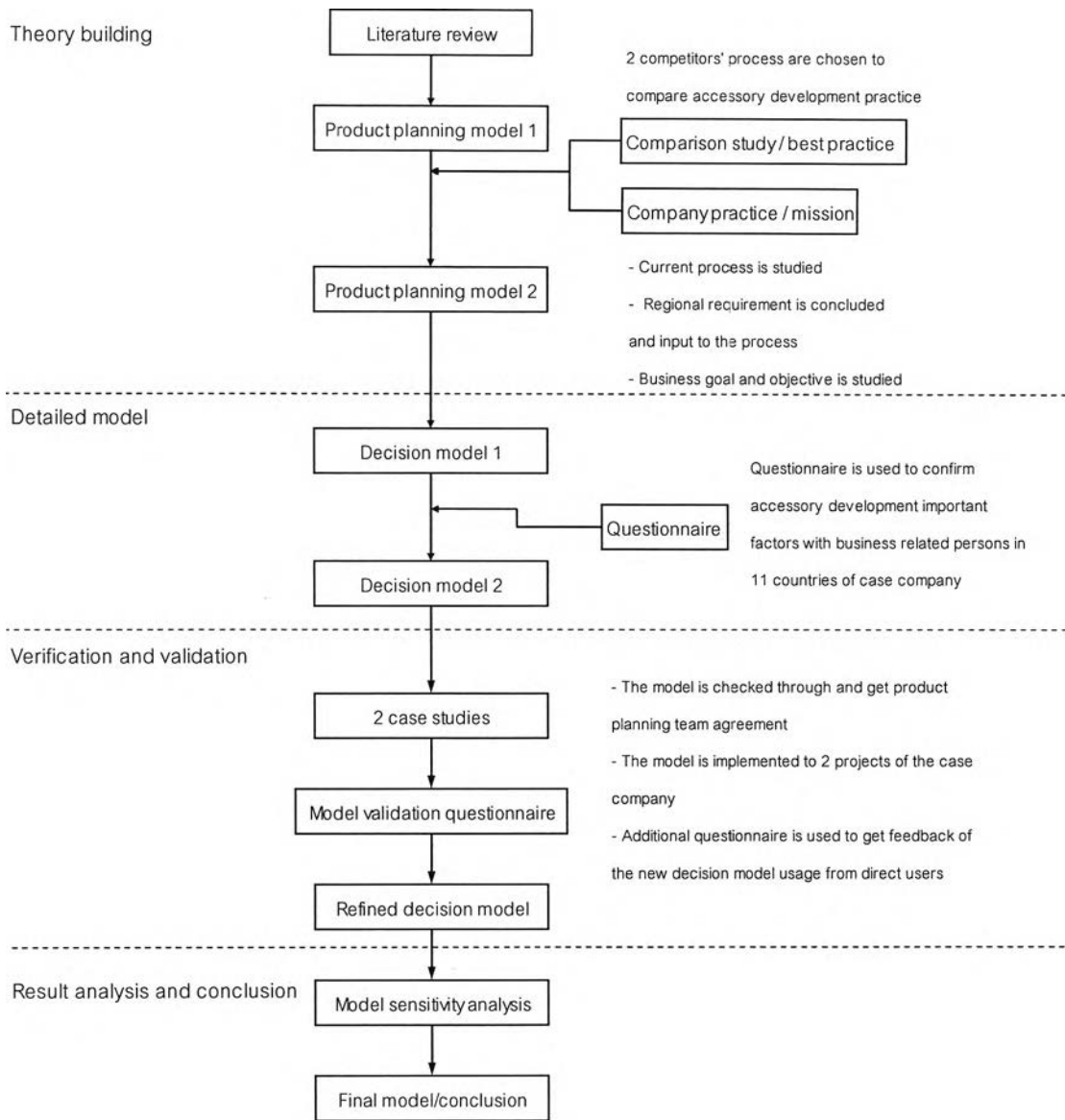


Figure 35: Research design

3.1 Theory building

In theory building section, literature review was done on 4 topics including marketing, product planning in new product development process, decision making process and regionalization and globalization. From literature review, a product planning conceptual model is proposed.

Product planning process has been defined by many authors; six of them are used in order to define the case company's process proposal. They are

- Stage Gate® Process (Cooper, 2006)
- Product development stages (Mcdaniel and Darden, 1987)
- New product development process (Moore and Pessemier, 1993 based from Booz-Allen, 1982)
- Product planning (Agouridas *et al.*, 2007 based from Cagan and Vogel, 2000 – Integrated New Product Development model)
- Product planning (Baker, 1995)
- Front end process of New Product Development (Ulrich and Eppinger, 2000)

Combining the processes in theoretical view, the case company's planning process characteristics should include factors below;

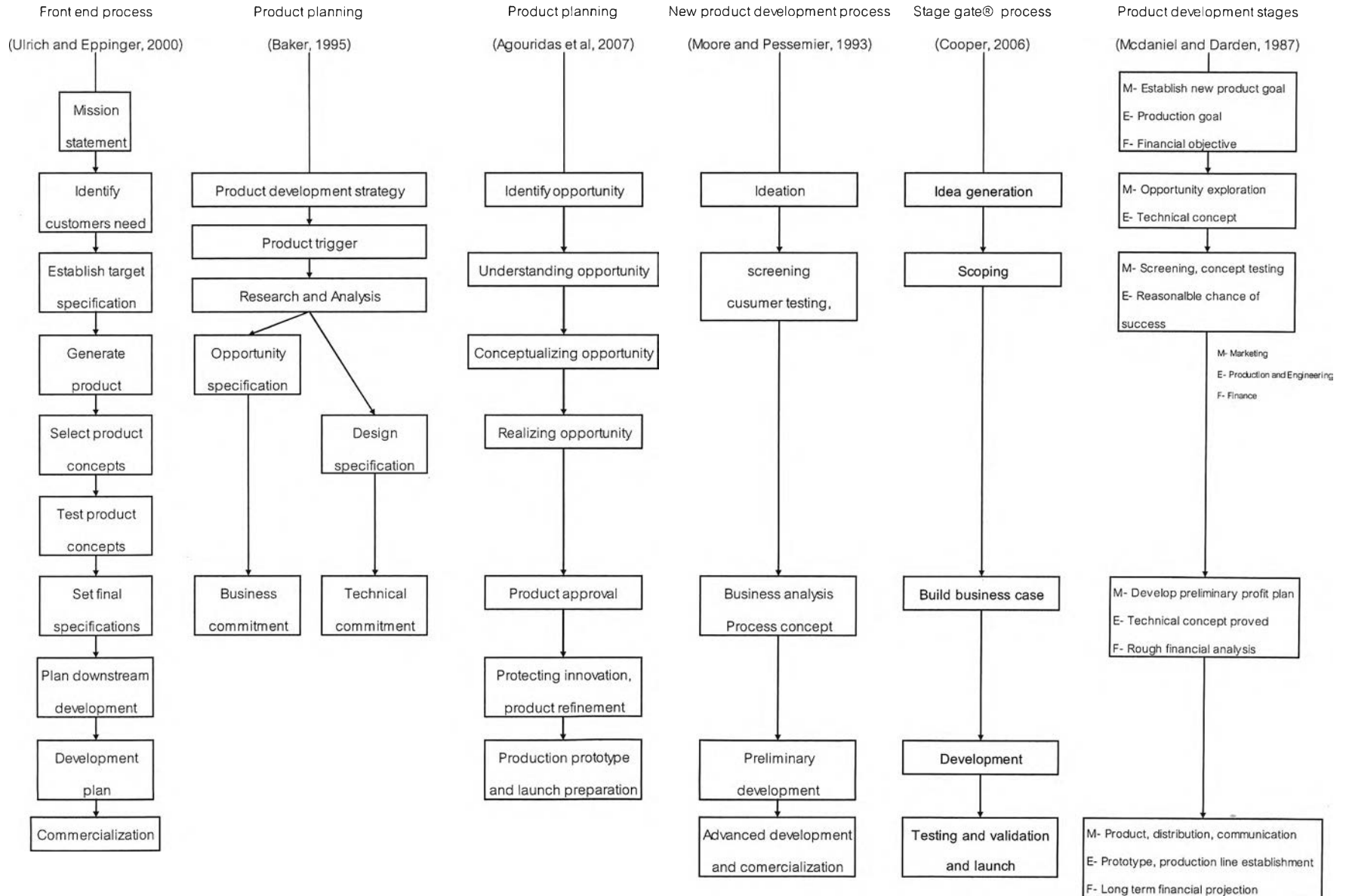
- involve marketing, product planning, production, engineering and financial perspectives
- early involve supplier and customer
- be shortened by having stages and gates flexibility
- have a clear defined input and out put of each gates
- includes project management approach

Gates in the product planning process which are considered, focused and detailed in this thesis are

- Idea screening and overall business and company goal score card
- Regionalization considerations, product category identification, draft business
- Product selection and business performance approval

From all above considerations, a product planning process is drafted. Normally, product planning process should be led by marketing team who owns big portion of the input section and is closest to customer. In the case company, the person leading the overall process is product planner who works closely with vehicle product marketing team.

Figure 36: Product planning process comparison



Process																					
Stage Gate® Process, Cooper 2006	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Product development stages, McDaniel and Darden, 1987	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
New product development process, Moore and Pessemer, 1993	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Product planning, Agourdas et al, 2007	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Product planning, Baker, 1995	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Front end process, Ulrich and Eppinger, 2000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Table 5: Product planning process comparison

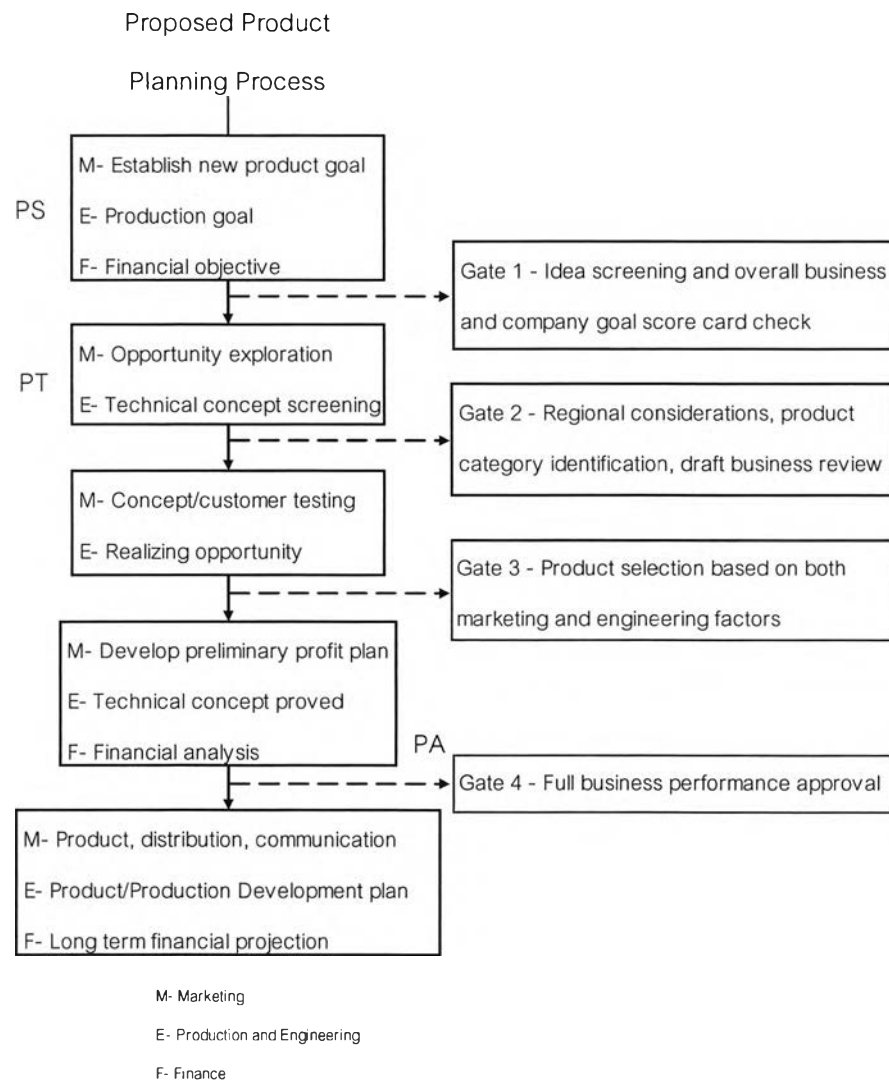


Figure 37: First product planning process concept and gate design from theory building

Note:

PS – "Program Start" according to case company's terminology

PT – "Program Target setting" according to case company's terminology

PA – "Program Approval" according to case company's terminology

The team, led by product planner, working on the product planning process will include vehicle marketing team, marketing team in each country, finance and purchasing team and production and engineering (including design studio) team.

From the first product planning conceptual model, it is refined using lean NPI method and detailed to fit the case company's current practice, case company's mission and benchmarked with competitors and information available. During this phase, a detailed study of case company's current product planning process is compared to the nature of accessory development practice. Two competitors', one of which is currently number one in automotive business, accessory development process and regional accessory decision making was also compared. For the number one competitor, a product marketing person was interviewed to get an idea of the product planning process including process timing and lesson learnt. The second competitor's information, a company in the same umbrella brand with comparable market share in APA, can be found in the case company's database system. The process was also confirmed with product marketing personnel in that company. Detail of this section can be found in chapter 4.

3.2 Detailed model

After the second product planning model is laid out, a decision making model is proposed. Since the case company does not have any standard product decision model in place, the first decision model is drafted per available information and discussion with product planning team plus theoretical view. All parameters and gates currently used by the case company are studied. However, since the regionalization plan is also undertaken by the organization, the new decision model has to consider the organization's change parameter and base vehicle and its financial constraints as well.

In order to get more information and confirm the current business understanding from customers which are marketing and customer service department and persons involved in accessory business who owns the input to the overall new accessory development as well as owns the final revenue and sales of the product, a questionnaire (will be called questionnaire 1 in this paper) is drafted and sent out. The questions cover areas below,

- confirmation of accessory product understanding in each market including factors that are most important from end customer (through customer service team) and marketing perspective
- opinion and input from end customer to the new regionalization objective set by the company
- feedback of the current gates and accessory development process and the issues markets are facing throughout the overall processes

A short questionnaire (see appendix A), 11 questions consist of 9 closed questions with both rating and choices and two open questions are used. With close questions, it is easier to answer, user can spend only a short period of time on the questions and the results are easy to analyze. After the questionnaire is drafted, it was verified by the case company accessory manager and product planning team. It was modified to reduce bias on answers leading questions and sent out to 35 recipients (product marketing personnel, customer service department marketing personnel, engineering project management team, purchaser and few other related functions personnel) who involved in the case company's accessory business in 11 countries throughout the region.

Recipients were given a one week time to reply back. A short discussion has been done with major marketing personnel in high volume countries which are China, India, Australia, South Africa and Thailand to understand more about the answers and suggestions as well as local practice for accessory development.

Decision model criteria are set and chose during this stage. Criteria to be used in determining new product development projects for the case company are more than two so Multi-criteria decision making method is considered. From literature review, the proposed approach is weight sum method (contained in MAUT/MAVT group category) which is quite popular and widely used. Even though AHP and ANP are among the most effective method for multi-criteria decision and group decision making according to Peniwati in Saaty *et al.* (2006), the pair wise comparison method only suits with less criteria and alternatives. With accessory development project, more than 20 alternatives

are considered in the same time, AHP matrix of 20x20 or more will be too complicated. In order to save decision making time and save company's investment in new calculation program and database development and reduce calculation complexity where only project ranking among criteria chosen is needed, weight sum method arranged in excel sheet format (program officially available to everyone in the case company) using AHP calculation for criteria weight assignments is pursue.

Based on Peniwati in Saaty *et al.* (2006)'s summary, MAUT/MAVT and AHP/ANP method are compared in the table below.

Table 6: Comparison of MAUT/MAVT and AHP/ANP method (modified from Peniwati in Saaty *et al.*, 2006)

Criteria	MAUT/MAVT	AHP/ANP	Analysis note
Group maintenance: Leadership effectiveness	Medium	High	Only a simple structure that can help prioritize and screen out non applicable project (not profitable, not feasible, high investment, etc.) to facilitate program team is required so MAUT/MAVT method is acceptable. However, AHP/ANP's advantage that should be included in the decision model is the consistency and communication effectiveness.
Group maintenance: Learning	High	Very high	Both method provides learning action and are not too difficult to apply and use.
Problem abstraction: Development of alternatives	High	Very high	Although AHP/ANP suits more for higher degree of alternative problem, MAUT/MAVT is enough and not too complicated.
Structure: Breadth	High	High	Both do not limit criteria and factor numbers.

Table 6 (continue): Comparison of MAUT/MAVT and AHP/ANP method (modified from Peniwati in Saaty *et al.*, 2006)

Criteria	MAUT/MAVT	AHP/ANP	Analysis note
Structure: Depth	Low	High	AHP/ANP allows sub-criteria to be analyzed so it is considered better than MAUT/MAVT in the case company's case. However, considered the sub-criteria can be combined and considered within sub-process as well as along the screening criteria before arriving at the decision making point, MAUT/MAVT can still be used.
Analysis: Faithfulness of judgments	High	Very high	Both elicit elementary judgments.
Breadth and depth of analysis	High	Very high	Structural flexibility is considered and AHP/ANP provides better analysis depth with inconsistency and incompatibility measurements. So it is chosen to allocate weight of the decision criteria used in weight sum matrix.
Fairness: Cardinal separation of alternatives	High	High	Both methods provide the same level of alternative comparison.
Fairness: Prioritizing group members	High	Very high	Fairness can be achieved when the criteria are structured and weighted been considered by levels of people.
Fairness: Consideration of other actors and stakeholders	Low	High	AHP/ANP is the only method that facilitates other concerns in detail. However, it can also be argued that the concern of other actors is not truly required for alternative ranking. It can also be one of the weighted criteria in the matrix as well.

Table 6 (continue): Comparison of MAUT/MAVT and AHP/ANP method (modified from Peniwati in Saaty *et al.*, 2006)

Criteria	MAUT/MAVT	AHP/ANP	Analysis note
Scientific and mathematical generality	High	Very high	Both are based on mathematical calculation and are generally not too difficult to apply.
Applicability to intangibles	Medium	Very high	AHP/ANP provides better carefulness to the user's measurement. In this case that MAUT/MAVT is chosen, a cautious judgment is needed.
Psychophysical applicability	Medium	High	In AHP/ANP, scales are used to normalize physical measurement value which is used to weight decision criteria for case company's decision model.
Applicability to conflict resolution	Medium	High	Feedback for improvements can be found when using AHP/ANP method.
Validity of the outcome	Medium	High	As MAUT/MAVT is a simplified model representation, it is considered AHP/ANP provides a more meaningful and structured way to order or rank elements. However, with the number of criteria and alternatives presented to case company's project, a simplified model is more suitable.

The output of this stage is a detailed decision model including all decision making tools ready to be tested. Steps are squeezed in order to have the shortest process flow but increased in decision making visibility and structural approach. Some detail process steps will have to follow the case company's standard practice while other processes which are controlled by other support functions such as finance has to be re-confirmed with the function head again.

3.3 Model verification and validation

After the decision model is proposed, it is verified and tested in order to understand whether or not the designed model is applicable and fit to real company projects. There are three steps in verifying and validating the model.

3.3.1 Verification of the model

Before using the model, parameters and steps are confirmed and proposed to case company's product planning and management team in order to get an agreement to precede the model trial. The model is subjected to last modification in order to satisfy management's and primary users' comments. The model's user interface section is verified in order that it is easy to read and interpret as well as captured all program's requirements. The calculation sheet will be used as a base template for product planning team in the future.

3.3.2 Validation of the model with case projects

Two projects were chosen to validate the decision model in real project practice and to be able to compare the new process and results with previous projects by measuring the time spending on the decision process (from program start to project selection).

The two projects chosen are similar as both are passenger vehicle but also different in some perspectives. Project information is shown below.

Project B515

B515 is a small SUV vehicle. It is placed in small niche vehicle segment (new segment for the case company). There is little benchmark information available for this segment since most of the vehicles are already equipped with both decoration and performance parts in vehicle series line up. The vehicle target customer is new graduate persons who would like to have a car that suites both city drive (small, high fuel efficiency, stylish) and rural drive (able to carry some load, good vehicle handling, high utility). However, as the

vehicle is placed between two big segments (small car and utility car), it is difficult to determine what accessory a customer would want. A heavy performance part will not be able to pursue from engineering specification stands point that the vehicle is small and decoration parts will not suit a country side driving environment. The project is a 50% global project (South America, Asia Pacific and Africa regions and Export and Growth markets) lead by South America team. The countries in APA which are taking the vehicle arranged by volume from highest to lowest are, China, India, Australia, South Africa and Taiwan.

Project C346

C346 is a major platform changed in C car segment vehicle which is the largest vehicle segment from the case company's data (second largest segment according to volume sales is small car). It has a lot of competitors already in the market and that there are a lot of historical and bench marking data available. (This segment's popular vehicles are Toyota Altis, Honda Civic, Mazda3, Ford Focus, Chevrolet Optra, Mitsubishi Lancer, Nissan Tida, etc.) C346 is a global vehicle platform lead by Europe followed by America (North and South) then Asia Pacific and Africa and Export and Growth markets. In APA, countries taking the vehicle, arranged by volume from highest to lowest, are China, Australia, ASEAN, South Africa, Taiwan and New Zealand. India will be the last country to launch the vehicle and will be years behind at minor change. This vehicle's accessory range is quite wide; there can be a lot of both functional and decorative parts. There are common parts between regions as well as unique APA or country's accessories.

The same decision making model is applied to these two projects. After the model trial, results and basic decision steps are shown and explained to product planning team as well as project engineering team who will use this information as their input for development before showing the prioritized selection alternatives to management, finance and base vehicle team to further request for funding and project approval.

3.3.3 Validation of the model using user's feedback

Another questionnaire (will be called questionnaire 2 in this paper) is drafted to ask 4 primary users (persons who will be exercising the model including 100% of product planners, 2 person, one purchaser and one finance personnel) about their assessment on the model. (See Appendix B for the questionnaire 2 detail)

Users' satisfaction of the model and model's results is based on the following topics/items.

- Model compatibility, correctness, validity, maintainability, ease of use and reliability
- Model result usefulness, relevance, clarity, transparency and consistency
- User interface and time consumption when using the model

A refined model is proposed after users' feedback analysis. Product planning team needs to be aware that continuous improvement and modification will be needed for future programs in order to suit the changes which will take place as well as to fit with each project's constraints and needs.

3.4 Result analysis and conclusion

After getting feedback from users, the decision model is discussed with product planning team in order to summarize the improvement of the new product decision model comparing to previous organization's practice. Criteria to be compared are as follow.

- Decision making time from program initiation to final accessory list proposal
- Validity and transparency of the decision model results as input to engineering development
- Maintainability and flexibility of the model in the case new factor to be added
- Efficiency improvement of product planning team
- Results are easily picked and decide by management and finance team

A sensitivity analysis (the effect of input variable change in a limit interval to the output or result) is done to the model's weighting criteria to understand the robustness of the model. Five criteria variable will be changed, from selected case scenario determined by case company's highest management of the planning organization to the best case scenario which suits the best for marketing and product planning team. Weight ranking according to the case company's practice is also taken into consideration. From comparison study, it was found that the case company gives different importance to decision criteria comparing to the other two companies.

Observations are as follow

- 1) The case company is among very few companies that does not exclude accessory business into a separated profit registered organization.
- 2) The case company is among very few companies that does not offer safety related and drive performance accessories.
- 3) While other company's accessory development is leaded by marketing team with accessory market research data, the case company's lead function is finance. Thus, financial performance of the projects including return on investment and profitability are the most critical to project decision. Even though an accessory is provided by all other competitors, if the project can not justify business performance, it would not be pursue.
- 4) Marketing justification has very little influence to management's already made decision.
- 5) The case company provides accessories at vehicle quality specification unlike other company's that has a separated set of specification where accessories and vehicles are developed by a separate engineering team.
- 6) There is an accessory marketing person assigned to work on accessory determination and lead the project in other company's but a planner for the case company.
- 7) As main competitors have their base in Asia Pacific and Africa region, APA usually is the lead market for accessories as well. For the case company, APA is the third

important region and is considered a growing market. Globalization and regionalization perspective and practice is different.

- 8) The case company's vehicle market share is not significant which makes it more difficult to justify investment.

Results are analysed and concluded with final decision making model.