

# CHAPTER VII

## Result analysis and Conclusion

### 7.1 Results in applying the model

A comparison of before and after use of the decision making model is done.

#### 7.1.1 More effective use of resource

The improvement of resource usage can be grouped into two main categories, man hour used in order to come up with the final list and time reduced from process and gates effectiveness.

It is not possible to calculate actual man hour usage of before and after use of the model since from regionalization plan, the whole engineering team was changed from Thai experienced engineers to a completely new Chinese team located in China. However, the use of the new model creates a shorter accessory list needed for engineering and purchasing study since the beginning of the screen out. Instead of 65, only 17 items are preceded as regional development through business case process for B515 project and 31 items (18 commodities) from 71 items of C346 project.

Process step is reduced from 11 main processes with lots of loops to 8 less complicated processes. And gates are reduced from 16 gates to only 5 gates.

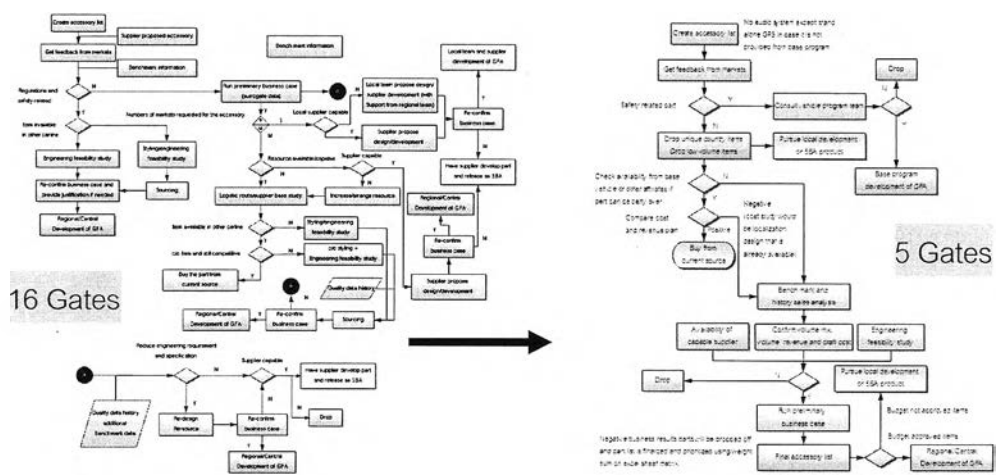


Figure 77: Comparison between the original decision model and the new decision model

Since the process steps and gates are reduced. The reduction of the overall timing used from initial accessory list to final accessory list is evident.

It is observable that not all accessories requested by local marketing team needed to be studied and follow through all the processes. Only parts that are not duplicated with other region or other carline, have low risk on quality and safety issues occurrences and true regional development parts that makes profit to the company should be pursue.

#### 7.1.2 Increase of product planning process transparency and reduce communication error

There is an increase in product planning process efficiency and the reduction of communication error between product planning team who provide input to the product development process and engineering team who will take over the input and develop accessories. Less engineering design and feasibility work is needed up front in the program where only few information is available. The model presents a systematic one way process with clear objective, less loop and only parts that aligns with company's and organization's objective will be pursue along with vehicle development time line. A group of accessory per new vehicle is proposed in one time and ad hoc requests are eliminated.

#### 7.1.3 Reduction of lead time from start to final accessory list

As process steps are reduced, timing from first accessory list to final accessory project approval improved from about 27 weeks (6months) to 17 weeks (3.5 months).

Note that the 27 weeks is average accessory approval timing with the old process which ranges from 20 weeks to 35 weeks. The reduction is mainly from the reduction of upfront engineering and purchasing resources used. However, the accuracy of data input to business case study has to be agreed and improved.

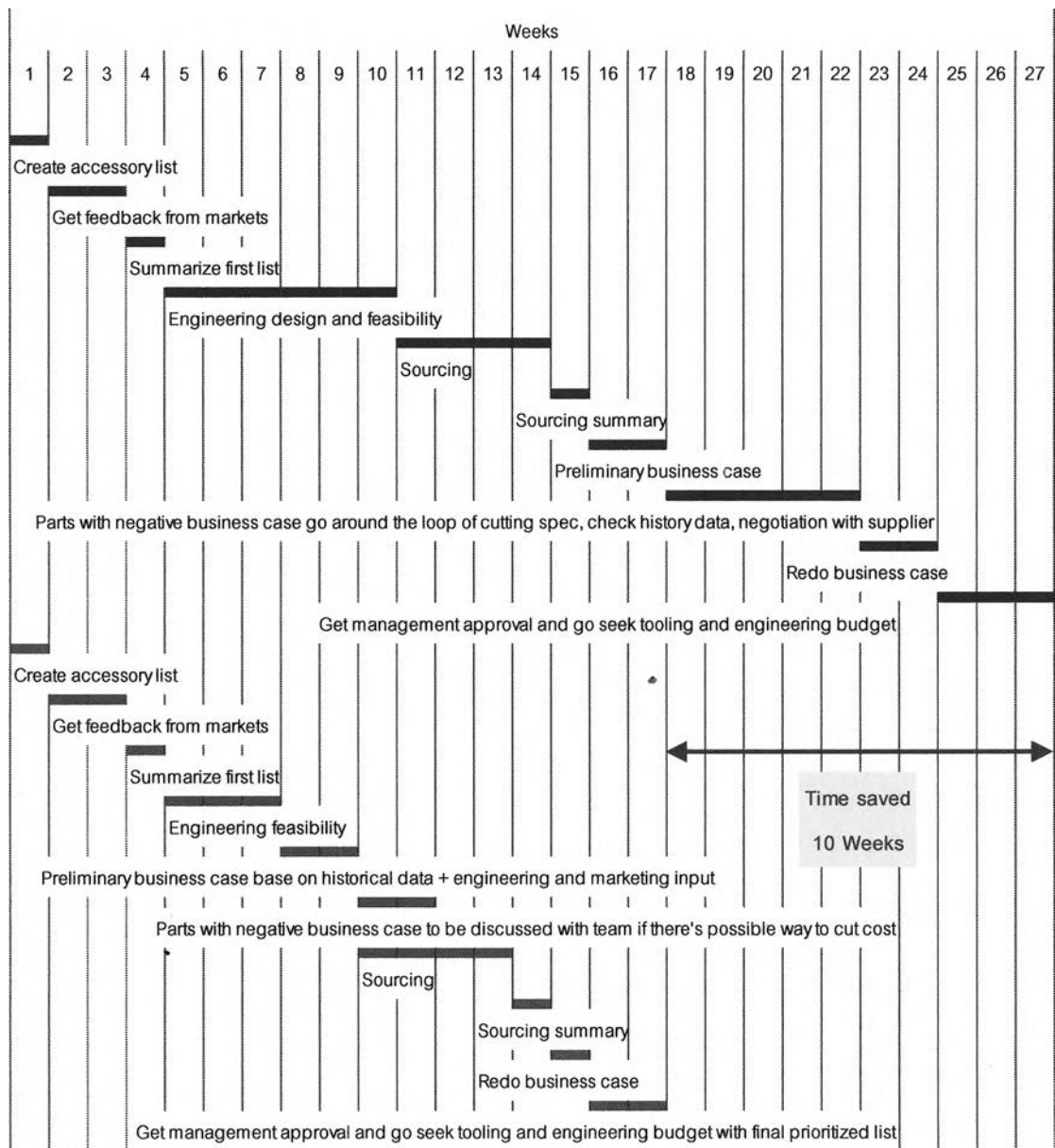


Figure 78: Time saved with the new decision model

## 7.2 Sensitivity analysis

In this paper, only one type of sensitivity analysis which is the most critical one to be done. The determination of the minimum modification of the weights required to make the first alternative rank changed is used in order to understand whether the alternatives can reasonably be selected given the weight variation specified by the decision rule maker. The weight criteria will be varied, with keeping the rank order of the weight and the relations that all weight equals 100% as a boundary.

By changing the parameters in AHP pair wise comparison to the extreme case where ATROS and Payback are equally importance and benchmark and investment number are also equally importance, 37 scenarios (from 3,486,784,401 scenarios with no constrains) are used for alternative prioritization calculation.

Table 22: Sensitivity analysis scenarios

Scenario	ATROS	Payback	Benchmark	Investment	Vehicle integration/ Marketing need
1 (selected)	28%	45%	8%	14%	5%
2	29%	44%	8%	14%	5%
3	30%	43%	8%	14%	5%
4	31%	42%	8%	14%	5%
5	32%	41%	8%	14%	5%
6	33%	40%	8%	14%	5%
7	34%	39%	8%	14%	5%
8	35%	38%	8%	14%	5%
9	36%	37%	8%	14%	5%
10	28%	45%	11%	11%	5%
11	28%	45%	9%	13%	5%
12	28%	45%	10%	12%	5%
13	29%	44%	11%	11%	5%
14	29%	44%	9%	13%	5%
15	29%	44%	10%	12%	5%
16	30%	43%	11%	11%	5%
17	30%	43%	9%	13%	5%
18	30%	43%	10%	12%	5%
19	31%	42%	11%	11%	5%
20	31%	42%	9%	13%	5%
21	31%	42%	10%	12%	5%
22	32%	41%	11%	11%	5%

Table 22 (continue): Sensitivity analysis scenarios

Scenario	ATROS	Payback	Benchmark	Investment	Vehicle integration/ Marketing need
23	32%	41%	9%	13%	5%
24	32%	41%	10%	12%	5%
25	33%	40%	11%	11%	5%
26	33%	40%	9%	13%	5%
27	33%	40%	10%	12%	5%
28	34%	39%	11%	11%	5%
29	34%	39%	9%	13%	5%
30	34%	39%	10%	12%	5%
31	35%	38%	11%	11%	5%
32	35%	38%	9%	13%	5%
33	35%	38%	10%	12%	5%
34	36%	37%	11%	11%	5%
35	36%	37%	9%	13%	5%
36	36%	37%	10%	12%	5%
37	30%	30%	16%	16%	9%

It was found that, the first five alternatives never change their importance while investment can change the latter rank once ATROS increases its importance and Payback reduces its importance.

Table 23: Prioritization calculation result from sensitivity analysis scenarios

Alternative	Scenario									
	1	2	3	4	5	6	7	8	9	10
	Preference									
1	2.294	2.282	2.311	2.340	2.369	2.398	2.426	2.455	2.484	2.444
2	2.244	2.235	2.263	2.290	2.318	2.346	2.373	2.401	2.429	2.394
3	2.085	2.082	2.110	2.138	2.166	2.194	2.222	2.250	2.277	2.235
4	2.066	2.065	2.091	2.118	2.144	2.170	2.196	2.222	2.248	2.216
5	2.007	2.009	2.035	2.061	2.088	2.114	2.140	2.166	2.193	2.157
6	1.934	1.939	1.965	1.992	2.019	2.046	2.073	2.099	2.126	2.084
7	1.924	1.949	1.987	2.025	2.062	2.100	2.138	2.175	2.213	2.074
8	1.889	1.895	1.922	1.950	1.978	2.006	2.034	2.061	2.089	2.039
9	1.798	1.808	1.834	1.861	1.887	1.914	1.940	1.967	1.993	1.948
10	1.770	1.782	1.807	1.832	1.857	1.882	1.907	1.932	1.957	1.920

Alternative	Scenario									
	11	12	13	14	15	16	17	18	19	20
	Preference									
1	2.344	2.394	2.473	2.373	2.423	2.502	2.402	2.452	2.530	2.430
2	2.294	2.344	2.421	2.321	2.371	2.449	2.349	2.399	2.477	2.377
3	2.135	2.185	2.262	2.162	2.212	2.290	2.190	2.240	2.318	2.218
4	2.116	2.166	2.242	2.142	2.192	2.268	2.168	2.218	2.294	2.194
5	2.057	2.107	2.183	2.083	2.133	2.209	2.109	2.159	2.235	2.135
6	1.984	2.034	2.111	2.011	2.061	2.138	2.038	2.088	2.164	2.064
7	1.974	2.024	2.111	2.011	2.061	2.149	2.049	2.099	2.187	2.087
8	1.939	1.989	2.067	1.967	2.017	2.095	1.995	2.045	2.122	2.022
9	1.848	1.898	1.974	1.874	1.924	2.001	1.901	1.951	2.027	1.927
10	1.820	1.870	1.944	1.844	1.894	1.969	1.869	1.919	1.994	1.894

Table 23 (continue): Prioritization calculation result from sensitivity analysis scenarios

Alternative	Scenario									
	21	22	23	24	25	26	27	28	29	30
	Preference									
1	2.480	2.559	2.459	2.509	2.588	2.488	2.538	2.617	2.517	2.567
2	2.427	2.504	2.404	2.454	2.532	2.432	2.482	2.560	2.460	2.510
3	2.268	2.346	2.246	2.296	2.374	2.274	2.324	2.402	2.302	2.352
4	2.244	2.320	2.220	2.270	2.346	2.246	2.296	2.372	2.272	2.322
5	2.185	2.262	2.162	2.212	2.288	2.188	2.238	2.314	2.214	2.264
6	2.114	2.191	2.091	2.141	2.218	2.118	2.168	2.245	2.145	2.195
7	2.137	2.224	2.124	2.174	2.262	2.162	2.212	2.300	2.200	2.250
8	2.072	2.150	2.050	2.100	2.178	2.078	2.128	2.206	2.106	2.156
9	1.977	2.054	1.954	2.004	2.080	1.980	2.030	2.107	2.007	2.057
10	1.944	2.019	1.919	1.969	2.044	1.944	1.994	2.069	1.969	2.019

Alternative	Scenario						
	31	32	33	34	35	36	37
	Preference						
1	2.646	2.546	2.596	2.674	2.574	2.624	3.497
2	2.587	2.487	2.537	2.615	2.515	2.565	3.352
3	2.430	2.330	2.380	2.458	2.358	2.408	3.079
4	2.398	2.298	2.348	2.424	2.324	2.374	2.955
5	2.341	2.241	2.291	2.367	2.267	2.317	2.860
6	2.272	2.172	2.222	2.298	2.198	2.248	2.756
7	2.337	2.237	2.287	2.375	2.275	2.325	2.582
8	2.234	2.134	2.184	2.261	2.161	2.211	2.726
9	2.133	2.033	2.083	2.160	2.060	2.110	2.498
10	2.094	1.994	2.044	2.119	2.019	2.069	2.368

It can be concluded here that the model is not sensitive to changes of the weight criteria considering the rank order of the weight remains.

### 7.3 Conclusion

From old product planning and accessory development process and the company's change in direction and objective in order to respond to the economic turmoil and external changes pressure, a new, less complicated but useful accessory development decision model is proposed. The new model taken into account not only the case company's objective but also the resource availability from organization structure change toward regionalization, the integration to base vehicle development process, milestones and timing and the nature of vehicle accessory business. Accessories can be developed on global (integrated as a part of vehicle development), regional (regional accessory team development) or local development depending on the safety related, historical sells data, uniqueness and level of technology and fashion each accessory is. Validated with case company's two different projects, the new model shows improvement in resource and timing usage from the initial accessory list to final prioritized accessory list to be proposed to management's investment decision. Additionally, with the transparency and systematic arrangement of the model, engineering input from product planning team is clearer and communication error is reduced. Main achievements and thesis summary can be found below

1. Reduction of process steps and gates – from 16 gates to 5 gates
2. Selection criteria and process steps are clearly defined and company objective oriented with process transparency improvement – 79% user satisfaction
3. Reduction of time used from start to accessory final list – 27 weeks to 17 weeks
4. Outputs of the process worth time and resource put in – 82% user satisfaction



Table 24: Thesis summary

Objective	Method used	Output/Results	Efficiency/Benefits
To develop a decision making model for regional vehicle accessory development that fits to new product planning process	+ Literature review	→ Planning model	> Understanding of accessory development nature
	+ Best case and competitor comparison		> Integration to base vehicle development makes accessories forced to be introduced on time at launch
	+ Company's best practice	→ Decision model 1	> Align with company's objective and regionalization plan
	+ Confirmation questionnaire		> Reduction of process complexity (16 gates to 5 gates)
	+ A combination of stage gate process, AHP and WSM in MCDM method		→ Decision model 2
+ 2 case studies	→ Refined decision model	> Process transparency and clearer planning output	
+ User validation questionnaire		> Effectively used of upfront resource	
	+ Model sensitivity analysis		> 79% users satisfaction

It is suggested to the case company that in order to improve the accuracy and reliability of input data to the model prioritization calculation section, a better database system is required.

In addition to the benefits to the case company, there are also contributions to theory and academic research. As there are very few case studies on automotive accessory business, this one can demonstrate that multi-criteria decision making method and planning process can also be applied effectively to the development of vehicle accessory. Moreover, it is done on a regional, Asia Pacific and Africa, basis which is diverse. It is found that flexibility to accommodate all marketing requirements from each country is not likely to be done but benefits on cost and timing reduction from regional development can accommodate the lost. Countries should be able to add more unique accessories by their own and the overall result still gives a competitive position for a company. The advantages of AHP and WSM (Weight Sum Method) can also be combined and used to prioritize alternatives which are more than 20 and still the model is quite solid. However, for the weight calculation using AHP analysis, in order to lessen the bias when doing pair wise comparison, it is recommended to have group decision by comparing each decision makers' individual thoughts. Similar comparison can be used directly to the calculation but differences among decision makers can then be debated to get the final decision conclusion.

The implementation of the model is not detailed in this thesis since from the organization change, all persons involved in the accessory business changed and it is considered as a totally new process for the case company new team. However, if there is no organization change, change management especially people involvement will be difficult. It is suggested that the company established a change management team including product marketing, product planning, finance personnel, purchasing personnel and engineering program management person. The team leader should be a high level management who owns final decision gate so that the process can be easier implemented. The model proposed in this study only consider one project at a time but in reality, the company will have several projects running in parallel and resources will

need to be shared. Once the case company has a prioritized accessory list on hand, a portfolio analysis using project management approach to consider the overall company's projects should be study further.