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BUSINESS PROCESS IMPROVEMENT OF NEW PRODUCT DEVELOPMENT - FITTING KITS USING THEORY OF CHANGE AND ECRS (CASE STUDY: MOTOACCESSORY CHINA, LTD)

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Abstract

Motorcycle sales reached 47.2 million in 2020, generating US$117.2 billion. China and India sold 36.7% of units worldwide in 2020. Indonesia had the third highest unit sales and China the largest revenue share. China's economic growth may surpass the US's sooner than expected as the Republic of China recovers faster from the initial COVID-19 pandemic. Moto accessory China Limited Companies (MCC), founded in Shanghai in 2006, saw this economic expansion as an opportunity and a vast potential fitting kits market in China since MCC top fitting kits sales volume is relatively low compared to top cases. Top cases and new fitting kits would expand as motorcycle sales and models in China increased. MCC must improve the business process of new product development-fitting kits (NPD-FK) to increase fitting kit sales and speed up product development to strengthen DASH market position in China. In China, Brand "Q" has a 36% market share, and DASH fitting kits only have 1%. MCC faces dozens of local players in this product category, with a share of 55%, making it difficult. SWOT analysis is used to analyze business circumstances in the early stages of the study to clearly identify MCC actual and intended conditions. Brainstorming, interviews, and focus groups with linked business functions provided the core data. Main issues identified as slow development cycle of new fitting kits model in MCC. Furthermore, we used business process analysis to identify the bottleneck or the longest time that takes place in product development during the prototyping stage. Stakeholder analysis and root cause analysis are also used as supporting solution tools in the Theory of Change. We found that the root cause of the main issues related to methods (no clear communication channel, lack of understanding of roles and responsibilities, and no standard format report), then manpower (inexperienced in NPD-FK, lack of knowledge, and lack of understanding the benefit of the project), and material (not working with standard fitting kits components). In this study, improvements were made using Theory of Change and Eliminate Combine Rearrange simplify (ECRS) concept to address these issues. This proposed strategy could reduce product development lead time by 20–22% and speed up development cycle of new fitting kits. For successful implementation, we recommended that all internal stakeholders related to NPD-FK be made aware of their existence to give support and make a significant contribution to MCC.

Keywords: Fitting Kits, Motorcycle Accessories, China Company, New Product Development, Problem and Solution Tree Analysis, ECRS, Theory of Change

A. INTRODUCTION

In 2020, unit sales worldwide of motorcycles exceeded 47.2 million, and the market realized a total revenue of US$117.2 billion. China and India accounted for 36.7% of units sold worldwide in 2020. China also achieved the largest market share of revenue while Indonesia had the third largest share of unit sales. Asia, in general, accounts for most of the motorcycle sales worldwide as shown in figure 1.

In Asia, the motorcycles market generated a total revenue of US$79.3 billion or around 68% from worldwide motorcycles market in 2020, with unit sales of more than 40.3 million motorcycles (excluding Scooters or mopeds < 50cc). China was the country / territory with the most unit sales in that year. Expectation the revenue aggregated from motorcycles sold in Asia

ISSN 1533-9211

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to amount to US $ 114.7 billion, with over 53.0 million motorcycles sold, in 2026. (Statista, 2022).

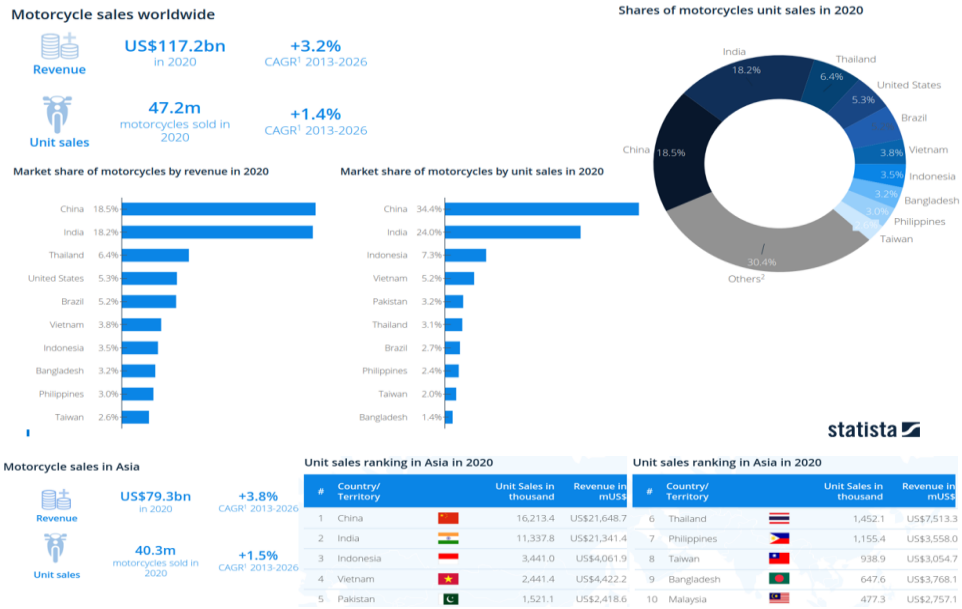

Figure 1: Statista Mobility Market Outlook (Statista, 2021)

As the Republic of China recovers faster than the United States from the initial Covid-19 epidemic, it appears that China's economic growth will outstrip that of the United States sooner than economists predicted. Researchers from Capital Economics published a paper at the beginning of 2022 stating that their most likely scenario foresees China's GDP increasing to approximately 87% of the size of the United States' economy in the year 2030. (Xie, 2022). The British consultancy Centre for Economics and Business Research (CEBR) projects that China's GDP would expand 5.7% yearly through 2025 and then 4.7% annually until 2030. China, currently the world's second-biggest economy, is predicted to surpass the United States as the greatest economy by 2030. (Jennings, 2022).

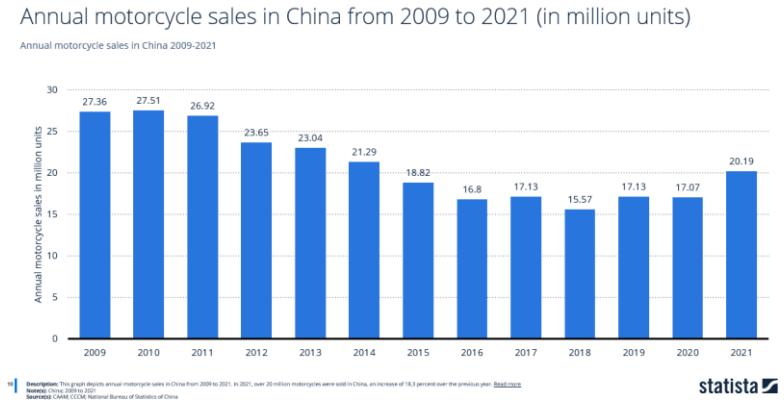

Figure 2: Annual Motorcycle Sales in China from 2009 to 2021 (Statista, 2022)

The Seybold Report
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Local and provincial governments in China carefully regulate the sale of domestic motorcycles. A succession of bans and restrictions on the use of motorbikes in Chinese metropolitan areas have significantly impacted sales growth. In China, annual motorbike sales have steadily declined over the past decade but have begun to improve in 2021. In China's rural areas, motorcycles are among the primary modes of mobility. Guangdong and Guangxi provinces, for instance, have an average of almost 60 motorcycles per 100 households. (Statista_Research_Department, 2022). As shown in figure 2 the graph illustrates annual Chinese motorcycle sales from 2009 through 2021. According to Statista (2022) mobility market outlook 2021 that motorcycle sales in China will grow at Compound Annual Growth Rate / CAGR of 5.5% between 2013 to 2026. Motorcycle fitting kits or luggage racks or rear carrier or motorcycle bracket is metal parts installed on the back and side of a motorcycle. It's connecting top case and side case into motorcycle. They are a necessity for carrying anything on their motorcycle and needs the extra storage space. One models of fitting kits is dedicated for one motorcycle model, even though there are few fitting kits that compatible with more than one motorcycle model.

Moto accessories Espana Sociedad Limitada or S.L, (later we call MES) as the mother company of Moto accessory China Limited Companies or LTD, (later we call MCC) was seeing this economic growth as an opportunity and there was a huge potential fitting kits market in China considering MCC top fitting kits sales volume is very low. Top Fitting kits volume was only around 3% compared to top case sales volume from 2017 to 2019. Meanwhile, Indonesia was having 39%, Spain was having 79% and other European countries were having 105% of top fitting kits sales volume compared to top case sales volume. The establishment of the project team for new product development of motorcycle fitting kits (later called NPD-FK) it's important to overcome this issue as MES asked to MCC. One of main reason is because MCC rely on import fitting kits from Spain, so they don't have local fitting kits with DASH brand. The increment of motorcycles sales volume and models in China would increase also the demand for top cases and new fitting kits developed every year. MCC must improve the new product development of fitting kits process to increase the top case sales volume and grow in China.

Business situation analysis is the first step since it shows us the current state of business. Simple and direct assessment of the current situation, without embellishment as shown in figure 3. According to Rothaermel (2017), SWOT analysis is the framework that allows leaders to synthesize insight obtained from an internal analysis of the company's strengths and weaknesses (S and W) with those from an analysis of external opportunities and threats (O and T) to derive strategic implications. In this research, SWOT Analysis is used to identify the business situations. We can better understand where we want to take the company after we have a complete picture of its current state. We could be able to clearly identify our business's current and desired states.

ISSN 1533-9211

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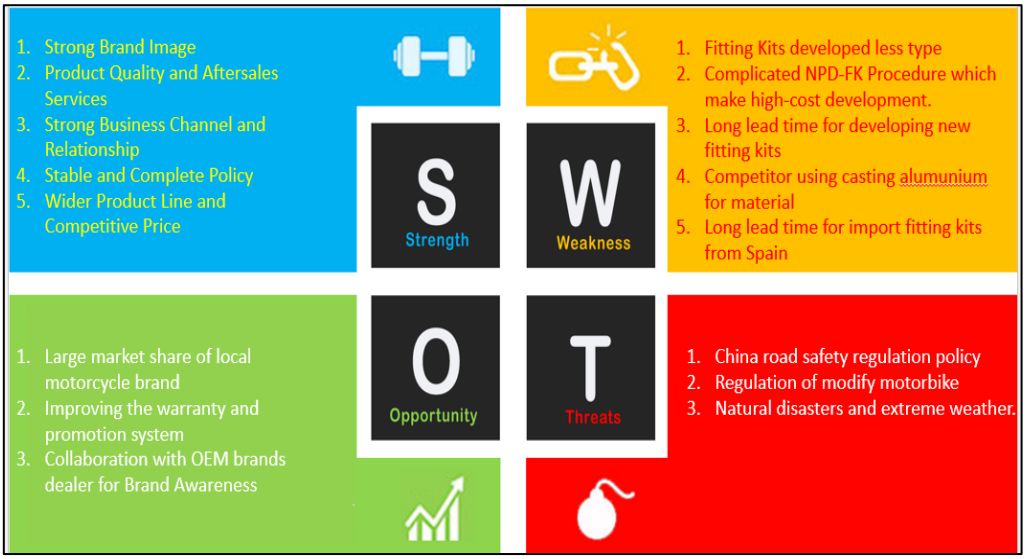

Figure 3: SWOT Analysis

MCC was starting this project of new product development for fitting kits products in January 2021 with the objective to develop one to three models of fitting kits per motorbike per month since one fitting kits is dedicated for one motorcycle models so they can produce a prototype minimum for twelve fitting kit models annually. It's important to have complete fitting kits catalogue for more offering to client. Importantly, MCC believes by having more new fitting kits developed, bigger volume, and models in the fitting kits catalogue will increase the fitting kits sales volume and top case sales which is going to reinforce their market position in China, strengthen DASH market position with their competitor in China, Encourage the investment for increasing the Return on Investment (ROI), and Barrier to entry – Important to have fitting kits service offering to be more competitive in China market.

However, Top management realized that there was a stressful gap between their expectations of twelve items of new fitting kits developed compared to the reality of four items after one year of running and evaluating the NPD-FK project where the local competitor able to make 14 – 25 items, MAI as sister company able to make 16 items (development capability is 4 new fitting kits per month) and MES as mother company able to make 36 items (development capability is 8 new fitting kits per month) in 2021. Based on business situation analysis, **main problem is slow development cycle of new fitting kits model**. The effect of this problem is reduced profitability because of high cost of development, decreased brand recognition and lost market opportunity because of delayed market entry, less offering for mid-end market because of less type of the local fitting kits in the MCC product catalogue, and segmented for high end market (premium product) because of currently they rely on import product from Spain.

The Seybold Report
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B. STATEMENT OF THE PROBLEM

The business issue generates research questions. There are four research questions relating to the business issue that will help determine the solutions in this research:

1. What is the current fitting kits market condition in China?
2. Who is the stakeholder involved and how to manage them?
3. What is the root cause of slow development cycle of new fitting kits model?
4. How to speed up the development cycle of new fitting kits model at MCC?

C. RESEARCH METHODOLOGY

A research design is the overall strategy that author use to coordinate the different components into coherent and logical whole, ensuring that the research question is addressed effectively, it represents the blueprint for data collection, measurement, and analysis (De Vaus, 2001). In order to explore the research design, this research utilize single case study approach considering this research only focuses on one case or one phenomenon. In a single case study, the aim or focus of the research is generally towards the context or the core of the problem. Single case study is a qualitative research approach that is used to understand an issue or problem by using a case (Creswell, 2007). Case studies can be particularly useful for studying a process, program or individual in an in-depth, holistic way that allows for deep understanding (Merriam, 1998).

This research used the qualitative research method along with descriptive analysis to see the insight in the data see from the results of the interviews and focus group discussions. The author starts to analyse from the stakeholder. This research used the stakeholder management technique then continue with business process analysis and root cause analysis.

Data collected between April 2022 – February 2023 and conducted using two types of data source is primary and secondary. In primary data, author collected data from brainstorming, interviews and focus group discussion. While secondary data, author collected data from company websites, company annual reports, online newspapers, and online articles.

D. RESULTS AND DISCUSSIONS

1. Data Analysis

Stakeholder Identification

Stakeholder identification forms the first step in an effective stakeholder management. Judgment and expert (Global Director) opinions are gathered to identify stakeholders, also profile analysis meetings with team members and the sponsor are beneficial for identifying stakeholders and their roles, and impact in the project. Defining the stakeholders involved in this current situation by figuring out who these people are before the project starts and grouping each one in stakeholder onion diagram, Stakeholders closer to the center of the diagram are

ISSN 1533-9211

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more significant involved in developing a new fitting kit in MCC. There are 11 internal stakeholder and 6 external stakeholders with 4 layer group, as follow:

- Layer 1: Stakeholders closely involved in the ideation and product definition stage of NPD-FK. Stakeholders include the sales & marketing manager as project leader, project developer, and project manager. They are the key person in NPD-FK MCC.
- Layer 2: Stakeholders whose work after product definition stage. Stakeholders include MES Global Manager NPD-FK, MES Marketing Dept, Operations Manager, Supply Chain Dept and Fitting Kits Supplier.
- Layer 3: Investor, Global Director, Operations Manager and General Admin Dept who interact closely with the system.
- Layer 4: External Stakeholders such as customers, wholesaler / retailer, regulators / government, Local Communities, and Competitors.

General Business Process of NPD-FK

Activities or tasks list are generated from the results of interview process with key personnel and FGD. It is related with the question: "How is the business process/procedure of the new product development of fitting kits in your area from your perspective?". Beside activities list, the completion time of each activity also being measured. Time measurement is asked during FGD with the question how long to perform each activity? Therefore, this final project use time metrics that based on estimation related personnels that are thought to be reasonably accurate.

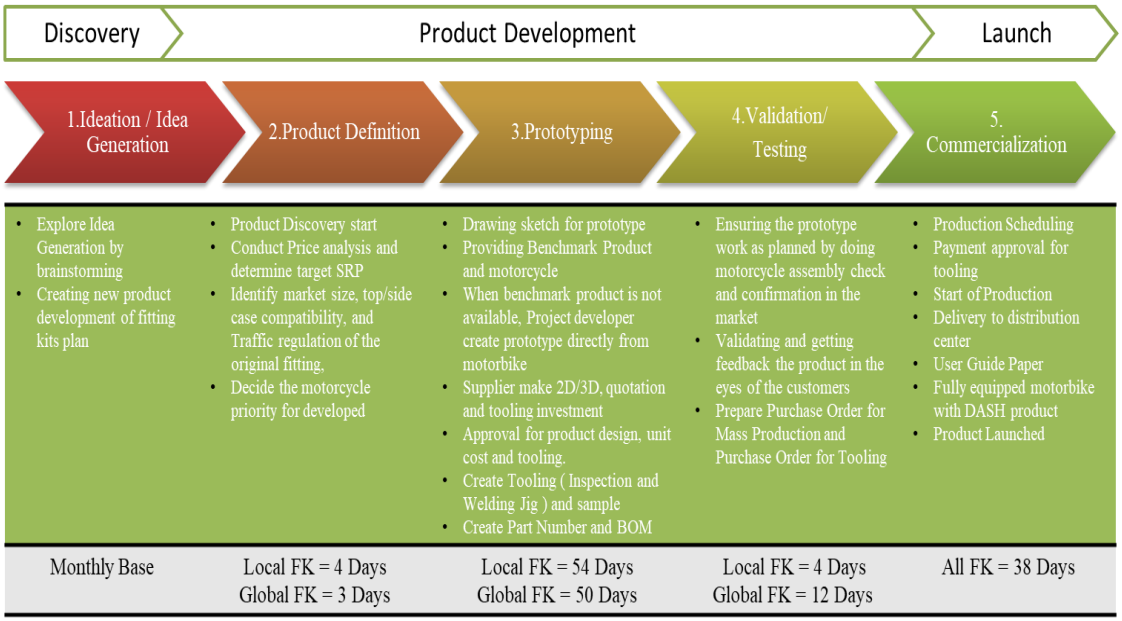

Figure 4: Summary of Business Process Mapping of NPD-FK

Product Development (Product definition, prototyping and validating / testing) has 2 type of cycle time. It will take 62 days (4 + 54 + 4) for local fitting kits and 65 days (3 + 50 + 12) for

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global fitting kits. Then commercialization will take 38 days. Furthermore, the lead time of local fitting kits is 100 days and global fitting kits 103 days. It is known also that the bottleneck or the longest time in Product Development is stage 2: Prototyping with 54 days for local fitting kits and 50 days for global fitting kits.

Furthermore, by using interview and FGD, author identifies problems or issues happened at each stage with interview question:" Do you think the current business process /procedure is the best way? If no, please explain to us?". Problem identification at each stage is listed on table below:

Table 1: Problem Identification from Breakdown Activities in Business Process

	Stage	Problem(s)	Source Activity
1	Stage 0: Ideation	No problems identified	1,2
2	Stage 1: Product Definition	The composition of local fitting kits model < global fitting kits model in NPD-FK priority decision.	3,4
		No problems identified	5,6
		• Preparing proposal sketch design of local fitting kits should be conduct by PD. • **No standard format of motorcycle initial report.**	7,8
3	Stage 2: Prototyping	No problems identified	9,10,11
		GM need more time to give sketch FK design because information not complete	12,13
		Lack of mutual understanding among PD, PM and SMM (poor communication between team member)	14
		No problems identified	15
		PD struggle to develop the prototype of FK because of lack of knowledge, less support from old project manager, and not using standard fitting kits component)	16
		No problems identified	17,18,19,20
		GM need more time to validate the quotation tooling and structure cost because mostly the information not complete and not using standard format.	21
		No problems identified	22,23,24,25
		Long cycle time for making tooling (inspection & welding jig) and FK master sample	26
		No problems identified	27
4	Stage 3: Validating /Testing	No problems identified	28
		No clear information between PD and PM for the job roles & responsibilities	29
		No problems identified	30,31,32,33
		No clear information between PD and PM for the job roles & responsibilities	34
		No problems identified	35,36,37
5	Stage 4: Commercialization	No problems identified	38,39,40,41,42,43,44,45,46,47,48,49,50,51

The finding of problem in each activity during new product development process – fitting kits of MCC is shown in table 1 where most of problem happened in the Stage 1 until Stage 3 (total 34 activities) where 4 out of 34 activities (12%) in stage 1, 6 out of 34 activities (18%) in stage 2 and 2 out of 34 activities (6%) in stage 3.

ISSN 1533-9211

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Root Cause Analysis

In this research, a root cause analysis conducted to find the main cause or root cause of known problems or symptoms. These problems or symptoms were already found during business process analysis and FGD. If we can figure out what the main causes are, we'll be able to come up with business solutions that work. According to the table 1. Problem Identification from Breakdown Activities in Business Process then we found some cause as follows: No standard format report, Poor communication between team member, PD Struggle to make prototype and lack of understanding job roles & responsibilities.

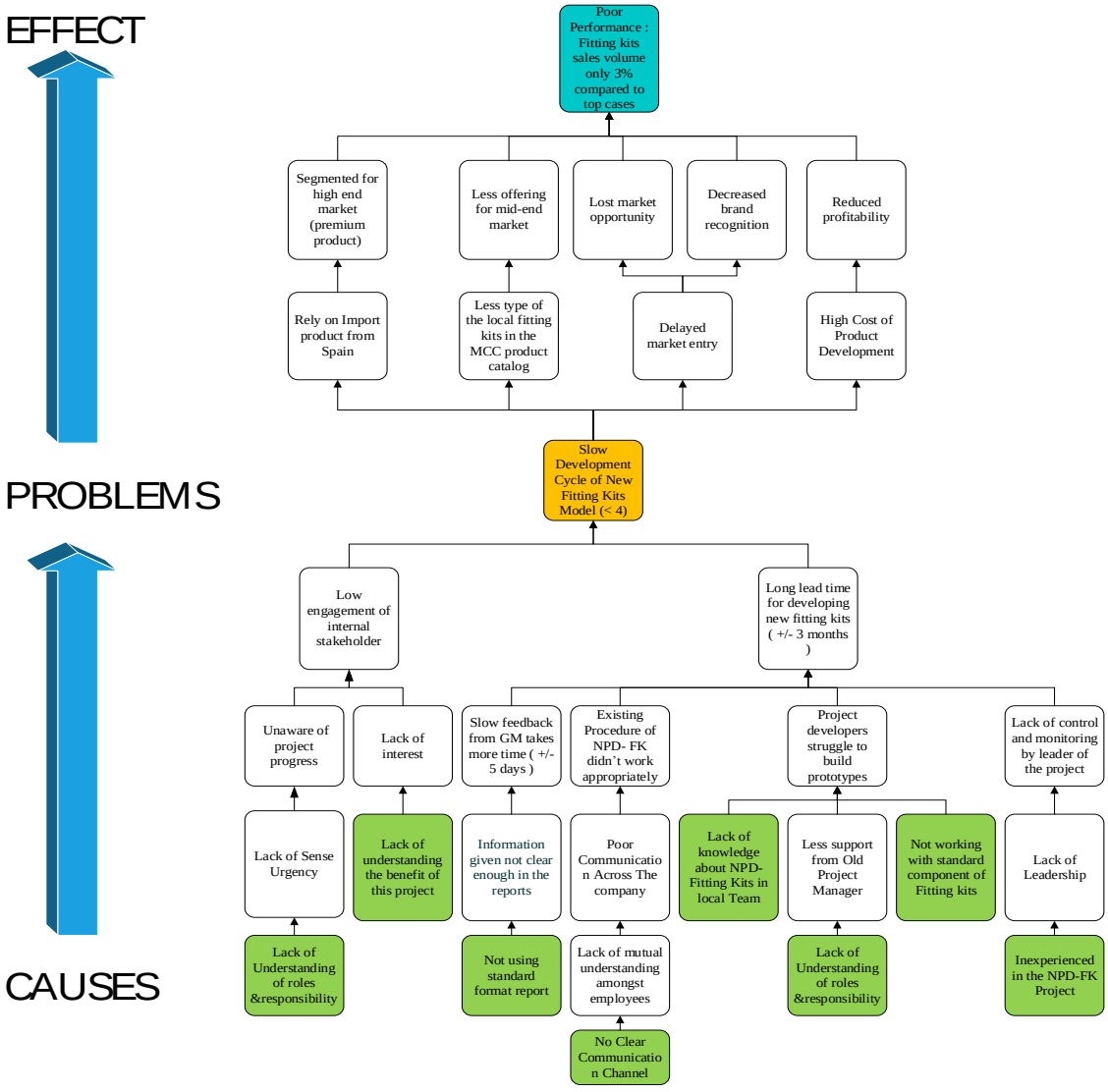

Figure 5: Problem Tree Analysis

The problem tree analysis is the phase in which the negative aspects of a given situation are identified, establishing the cause-and-effect relationship between the observed problems. After

ISSN 1533-9211

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problem tree analysis being made then it is shown in figure 5 that the main problem for slow development cycle of new fitting kits model are related with the manpower (inexperienced in the NPD-FK project, lack of knowledge about NPD Fitting kits in local teams, and lack of understanding the benefit of the project), material (not working with standard fitting kits component) , and methods (no clear communication channel, lack of understanding roles and responsibility, and no standard format report).

When we have completed the solution tree, we will have multiple viable outputs that lead to the desired outcome and impact. At this step, we must choose which output(s) we can realistically accomplish with our time, resources, and skills. After analyzing the possible solutions, we choose the best one and start planning how to communicate and evaluate our project. (ACGC, 2023). The objective/solution tree presents a summary image of the desired future condition, including the indication of the means by which ends can be attained as show in figure 6.

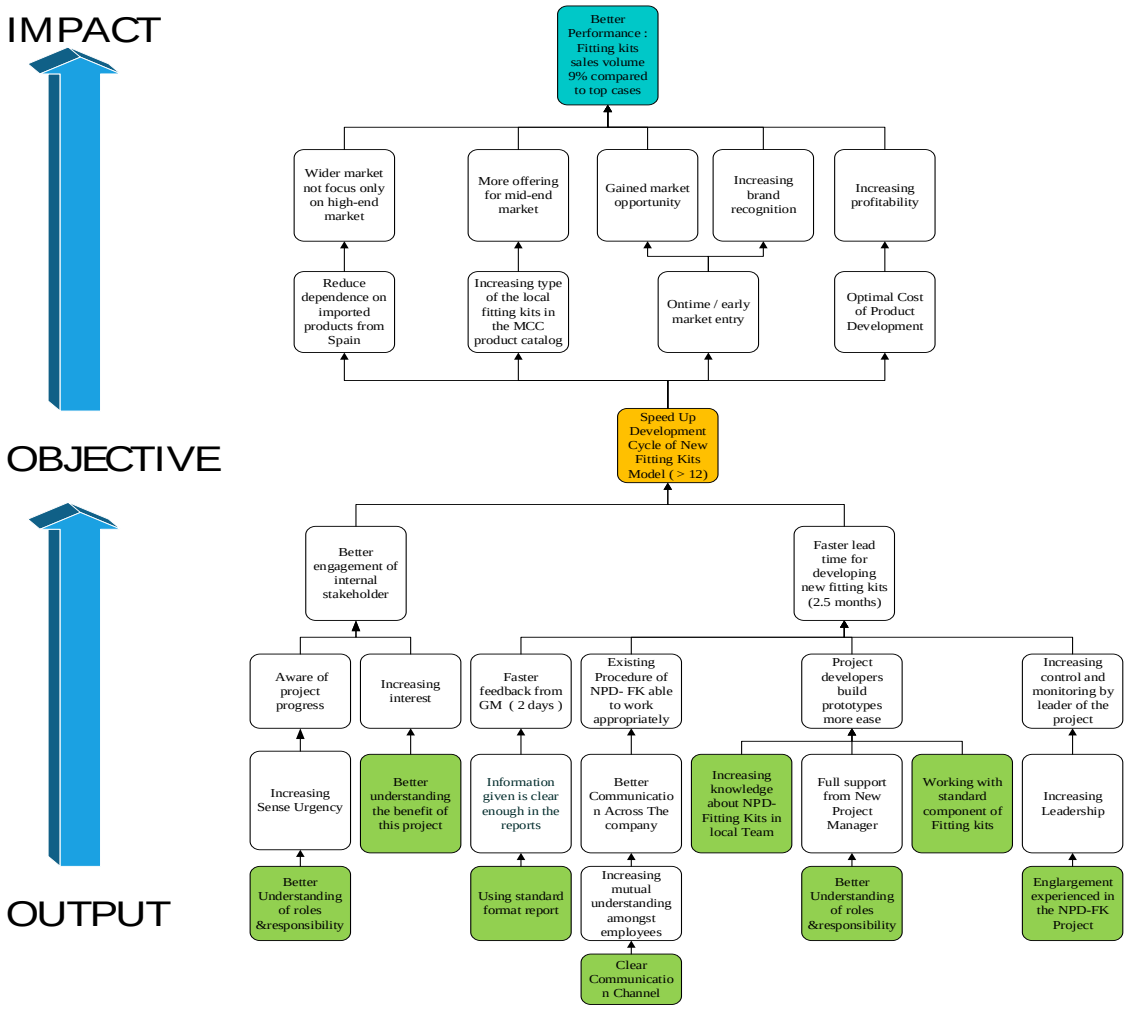

Figure 6: Solution Tree Analysis

The Seybold Report
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According to solution tree analysis then we can write or recite our project statement as a single sentence such as: **IF** the NPD-FK team has better understanding of roles &responsibility, better understanding the benefit of this project, increasing knowledge about NPD-FK, having clear communication channel, using standard format report, working with standard component of fitting kits, and enlargement experienced in the NPD-FK project. **THEN** the new fitting kits development cycle can speed up. **SO THAT MCC** will having better performance: percentage of fitting kits sales volume close to top case sales volume.

2. Business Solution

ECRS / Eliminate Combine Rearrange Simplify

ECRS strategy is commonly used in a lean manufacturing context as a problem-solving tool to improve processes and increase efficiency. In terms of NPD-FK, ECRS strategy can be used as a tool to help achieve MCC goals by simplifying business processes and optimizing business process flow. There are various tasks that can be applied to ECRS, which is blending the function. New product development cycle time can be decreased by eliminating, combining, rearrange and simply jobs or activities. A task or activity that is recommended for combine is an activity that can be done simultaneously, so that can be more efficient. While the planned elimination of the activity or job is unneeded due to function blend. An activity or task that is proposed to be Rearrange / moved is one that is thought to bring more value if completed earlier. An activity or task that is proposed to be simplify is repetitive movements. Table 2. Will show development activity or task that is proposed to be ECRS.

Table 2: Activity changes as the impacts of ECRS

	Activity	Source Activity	Proposal	Reason
1	Preparing proposal and information	7	Rearrange / Move	Empowering PD and make him to be more proactive from the early stage
2	Motorcycle initial reports	8	Rearrange / Move	PD made the standard reports and consulted with PM (information 100% clear) before sending it to GM
4	Passing the fitting kits sample	10	Eliminate	GM can directly send the FK sample to supplier and put SMM, PM and PD on cc email for tracking.
5	Creating tooling (dies, inspection & welding jig) and FK sample	26	Rearrange / Move	30 days to create inspection & welding jig, and master sample is too much. Supplier only make master sample (and tooling dies if necessary) and the task for making tooling jig is moving to PD so not necessary to make it.
6	Translating Cost Structure & Tooling Cost Quotation	20	Rearrange / Move	PD must pre-check the unit cost structure in standard format and translating it using translator tools then consulted with PM (information 100% clear) before sending it to GM
7	Create Part Number and BOM	29	Rearrange / Move	When validation is finished by SMM then PD must do administrative tasks by creating part number and bill of material

The change activity on the proposed business process can reduce time after holding the application of the new business process specifically in stage 2: prototyping and it justifies with the project manager and project leader as shown in figure 7.

The Seybold Report
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1. By Using standard format report then Global manager easy to understand the information and made the fitting kits design sketch faster to send to Project Developer, which is save time 1 days (before: 1.5 days, after: 0.5 days)
2. By using standard format report then Global manager easy to understand the quotation and cost structure information and made the approval decision faster to project manager, which is save time 3 days (before: 4.75 days, after: 1.75 days).
3. By making the job roles & responsibility clear for project developer, so the creation of tooling (inspection and welding jig) was re-arranging / moving from supplier to project developer. Project developer did faster than supplier, which is save time 18 days (before: 30 days, after: 5+7 days). Project developer was able to create directly the tooling without rely on work schedule of operator in supplier. Supplier only prepare the fitting kits master sample which is spend 7 days.

LOCAL FK-BEFORE		
Task Name	Duration	Resource Names
STAGE 2 : PROTOTYPING	**54 days**	
Sketching fitting kits design	1.5 days	NPD-FK Global Manager
Sketch drawing instruction	0.5 days	NPD-FK Global Manager
Coordinating and translating info	1 day	NPD-FK Project Manager
Providing motorbike	2.75 days	Sales and Marketing Manager
Creating prototype fitting kits	7 days	NPD-FK Project Developer
Request for quotation	0.25 days	NPD-FK Project Developer
Create 3D and 2D	2 days	Fitting Kits Supplier
Cost structure and tooling cost quotation	1.5 days	Fitting Kits Supplier
Translating cost structure and tooling cost quotation	0.5 days	NPD-FK Project Manager
All Correct (Check Quotation and Cost Structure)	4.75 days	NPD-FK Global Manager
Modification Instruction	0.25 days	NPD-FK Global Manager
Fixing SRP	1 day	Operations Manager
SRP list	0.25 days	Business Manager,Sales and Marketing Manager
Coordinating	1 day	NPD-FK Project Manager
Creating tooling (inspection and jig) and fitting kits sample	30 days	Fitting Kits Supplier
All Correct (check the fitting kits master sample)	1 day	NPD-FK Project Developer

LOCAL FK-AFTER		
Task Name	Duration	Resource Names
STAGE 2 : PROTOTYPING	**32 days**	
Sketching fitting kits design	0.5 days	NPD-FK Global Manager
Sketch drawing instruction	0.5 days	NPD-FK Global Manager
Coordinating and translating info	1 day	NPD-FK Project Manager
Providing motorbike	2.75 days	Sales and Marketing Manager
Creating prototype fitting kits	7 days	NPD-FK Project Developer
Request for quotation	0.25 days	NPD-FK Project Developer
Create 3D and 2D	2 days	Fitting Kits Supplier
Unit cost structure quotation	1.5 days	Fitting Kits Supplier
Translating unit cost structure quotation	0.5 days	NPD-FK Project Developer
All Correct (Check Unit Cost Structure)	1.75 days	NPD-FK Global Manager
Modification Instruction	0.25 days	NPD-FK Global Manager
Fixing SRP	1 day	Operations Manager
SRP list	0.25 days	Business Manager,Sales and Marketing Manager
Coordinating	1 day	NPD-FK Project Manager
Creating tooling (inspection and jig)	5 days	NPD-FK Project Developer
Creating fitting kits master sample	7 days	Fitting Kits Supplier
All Correct (check the fitting kits master sample)	1 day	NPD-FK Project Developer

GLOBAL FK-BEFORE		
Task Name	Duration	Resource Names
STAGE 2 : PROTOTYPING	**50 days**	
Delivery kits sample	7 days	NPD-FK Global Manager
Passing the fitting kits sample	1 day	NPD-FK Project Manager
Study the fitting kits sample	1 day	Fitting Kits Supplier
Create 3D and 2D	2 days	Fitting Kits Supplier
Unit cost structure quotation	1.5 days	Fitting Kits Supplier
Translating cost structure and tooling cost quotation	0.5 days	NPD-FK Project Manager
All Correct (Check Unit Cost Structure)	4.75 days	NPD-FK Global Manager
Modification Instruction	0.25 days	NPD-FK Global Manager
Fixing SRP	1 day	Operations Manager
SRP list	0.25 days	Business Manager,Sales and Marketing Manager
Coordinating	1 day	NPD-FK Project Manager
Creating tooling (inspection and jig) and fitting kits sample	30 days	Fitting Kits Supplier
All Correct (check the fitting kits master sample)	1 day	NPD-FK Project Developer

GLOBAL FK-AFTER		
Task Name	Duration	Resource Names
STAGE 2 : PROTOTYPING	**29 days**	
Delivery kits sample	7 days	NPD-FK Global Manager
Passing the fitting kits sample	1 day	NPD-FK Project Manager
Study the fitting kits sample	1 day	Fitting Kits Supplier
Create 3D and 2D	2 days	Fitting Kits Supplier
Unit cost structure quotation	1.5 days	Fitting Kits Supplier
Translating cost structure and tooling cost quotation	0.5 days	NPD-FK Project Developer
All Correct (Check Unit Cost Structure)	1.75 days	NPD-FK Global Manager
Modification Instruction	0.25 days	NPD-FK Global Manager
Fixing SRP	1 day	Operations Manager
SRP list	0.25 days	Business Manager,Sales and Marketing Manager
Coordinating	1 day	NPD-FK Project Manager
Creating tooling (inspection and jig)	5 days	NPD-FK Project Developer
Creating fitting kits master sample	7 days	Fitting Kits Supplier
All Correct (check the fitting kits master sample)	1 day	NPD-FK Project Developer

Figure 7: Improvement of Task Elements with ECRS

The Seybold Report
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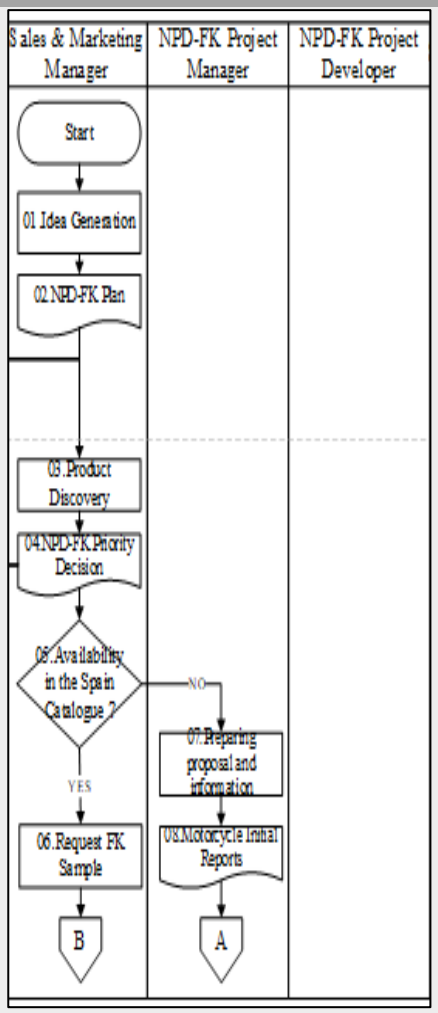
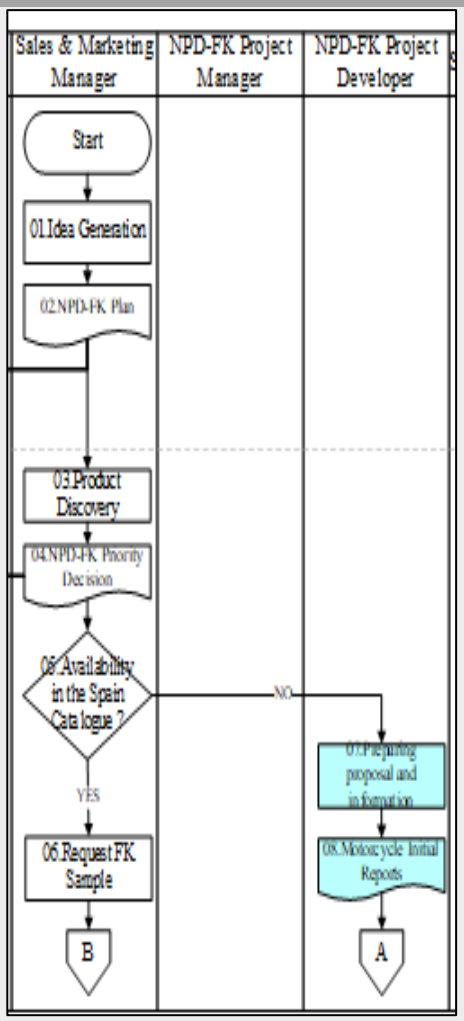
After completely changes the activity as shown in table 2. Then we will compare the before and after the ECRS proposed solution as described in table 3 below:

Table 3: Comparison Previous Business Process and New Business Process

Before	After
	
Explanation: PM handle directly the activities Preparing proposal and information, and Motorcycle initial reports.	**Explanation: This process rearrange/move to PD, the objective is empowering PD and make him to be more proactive from the early stage, and PD made the standard reports and consulted with PM (information 100% clear) before sending it to GM.**

The Seybold Report
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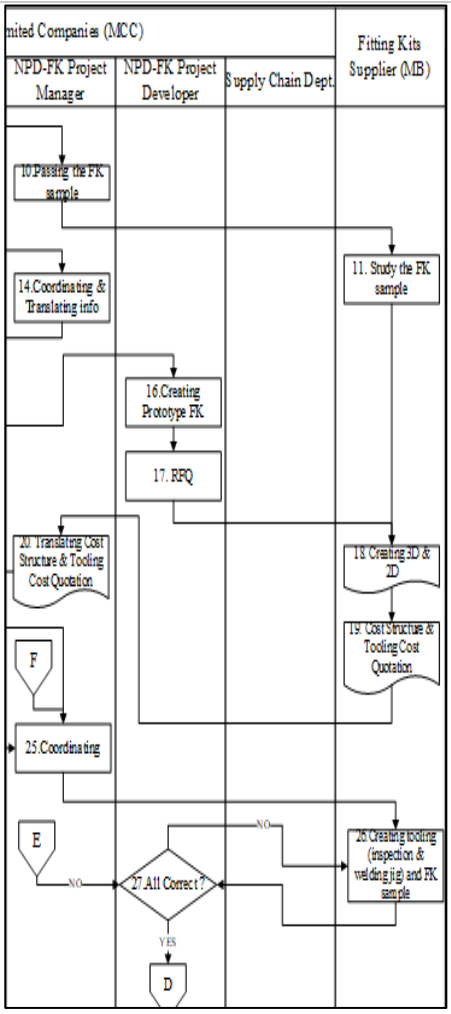
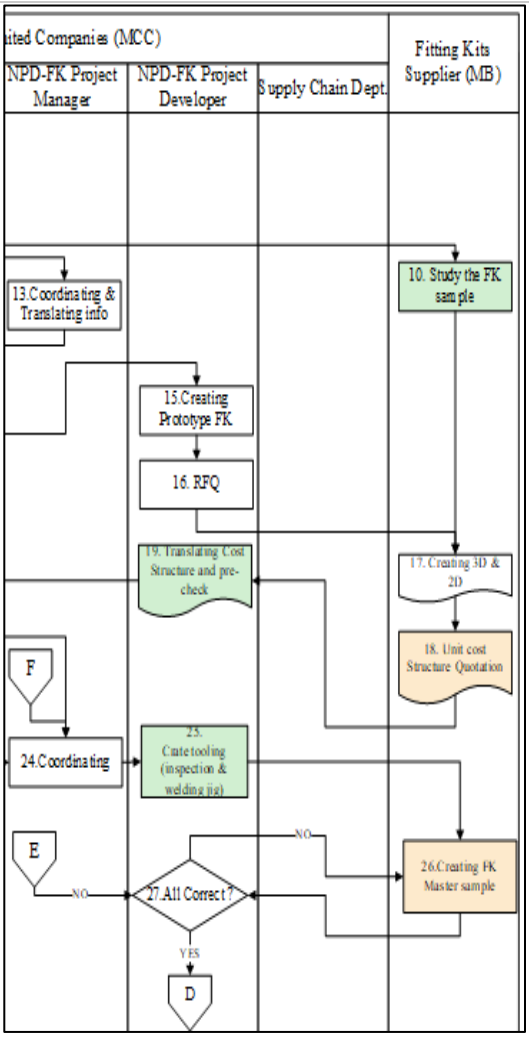


Explanation:

1) **GM sending the FK sample to PM then PM pass the sample to supplier.**
2) **PM also translating cost structure and tooling cost quotation.**
3) **Supplier creating tooling (inspection and welding jig) and master sample.**



Explanation:

1) **This process eliminated because of GM sending directly the FK sample to supplier.**
2) **This process rearrange / move from PM to PD. PD must pre-check the unit cost structure in standard format and translating it using translator tools then consulted with PM (information 100% clear) before sending it to GM.**
3) **This process rearrange / move from Supplier to PD. 30 days to create inspection & welding jig, and master sample is too much. Supplier only make master sample (and tooling dies if necessary) and the task for making tooling jig is moving to PD so not necessary to make it.**

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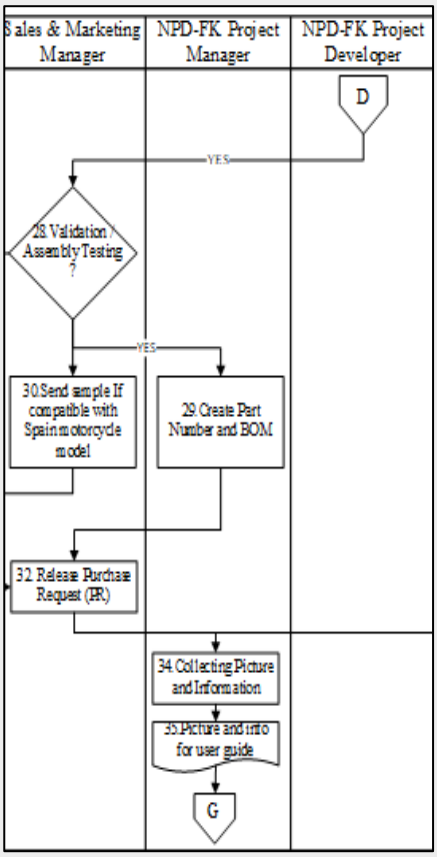
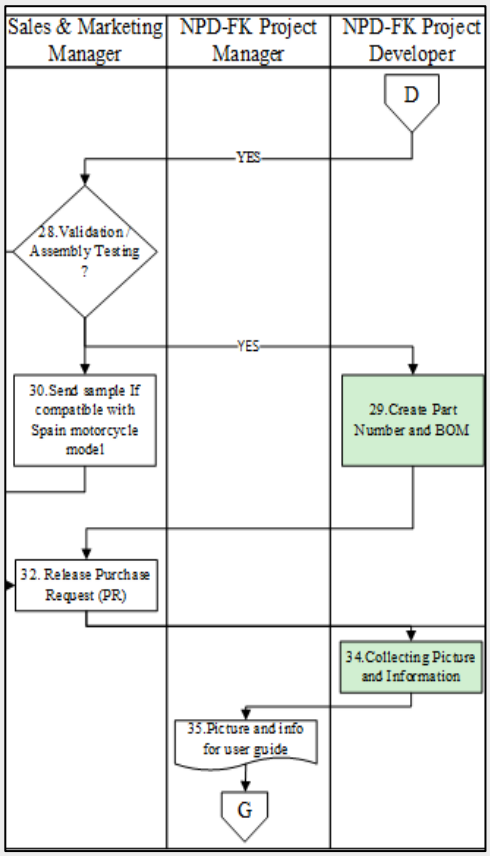


Explanation:

1) **PM create part number and BOM after validation by SMM.**
2) **Then PM collecting picture and information from PD to create user guide paper.**



Explanation:

1) **This process rearrange / move from PM to PD. When validation is finished by SMM then PD must do administrative tasks by creating part number and bill of material.**
2) **This process rearrange / move from PM to PD. PD actually have the complete picture and information when he is developing the prototype at the previous steps, so he need to send the draft steps of user guide paper with complete picture and send to PM for checking before send it to GM**

Finally, when all the business proposal are implemented on new product development – fitting kits at MCC, the flow of activities or task is changed. The number of activities doesn't change still 51 activities; however, the NPD-FK lead time can be reduced for local fitting kits from 100 days to 78 days (reduced 22%) and global fitting kits from 103 days to 82 days (reduced 20%).

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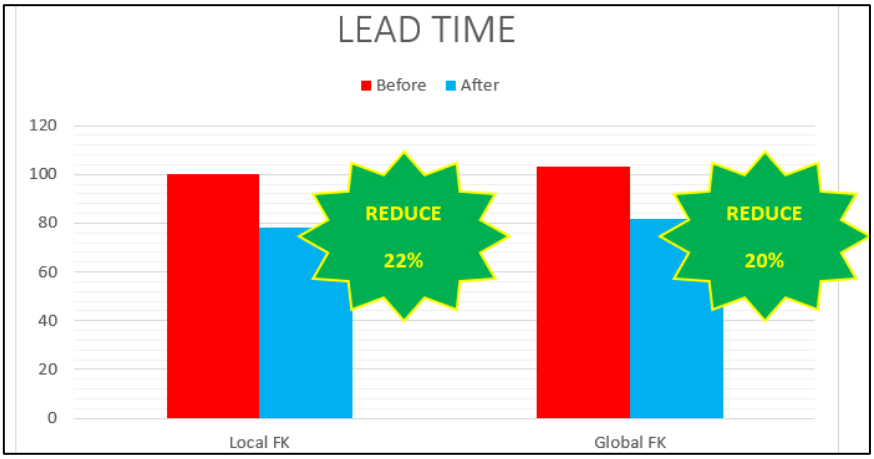

Figure 8: New product development lead time improvement

Prototyping cycle time reduce from 54 days to 32 days (reduced 41%) for local fitting kits and reduce from 50 days to 29 days (reduced 42%) as shown in table 4.

Table 4: Improvement summary with ECRS

	Before (days)		After (days)	
NPD-FK Stage	Local FK	Global FK	Local FK	Global FK
Stage 1: Product Definition	4	3	4	3
Stage 2: Prototyping	54	50	32	29
Stage 3: Validating/Testing	4	12	4	12
Stage 4: Commercialization	38	38	38	38
Total Lead Time	100	103	78	82

Theory of Change

Weiss (1995) described a Theory of Change (ToC) as a theory of how and why the program will work. ToC is a clear methods to think about and write down how a program or intervention is supposed to work, why it will work, who it will help (and in what way), and what conditions must be met for it to be successful (Weiss & Connel, 1995).ToC is an increasingly popular tool for organisations to describe how they believe that change happens, and to help focus their work on achieving their long-term goals. In essence, an organisation's ToC describes how it believes it makes a difference. It should clearly link inputs and activities to outcomes and to achieving the organisation's overall goals (MC, 2023).

There are two different ways to read this ToC. If we are using this ToC as a planning tool, then we should read from the top down. However, if we are using this ToC as an evaluation tool, then we should read from the bottom up. By using the theory of change, MCC can ensure that their programs are well-designed, evidence-based, and aligned with their goals and objectives. There is no right or wrong method to draw an outcome map; each map will look different

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depending on the particular demands and preferences of the stakeholder. The main element is to listen to stakeholder perspectives so that our map represents their perspectives on how change occurs (Annie E. Casey Foundation, 2023).

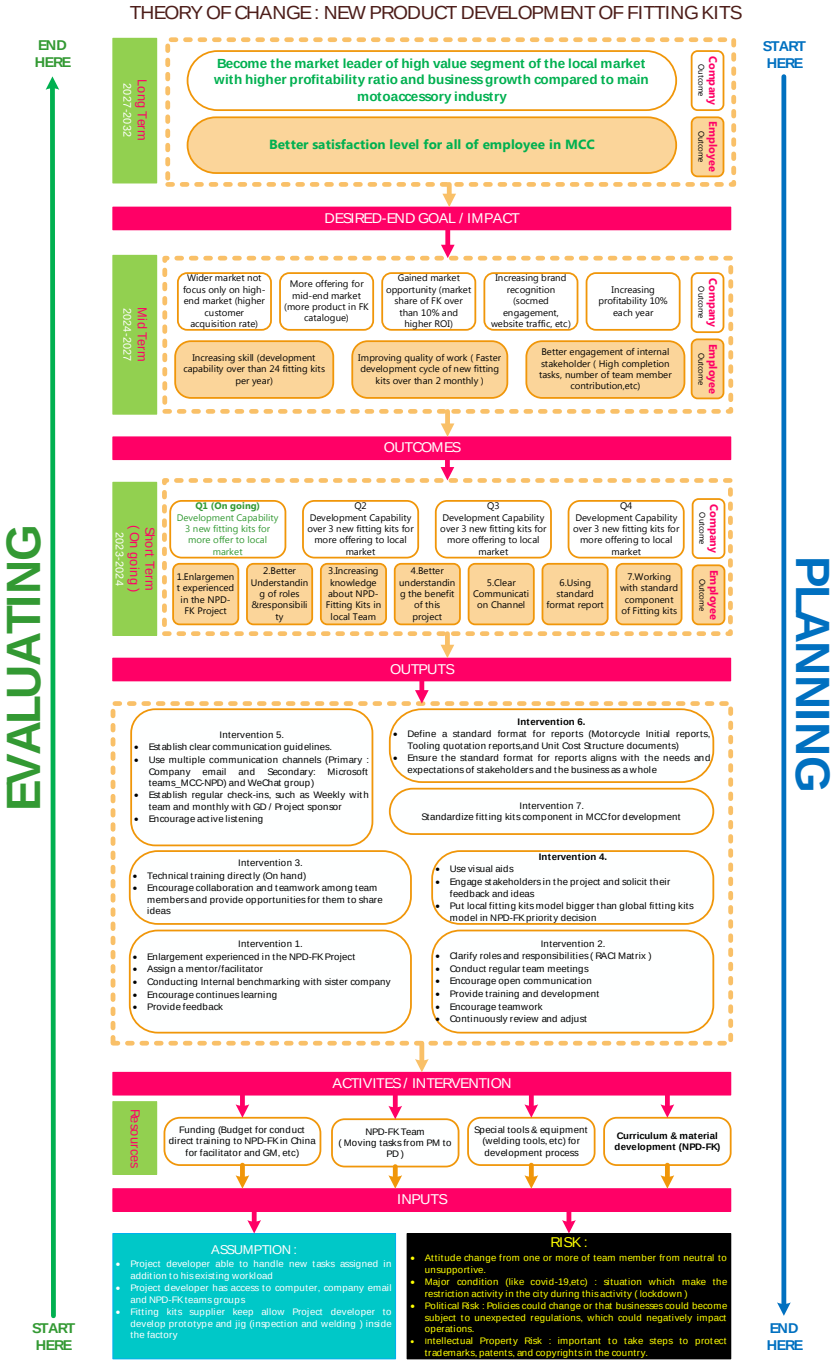

Figure 9: Theory of Change / TOC of NPD-FK

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/9KZSQ

3. Advantage and Disadvantage of Proposed Solution

A short discussion was held in order to validate and provide support for the idea or solution that was offered earlier. The discussion included some straightforward questions regarding the benefits and drawbacks of each of the potential solutions that were being considered for new product development product – fitting kits. The discussion took place with the Global Director and the Project Manager.

Table 5: Advantage and Disadvantage of Proposed Solution

No	Proposed Solutions	Advantage & Disadvantage
1	**Enlargement experienced in the NPD-FK Project** **a)** Provide training and development opportunities: Offer training and development opportunities to help team members build the necessary skills and knowledge for the new product development process. **b)** Assign a mentor/facilitator: Assign a mentor or facilitator to each team member to provide guidance, support, and feedback as they work on the new product development. **c)** Internal benchmarking with MAI as first DASH overseas fitting kits facility **d)** Encourage continuous learning: providing access to relevant training materials, and other resources, and by promoting a culture of continuous improvement / kaizen. **e)** Provide feedback: Provide regular feedback to team members on their performance and areas for improvement, and recognize their successes and achievements	**Advantage: Increased skills and knowledge** (It can help employees acquire new skills and knowledge that they can apply in their current job or in future roles. This can improve their performance and **increase their value** to the organization), **Improved job satisfaction and retention** (they are more likely to be satisfied with their jobs and to stay with the organization for a longer period of time), and **Enhanced innovation and creativity** (It can help employees think outside the box and come up with innovative solutions to problems). **Disadvantage: Risk of employees leaving** (There is a risk that after being trained and developed, employees may leave the organization to find better opportunities elsewhere, which can lead to a loss of talent and increased recruitment costs).
2	**Better Understanding of roles & responsibility Clarify roles and responsibilities:** **a)** Clearly define each team member's role and responsibilities in writing, and make sure everyone understands their individual tasks and how they fit into the larger picture. (i.e. RACI Matrix) **b)** Conduct regular team meetings: Hold regular team meetings where everyone can discuss their progress, challenges, and issues related to their roles and responsibilities.	**Advantage: Improved efficiency** (Team can work more efficiently because they can focus on their specific tasks and avoid wasting time on tasks that should be done by someone else), **Reduced confusion and conflict** (It can help prevent misunderstandings and conflicts that can arise when multiple people try to take responsibility for the same task or when no one takes responsibility for a task), and **Better decision making** (When everyone understands their role and how their work fits into the bigger picture, they can make better decisions that align with the goals of the team or organization). **Disadvantage : Reduced collaboration** (If team members are too focused on their individual roles

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/9KZSQ

	c) Encourage teamwork: Encourage teamwork and collaboration among team members to help build a culture of trust and cooperation. **d)** Continuously review and adjust: Continuously review and adjust roles and responsibilities as needed to ensure everyone is aligned and working effectively as a team.	and responsibilities, they may not collaborate effectively with others on the team, which can limit the team's overall effectiveness)
3	**Increasing knowledge about NPD-Fitting Kits in local Team** **a)** Technical training directly, ensuring every team member understands and uses the concept of developing new fitting kits which will keep systems running smoothly and reduce costs arising from human error or miscommunication. **b)** Encourage collaboration and teamwork among team members and provide opportunities for them to share ideas.	**Advantage: Increased technical skills** (It can help employees develop and enhance their technical skills, which can make them more productive and effective in their jobs), **Improved job performance** (it can help employees to better understand their job responsibilities and perform their tasks more efficiently and effectively), and **Increased job satisfaction** (Technical training can help employees feel more confident and competent in their roles, which can lead to increased job satisfaction). **Disadvantage: Cost** (It can be costly, both in terms of the time and resources required to design and deliver the training) and **Resistance to change** (Some employees may be resistant to new technologies or processes introduced through technical training, which can make it difficult to achieve the desired outcomes).
4	**Better understanding the benefit of this project** **a)** Use visual aids: Use visual aids, such as diagrams, infographics, and presentations, to help communicate the benefits of the project in a clear and engaging way. **b)** Engage stakeholders in the project and solicit their feedback and ideas. **c)** Put local fitting kits model > global fitting kits model in NPD-FK priority decision to increase the number of models in product catalogue	**Advantage: Clarity** (Clear visual aids and engage stakeholders provide a clear framework for how information should be presented, which can help shared understanding of the benefits and their role in achieving them.), **Increased buy-in** (It can increase their buy-in and commitment to the project. This can lead to greater support and enthusiasm for the project, which can help to ensure its success), **Improved decision-making** (Stakeholders can bring different perspectives and expertise to the project, which can lead to improved decision-making and better outcomes), **Increased Accountability** (Increased accountability: It can increase accountability and help to ensure that everyone is working towards a common goal) **Disadvantage: Time-consuming** (may require additional resources).
5	**Clear Communication Channel** **a)** Establish clear communication guidelines: Develop clear and concise communication guidelines to ensure everyone is on the same	**Advantages: Clarity** (Clear communication guidelines provide a clear framework for how information should be presented, which can help to avoid misunderstandings and confusion), **Efficiency** (Clear communication guidelines can

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/9KZSQ

	page regarding expectations for communication. **b)** Use multiple communication channels: Use a combination of different communication channels, such as email, instant messaging, video conferencing, and in-person meetings, to ensure everyone is kept informed. Primary: Company email @dash.es and Secondary: Microsoft teams (MCC-NPD Group) and WeChat group for NPD-FK (1st group: Project Facilitator, Project Manager and Project Developer and 2nd group: Project Facilitator, Project Leader, and Project Manager) **c)** Establish regular check-ins, such as weekly meetings, to help ensure everyone is up to date on project progress and any issues that need to be addressed. **d)** Encourage active listening by encouraging team members to listen carefully and to ask questions when they need clarification.	save time and increase efficiency by streamlining the communication process. This can help to ensure that communication is timely and effective), and **Consistency** (Clear communication guidelines ensure that everyone is communicating in a consistent manner, which can help to establish trust and build stronger relationships). **Disadvantage: Limitation** (It may not accommodate all types of communication, which may result in important details being left out or not presented in the best way).
6	**Using standard format report** Define a standard format for reports, including what information should be included, how it should be presented, and any templates or tools that will be used from MCC to MES • Motorcycle Initial reports • Tooling quotation reports • Unit Cost Structure documents Ensure the standard format for reports aligns with the needs and expectations of stakeholders and the business as a whole.	**Advantage: Clarity** (make reports clear, consistent, and easy to read), **Time-saving** (Instead of having to decide on a format, the writer can focus on organizing the content and ensuring the report is accurate), **Professionalism:** A standard format can give a report a more professional look, which can help to enhance the credibility of the information being presented, and **Accessibility:** A standard format makes it easier for the report to be shared and understood by different audiences **Disadvantages: Rigidity** (Standard formats can be inflexible and may not accommodate all types of information. This can lead to important details being left out or not presented in the best way).
7	**Working with standard component of Fitting kits** Providing multiple component standard before the prototyping that can overlap which can save time.	**Advantage: Timesaving** (instead of spending many times to make the new design of component) **Disadvantage:** Need **an extra area** to keep the multiple components (good storage to avoid "rust" in the surface of metal component) in supplier then control the consumption.

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/9KZSQ

E. CONCLUSIONS

In order to provide an answer to the research question, the following research conclusion has been provided after completing an investigation of both the business issue and the proposed business solution:

Q1. Using semi structured interview, identified market share of DASH fitting kits product currently 1% in China market and the strongest competitor is Brand "Q" with 36%, Brand "X" with 5% and Brand "W" with 3%. There are dozens of local competitors who also joined in this product line with 55%.

Meanwhile according to Internal MCC Market research said that consumer preferences to buy new product (fitting kits) in China according to five things. The highest is price then quality of product after that easy access to buy, brand loyalty and the lowest is design. Chinese consumers, on the one hand, tend to think that the greater the price tag, the better the quality or more prestigious the brand. Customers may be suspicious of a foreign brand that is significantly less expensive than domestic ones. However, the price premium Chinese consumers are ready to pay varies widely across different product categories and demographic subsets. It's important to note that these preferences can change over time and vary based on the specific target audience and market segment.

Q2. Using stakeholder analysis and as explained in stakeholder analysis that there are 11 internal stakeholder and 6 external stakeholders. The improvement of business process will be more focus on the internal stakeholder and specifically on the 5 internal stakeholder such as global director, global manager, project leader, project manager and project developer.

The strategy to manage them is essential, according to power interest grid that we need keep satisfy the global director since he is the higher-ups who typically need to know that progress is being made in the proper direction of new business process, manage actively the global manager, project leader, and project manager since they play a crucial role in attaining the project's objectives furthermore keep on side the project developer since he has important roles in the new business process .

Especially for the stakeholder who have neutral attitude such as project leader and project developer. Strategy for gaining support or reducing obstacles with them is building a trust among them and encourage them to be an active member of this team. Meanwhile, global director, global manager and project manager is very supporting during the early stage of this research so no special strategy with them, just keep contact with them regularly whether in the weekly or monthly meeting.

Q3. The main problem on this research is slow development cycle of new fitting kits model. The root cause of these problem that we found from business process analysis and root cause analysis (problem tree) are mentioned below:

- Methods (no clear communication channel, lack of understanding roles and responsibility, and no standard format report)

The Seybold Report
ISSN 1533-9211
DOI 10.17605/OSF.IO/9KZSQ

- Manpower (inexperienced in the NPD-FK project, lack of knowledge about NPD Fitting kits in local teams, and lack of understanding the benefit of the project)
- Material (not working with standard fitting kits component).

Connecting the criteria for successful product development (Ulrich & Eppinger, 2016) with root cause that we found and using interview then we will understand that:

- In terms of product quality, the product developed in good quality and satisfy customer. In the other hand according to information from NPD-FK team that MCC don't have any quality issue since 2021 until now (the quality complain from customer is less than 0.1% and mostly about missing component)
- In terms of product cost, MCC don't have any problem with the price offered by competitive suppliers when compared to competitors who play in the mid-end market.
- In terms of product development time, it became main problem for MCC considering the product development cycle is slow, the new product development lead time of local fitting kits is 100 days and global fitting kits 103 days.
- In terms of product development costs, it becomes a problem because high development costs are a large portion of the investment needed to make profits.
- In terms of development capability, it is a problem because as follows: Lack of knowledge new fitting kits model with three key players namely the project leader, project manager and project developer has ever handled fitting kits products and received direct/offline training, it doesn't mean they are not competent, but they need more training for increasing knowledge and skill.

According to above criteria then MCC need to improve their product development time, product development cost and development capability in order to be more competitive and achieve company short term goals.

Q4. To solve these causes, one of the business solutions is to change current business process with using concept ECRS and Theory of Change. By using the theory of change, MCC can ensure that their interventions are well-designed, evidence-based, and aligned with their short term, midterm and long-term goals. With using ECRS, we can eliminate and rearranging/move some activities in the NPD-FK, and able to reduce product development lead time by 22% for local FK and 20% for global FK. Project developer empowerment is important since he is the only 100% dedicated manpower on this process in order to make project manager not overloaded on the NPD, global manager and project leader easy to complete their tasks, and project facilitator easy to monitor and help the NPD-FK team working on a project to achieve target.

At the moment, MCC is heading in the right direction in terms of performance, taking into account the fact that they have finished three new fitting kits by the end of February 2023. After that, they plan to put their development capability over three new fitting kits so that they can provide more offerings to the local market for each quarter (Q2-Q4).

ISSN 1533-9211

DOI 10.17605/OSF.IO/9KZSQ

F. RECOMMENDATIONS

In view of the findings on the conduct of this study, the following are offered for possible future undertaking.

- According to root cause analysis what it the root cause that making the slow development cycle of new fitting kits model, the problem tree analysis is to determine what is cause and affect about the slow development cycle then solution tree that will tell us what the MCC are should achieve to get to the company short term goals which is in this current situation are:

Company: Development Capability over 12 new fitting kits for more offering to local market

Employee:

- Enlargement experienced in the NPD-FK Project
- Better Understanding of roles &responsibility
- Increasing knowledge about NPD-Fitting Kits in local Team
- Better understanding the benefit of this project
- Clear Communication Channel
- Using standard format report
- Working with standard component of Fitting kits
- By doing that MCC can maintain situation and work quality of NPD-FK team

- We recommend that the organization examine the following for a successful implementation plan:

  - Project sponsor / Global director should ensure a leadership role and commitment in the implementation of new business process.
  - Project leader should be more support and gets the team involved, keeps them motivated, takes care of their needs, keeps monitor and evaluate the new tasks assigned to team members according to new business process.
  - New Project Manager should be more proactive and understanding the pain points of project developer for running a project, making sure deadlines are met, and keep the good performance of the new task assigned according to new business process.
  - Project developer should be more well-organized, providing regular reports to the new project manager and keep the good performance of the new task assigned from the new business process.
  - All internal stakeholders in the new business process maps need to be made aware of their existence in order for author to garner support and make a significant contribution to MCC.

ISSN 1533-9211

DOI 10.17605/OSF.IO/9KZSQ

- MCC must pay attention for the potential risk arise such as attitude change from one or more of team member from neutral to unsupportive, policies could change or that businesses could become subject to unexpected regulations, which could negatively impact operations. and important to take steps to protect trademarks, patents, and copyrights in the country.
- This complete concept has the potential to be expanded into a new subsidiary for the DASH company in another country when establish new product development of fitting kits.
- This business process improvement used for China motorcycle accessories company and is general. Therefore, it can be applied to other company as well.

Recommendation for future research

- Although this study has provided valuable insights into business process improvement of new product development-fitting kits in motorcycle accessories company in China by using the ECRS and theory of change, further research is needed to fully understand the mechanisms underlying these improvements. Specifically, future research could investigate the workload analysis of NPD-FK team in MCC. A workload analysis study using a job analysis and work sampling. It would provide valuable information on a particular job to identify areas where workload is excessive or insufficient.
- Concurrent Engineering also could be an interesting topic to investigate as an alternative solution to speed up the new fitting kits development cycle in the mid-term and long-terms target. It would provide valuable information to optimize the product development process by involving all relevant stakeholders in the design and development process and by addressing potential issues and challenges as early as possible. It is a collaborative and iterative method to product design and development that stresses taking into account all aspects of a product's life cycle at the same time. It's also can increase final product quality, reduce costs, and speed up time to market by including all important stakeholders in the design and development process.

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