ADDIS ABABA UNIVERSITY
COLLEGE OF BUSINESS AND ECONOMICS
SCHOOL OF COMMERCE
DEPARTMENT OF PROJECT MANAGEMENT

Technological Innovation and New Product Introduction: The Case of Ethiopian Metal Development Institute

BY
MESFIN LAKEW LEMMA

A Project Work Submitted to Addis Ababa University College of Business and Economics School of Commerce In Partial Fulfillment of the Requirements for the Degree of Master of Arts in Project Management

June 2019
Addis Ababa, Ethiopia

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Advisor: Mengistu B. (PhD)

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Statement of Declaration

I, the undersigned, have carried out a project work on the topic entitled "Technological Innovation and New Product Introduction: The case of Ethiopian Metal Development Institute" in partial fulfillment of the requirement for the Degree of Masters of art in Project Management with the guidance and help of my research advisor Mengistu Bogale (PhD).

This project is my work that has not been submitted for any degree or Master program in this or any other institutions.

Mesfin Lakew
Signature _____
Date _____
Addis Ababa, Ethiopia

Statement of Certification

This is to certify that Mesfin Lakew has carried out this project work on the topic entitled "Technological Innovation and New Product Introduction: The case of Ethiopian Metal Development Institute" under my supervision. This work is the first effort by the individual and it is sufficient for submission for the partial fulfillment for the award of Degree of Masters of Art in Project Management.

Mengistu Bogale (PhD)

Signature _____

Date _____

Addis Ababa University

College of Business and Economics Department of Project Management

MA Project Work

By

Mesfin Lakew Lemma

Approved By Board of Examiners

Mengistu Bogale (PhD)	_____	_____
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Internal Examiner	Signature	Date
_____	_____	_____
External Examiner	Signature	Date

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List of Abbreviations

MIDI: Metal Industry Development Institute

NPD: New product development

NPS: New Product Strategy

R&D: Research and development

NPI: New Product Introduction

ROI: Return on investment

VOC: Voice of Client

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ABSTRACT

Organizations ability to continuously innovate its product is essential to its business success. Also, firms' survival and improved performance hinge on introduction of innovative new products. This study is a product-oriented project which is focused in technological innovation and/or new product development and introduction process for Metal Industry Development Institute, an institute which offers innovative new products to the Metal and Engineering Industries. The objective of the study is to find and develop a framework which would clarify the entire product development and introduction process and increase the success rate on the new product launches. This study proposes elaborated guidelines which the institute could follow in its product development and introduction process. The product introduction plan was developed based on the Booz, Allen and Hamilton (1982) model, which is a reliable and successful method, used in different successful new product development cases. The Booz, Allen and Hamilton (1982) model was adopted according to the institute´s strategy. The researcher hopes that the final results could help the institute to have a clear understanding of each stage in the product introduction process and implement each of these stages in accordance with the type of the project or new product development strategy. The study also suggests that a research opportunity exists in implementing or testing of the proposed framework. It also be useful to open the door for academic research so as to determine the impact of this study on both practice and research.

Keywords: Technological, New Product Development, Innovation, New Product, Introduction.

CHAPTER ONE

1. Introduction

1.1. Background of the Study

Technological innovation is a critical factor influencing firm's business creativity. It is a major factor influencing the growth of output and productivity. It brings about new ideas, new product development and the development of new technologies and processes in manufacturing and service firms. Thus, it enhances market competitiveness (Tidd, 2001; Soutaris, 2003). Firms need innovations to open up new business gain competitive advantage and successfully increase market share. In the face of rapid technological changes, keen competition and globalization, it has become obvious that firms have to innovate or die. Firms are required to make investment in innovation a priority in their budgets and they should actually be committed to the course of innovation development (Globelics, 2014).

The aim of this thesis is to develop a product development and Introduction process for Metal Industry Development Institute (MIDI). A government owned institution established to assist private investors through Product Identification, Development and Introduction in line with the Basic Metal and Engineering products. The need for this thesis came during the researcher´s working experience with the institution. Among governmental institutions established to support other sectors such as textile, lather etc., MIDI is an older one that creates innovative products for the respective new investments to metal and engineering industries. Developing new unique products that offer several benefits to the investor is the central mission of MIDI.

As the new product development is a continuous process and MIDI is growing its product portfolio continuously, the General Director of the institution felt the need in restructuring the product development and introduction process in a well-defined step-by-step process that is easy to follow and communicate internally.

Product innovation should done on a continuous bases to its products is essential to its business success. To be successful in any industry today, firms must continue to improve on its products.

The process of innovating new products has also been noted for creating new investment for existing firms as well as creating new end-users. However organizational knowledge is a key driver for new product development and introduction, innovations are accomplished when firms translate internal knowledge to new products. The firm's innovation capability is the ability to mobilize the knowledge possessed by its employees (Kogut & Sander, 1992), and combine it to create new knowledge resulting in product and/or process innovation (Cakar & Erturk, 2010).

At MIDI it would be very beneficial to take the successful factors and organize in a structured product development and introduction process which would reduce significantly the risk of a product introduction failure. The newly developed product introduction process should include each step that should be taken when developing new products.

1.2. Statement of the Problem

The empirical literature reviews indicates that the introduction of the product to the market for firms including MIDI was the most problematic stage in the product development and introduction process. A firms' new product strategy should provide a clear understanding of the goals or objectives for the new product program, and should indicate the return-on-investment (ROI) expected such that the contribution of new products to corporate goals is well-understood. Furthermore, clearly defined arenas, i.e., specified areas of strategic focus, such as products, markets, or technologies, are needed to give direction to the firm's total new product program.

The problem at this stage is not only one of developing a clear strategy but also its implementation, i.e., translating the strategy into terms that everyone understands to bring focus to day-to-day actions, and communicating the strategy with other members in the organization. Prior research suggests that companies that recognize the importance of interventional coordination and effectively sharing an NPD across departments will have more successful new products (Cooper, 1999).

The role of new products in achieving institutional goals was clearly communicated to all in such firms. Thus, once a clear NPS, idea generation, screening and building business case, and

product development and testing strategy are clearly defined, the related confounding problem is communicating clearly the needs, requirements, resources, and plans for a new product effort- in essence, internalizing the strategy. In addition, prior to commencing an NPD project, companies must set objectives and devise a clear new product strategy (NPS) to meet them (Wind, 1982). The purpose of this stage is to provide guidance for the new product effort. It identifies the strategic business requirements that the new product should comply with, and these are derived from the corporate objectives and strategy of the firm as a whole. These business requirements assign roles to be played by the new products, which in turn are influenced by the needs of the industry (Booz, Allen & Hamilton, 1982).

Based on the above argument, each stages of the new product development have to be linked with CSFs', Tools and Techniques, and the Metrics and understood by people who engaged in innovative type projects.

The major problem addressed in this study is to understand the complexities of the new product development process that needed for successful new product introduction with internal capability.

Furthermore, this study intends to bring into perspective the vitally important links that connect new product development and introduction from end-to-end by doing so lower the probability of failure rate and maximizing the probability of successful new product development and introduction process.

1.3. Research Questions

The research questions are built to support the objective of this thesis and lead to an end product which is practical understanding and application. The followings are research Questions need to be answered through the process;

1. What is the product introduction process and what are the main steps taken when developing a new product?

2. How to increase the probability of successful product introduction in the case of MIDI?
3. How an existing product development and Introduction process can be modified and adopted to MIDI business case?

1.4. Objective of the Study

1.4.1. General Objective

The primary intention of this study is to explore the institution technological innovation approach and to develop a Model which would clarify the entire product development and introduction process. The finalized product aims to increase the success rate on MIDI ´s new product introduction.

1.4.2. Specific Objectives

To this end, three specific objectives are outline for the study; which are:

1. To identify the Product Introduction process and the main steps taken when developing a new product,
2. To increase the probability of successful Product Introduction in the case of MIDI.
3. To modify the existing product development and Introduction process that can be adopted to MIDI business case.

1.5. Significance of the Study

This study is believed to help in identifying the major causes of failure in developing new innovative products, which are unknown by the end user, in addition to examining the variations of failure/success of product development between and within firms. So the paper with thorough analysis and discussion on the subject matter will forward appropriate recommendations to the concerned management of the institute under consideration so as to create successfully operating projects which in turn benefits the institute.

This study will also be a stepping stone for further research in the area of innovation which is a vitally important, however, ignored to the growth of our nation.

1.6. Scope of the Study

This research is focused in the product development and introduction process which adopts and develops a Product Introduction method with clear steps. These steps can be used as checklist which the institution can edit or modify at any time according to the product type or the Institution´s strategic decision. There are several reasons why a structured product development and Introduction process is necessary within the institution.

Three reasons were stated why a structured Product Introduction is necessary; first, a structured method makes the decision process fully defined, giving the possibility for everyone in the team to understand the basis of the decision and reducing the chance that unsupported decisions move forward. Second, all the important issues will be included in the product development as the steps will be displayed in the checklist which will also act as reminder; third a structured method is normally self-documenting, as during the execution of the process the responsible team documents the decision for future reference. They would also be beneficial for the institution when training new employees, as the practical documentation could be used for educational purpose.

1.7. Limitation of the Study

As the institution mission is so wide and the internal resources are limited, the process is developed as a simple process, avoiding all unnecessary complexities that could possibly be applied in smaller size corporations. However, it is very important to take into consideration the importance and relevance of the information presented. It is also important to mention that the outcome of this study is a ready to modify and product application, as modifications and changes need to be done depending on the project requirements and product types developed. This limitation comes due to the need of the institution for a general product development and Introduction process that can be used in a long term prospective. The thesis researcher has to study the process from a wider prospective application and not study only a given typical product case.

1.7. Operational Definition

Followings are definitions of key terms, namely technological innovation and new product introduction.

Technological innovation is defined as work activities that concern new products and production processes. Technological innovations concerns the generation of breakthrough ideas (Tang & Murphy, 2012).

New product introduction is defined as new business offerings introduced by firms to meet external application or needs in the business environment. New product introduction entail external shaping of the innovations toward application, market entry, competition and viability (Tang & Murphy, 2012).

Following Tang and Murphy (2012) it argued that technological innovations are distinct from new product introduction on two basic premises. First, new product introduction indicate the business significance of an institution's technological innovations, they do not affect institution survival and growth until the ideas inherent in them are introduced to the business. Technological innovations do not generate value for the institution until business viability is realized, a market is discovered, profit is generated, and continuous profit when facing market competition is sustained (Dimov, 2007). The argument holds that the elements of viability derive directly from products not technological innovations. Second, a technological innovation can result in multiple new products and services (Shane, 2000) or, moreover, it may not lead to any new product or services. These argument hold that there is a clear inflection point in firm operations that separate technological innovations from new products introduction. The distinction between these two constructs is relevant and instrumental to institution entrepreneurship activity. Although the notions may seem clear conceptually, very little research assumes and almost no research explicitly describes this important difference. Moreover no study has provided evidence for examining it in Ethiopia.

1.9. Organization of the Study

This research report has five chapters. The first chapter consists of introduction, background information, objectives, scope and limitations, significance of the study, research questions and thesis organization. Chapter two on the other hand, consists of the review of the relevant literature. In the literature review Theoretical Framework: Product Introduction Process (Booz, Allen & Hamilton, 1982), stating that a new product that is introduced on the market evolves over a sequence of stages, beginning with an initial product concept or idea that is evaluated, developed, tested and launched on the market were revisited. Chapter three deals Approach and Methodology, data collection and data analysis. Chapter four contains the analysis of the data gathered by means of data collection methods and instruments indicated in the methodology part. The last chapter discusses about summary, conclusion and recommendation. Finally, references used in the study are listed at the end. Interview guide and questionnaire used are also attached in the Appendix part.

CHAPTER TWO

2. Review of Related Literature

2.1. Theoretical Literature Review

2.1.1 New Product Development

The New Product Development (NPD) process consists of the activities carried out by firms when developing and launching new products. A new product that is introduced on the market evolves over a sequence of stages, beginning with an initial product concept or idea that is evaluated, developed, tested and launched on the market (Booz, Allen & Hamilton, 1982). This sequence of activities can also be viewed as a series of information gathering and evaluation stages. In effect, as the new product evolves, management becomes increasingly more knowledgeable (or less uncertain) about the product and can assess and reassess its initial decision to undertake development or launch. Following this process of information gathering and evaluation can lead to improved new product decisions on the part of firms by limiting the level of risk and minimizing the resources committed to products that eventually fail. The NPD process differs from industry to industry and from firm to firm. Indeed it should be adapted to each firm in order to meet specific institutional resources and needs (Booz, Allen & Hamilton, 1982).

A number of detailed NPD models have been developed over the years, the best known of which is the Booz, Allen and Hamilton (1982) model, shown if Figure 1, also known as the BAH model, which underlies most other NPD systems that have been put forward. This widely recognized model appears to encompass all of the basic stages of models found in the literature. It is based on extensive surveys, in depth interviews, and case studies and, as such, appears to be a fairly good representation of prevailing practices in industry.

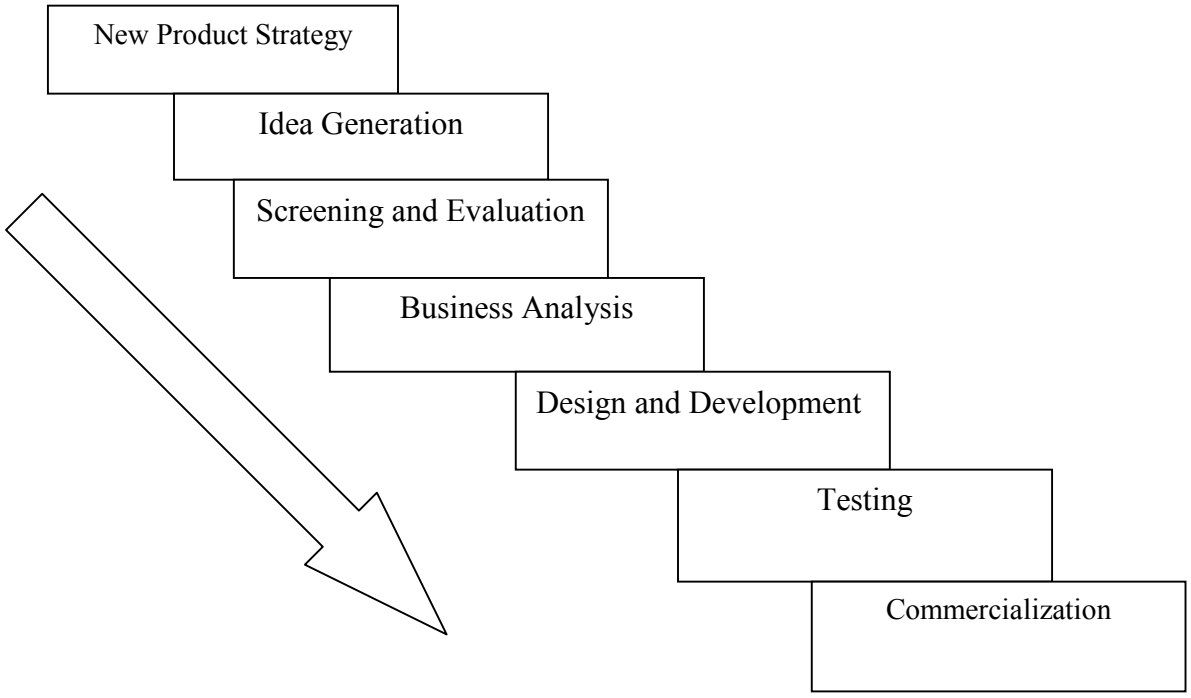

Figure 2.1 Stages of New Product Development (NPD) (Booz, Allen and Hamilton, 1982)

The stages of the model are as follows:

- *New Product Strategy*: Links the NPD process to the institution objectives and provides focus for idea/concept generation and guidelines for establishing screening criteria.

- *Idea generation*: Searches for product ideas that meet the institution objectives.

- *Screening*: Comprises of an initial analysis to determine which ideas are pertinent and merit more detailed study.

- *Business Analysis:* Further evaluates the ideas on the basis of quantitative factors, such as profits, Return-on-investment (ROI), and sales volume.

- *Development*: Turns an idea on paper into a product that is demonstrable and producible.

- *Testing*: Conducts commercial experiments necessary to verify earlier business judgments.

- *Commercialization*: Launches products.

Booz, Allen and Hamilton (1982) found that companies that have successfully launched new products are more likely to have some kind of formal NPD process and that they generally pass through all of the above stages. Our framework is based on the BAH model, however, we exclude the commercialization stage; while this stage represents an important area of concern, our study deals with the pre-commercialization stages of the NPD process.

2.1.2. Critical Success Factors for Stages of New Product Development

Over the last two decades, several studies have examined the determinants of NPD success and identified many factors that distinguish successful products from unsuccessful ones. Factors that are necessary and guarantee commercial success are termed as critical success factors (CSF): it is imperative to reflect on how one can benefit from each and how one can translate each into an operational aspect of the NPD process. Daniel (1961) and Rockart (1979) proposed that organizations need to identify factors that are critical to the success of that organization, and they suggested that the failure to achieve goals associated with those factors would result in organizational failure. In fact, it is even suggested that NPD itself is a CSF for many organizations. Given that this is now a well-known fact, the idea is to determine what factors in NPD are essential for success, and how to measure the extent of this success. The challenge is to design a process for successful product innovation - a process whereby new product projects can move quickly and effectively from the idea stage to a successful launch and beyond.

2.1. 3. Metrics for Stages of New Product Development

A metric tracks performance and allows a firm to measure the impact of process improvement over time. Metrics can play an important role in helping companies to enhance their NPD efforts and are important for at least three reasons. First, metrics document the value of NPD and are used to justify investments in this fundamental, long term, and risky venture. Second, good metrics enable Chief Executive Officers and Chief Technical Officers to evaluate people, objectives, programs, and projects in order to allocate resources effectively. Third, metrics affect behavior. When scientists, engineers, managers, and other NPD employees are evaluated on specific metrics, they often make decisions, take actions, and otherwise alter their behavior in

order to improve the metrics. The right metrics align employees' goals with those of the corporation; wrong metrics are counterproductive and lead to narrow, short-term, risk-avoiding decisions and actions.

Any metric that might be applied to NPD will often focus on one function or another or on the entire NPD process. But no one function is the sole contributor to the process that produces new products. A metric for the productivity of the R&D organization, for example, may show constant improvement. In spite of this improvement, however, there may be no improvement in the rate at which new products reach the market (Beliveau et al., 2002). What is important to measure is the effectiveness of the stages of NPD process in an interdependent fashion. A lack of useful metrics is undoubtedly one reason that the success rate of NPD has not improved appreciably over the past 40 years Crawford (1979, 1992). If companies had reliable metrics to gauge their performance, then specific problem areas could be addressed and managers might see the same improvement in their NPD efforts that they come to expect from their quantifiable total quality management programs (Lynn & Reilly, 2000).

2.1.4. Critical Success Factors and Metrics for Stages of the NPD process

In what follows, each stage of the NPD process and its respective CSFs, metrics, and tools and techniques for measuring progress is explained in detail.

2.2. Empirical Literature Review

2.2.1 New Product Strategy

Prior to commencing an NPD project, companies must set objectives and devise a clear new product strategy (NPS) to meet them (Wind, 1982). The purpose of this stage is to provide guidance for the new product effort. It identifies the strategic business requirements that the new product should comply with, and these are derived from the corporate objectives and strategy of the firm as a whole. These business requirements assign roles to be played by the new products, which in turn are influenced by the needs of the industry (Booz, Allen & Hamilton, 1982).

CSFs for NPS

A firms' strategy should provide a clear understanding of the goals or objectives for the institution's new product program, and should indicate the return-on-investment (ROI) expected such that the contribution of new products to corporate goals is well-understood. Furthermore, clearly defined arenas, i.e., specified areas of strategic focus, such as products, markets, or technologies, are needed to give direction to the firm's total new product program.

The problem at this stage is not only one of developing a clear strategy but also its implementation, i.e., translating the strategy into terms that everyone understands to bring focus to day-to-day actions, and communicating the strategy with other members in the organization. Prior research suggests that companies that recognize the importance of interventional coordination and effectively sharing an NPS across departments will have more successful new products (Cooper, 1999).

The role of new products in achieving institutional goals was clearly communicated to all in such firms. Thus, once a clear NPS is defined, the related confounding problem is communicating clearly the needs, requirements, resources, and plans for a new product effort - in essence, internalizing the strategy. This communication must take place in multiple forms; however, a well-documented plan and specification must serve as the foundation. In summary, the establishment and communication of a clear plan and a strategy for an NPD project is a key requisite for success. Businesses that have a well-articulated NPS fare much better than those lacking in this aspect and they have 32 percent higher NPD success rates, meet sales objectives 42 percent more often, and meet profits objectives 39 percent better (Cooper & Kleinschmidt, 1995).

Metrics for NPS

The return-on-investment (ROI) compares the institution's yearly income with the investment in the asset. While the ROI is not too challenging, management should understand how the ROI benchmarks have been calculate so that relevant comparisons can be made for the project under evaluation. The institution's ROI proves to be useful in setting the new product goals. This metric will help to determine if the cost to develop a new product exceeds the resulting benefit,

or if the payback affects the corporate bottom line. The aim here is to compare the return expected to be received from the project with some pre-established requirement. This long-term metric set by the corporate objectives should be linked with the NPS.

Tools and Techniques for NPS

The Balanced Scorecard (BSC) provides the instrument the firm needs to navigate to future competitive success (Kaplan & Norton, 1996). BSC translates an organization's strategy into a comprehensive set of performance measures that provides the framework for a strategic measurement and management system. The scorecard measures organizational performance drivers across four perspectives which provide its framework: financial, customers, internal business processes, and learning and growth. The objectives and the measures of the BSC are the collection of financial and non-financial performance measures; they are derived from a top-down process driven by the strategy of the business unit. The measures are balanced between the outcome measures - the results from past efforts - and the measures that drive future performance. The scorecard is balanced between objectives, easily quantified outcome measures and subjective performance drivers of the outcome measures. Organizations should use the scorecard as a strategic management system, to manage their strategy over the long run and use it for the measurement focus of the scorecard to accomplish critical management processes, including communicating and linking strategic objectives and measures.

The BSC strategic objectives and measures are communicated throughout an organization via the institution newsletters, bulletin boards, videos, and even electronically through groupware and networked personal computers. The communication serves to signal to all employees of the critical objectives that must be accomplished if an organization's strategy is to succeed. Once all employees understand high-level objectives and measures, they can establish local objectives that support the business unit's global strategy.

The organizational communication and education program should not only be comprehensive but also periodic. Multiple communication tools can be used to launch the BSC program: executive announcement, videos, meetings, brochures and newsletters. This initial announcement should

then be followed continually, by reporting scorecard and outcomes on bulletin boards, newsletters, groupware, and electronic networks. The design of such a program should begin by answering fundamental questions:

- What are the objectives of the communication strategy?
- Who are the target audiences?
- What is the key message for each audience?
- What are the appropriate media for each audience?
- What is the time frame for each stage of the communication strategy?
- How will top management know that the communication has been received?

The BSC links financial objectives to corporate strategy. The financial objectives serve as the focus for the objectives and measures in all the other scorecard perspectives. Every measure should culminate in improving financial performance. The scorecard starts with long-run financial objectives, and then links them to the sequence of actions that must be taken with financial processes, customers, internal processes, and finally employees and systems to deliver the desired long run economic performance. Many corporations, however, use identical financial objectives for all of their divisions and business units. This uniform approach is certainly feasible, consistent, and fair since all business unit managers will be evaluated by the same metric, but different business units may follow quite different strategies.

2.2.2. Idea Generation

After setting a well-defined NPS for NPD, the idea generation stage begins, where the search for product ideas is made to meet institutional objectives. The idea generation concerns the birth, development, and maturation of a concrete idea. After defining the markets and segments based on the NPS it wishes to target, the firm must advance and nurture ideas wherever they occur to take advantage of the identified opportunities. As per the study done by Booz, Allen and

Hamilton (1982), a firm has to generate at least seven ideas to generate one successful. Griffin (1997) says that an average of 100 ideas must be generated in order to yield 15.2 successes.

CSF for Idea Generation

Customer focused idea generation is a CSF for this stage as per studies done by many researchers that show that a thorough understanding of customer's needs and wants is vital for new product success (Cooper, 1993; Crawford, 1987). Successful businesses and teams that drive winning new products have a dedication towards the voice of the customer. A strong customer involvement is necessary right from the idea generation stage. According to Souder's (1987) review of causes of NPD success and failure, he concluded that internally generated ideas had lower success rates then externally generated ideas. A relatively high rate of success is achieved for project ideas that originated from marketing and customers as compared to ideas originating from R&D, suppliers, and management.

Metrics for Idea Generation

Metrics to track idea generation and enrichment include: number of ideas generated from the customer, number of ideas retrieved and enhanced from an idea portfolio, number of ideas generated over a period of time, and the value of ideas in idea bank. Among all of these metrics, the number of ideas generated from the customer is the most associated with the CSF of the idea generation stage. Firms must devote more resources to customer based idea generation activities, such as focus groups with customers; detailed, one-on-one interviews with customers; customer site visits, especially by technical people; the active solicitation of ideas from customers by the sales force; and the development of a relationship with lead users (Cooper, 1999).

Tools and Techniques for Idea Generation

Understanding customer and market needs is a consistent theme for successful product development in studies by Song and Parry (1996) and Cooper (1999). There are many creativity and brainstorming techniques for enriching the idea stream. Effective methods for enriching the customer based idea stream utilize lead user methodology and ethnographic approaches.

The lead user methodology takes a different approach as compared to traditional approaches in which ideas are generated based on customer input and usually collect information on new product needs from a random or typical set of customers. The lead user process collects information about both needs and solutions from the leading edges of the target market and from markets facing similar problems in a more extreme form. The rich body of knowledge collected during this process continues to be useful during the remaining steps of product development and marketing (Lilien et al., 2002).

An ethnographic approach is a descriptive, qualitative market research methodology for studying the customer in relation to his or her environment (Cooper & Edgett, 2008). Researchers spend time in the field observing customers and their environment to acquire a deep understanding of customer's lifestyles or cultures as a basis for better understanding their needs and problems. In this approach, observation, interviews and the documentation are done for traces that people leave as they go about their everyday lives. Since it allows the use of multiple converging perspectives - what people say, do, and use - it will always reveal more and provide greater insight. This deeper level of understanding is derived from customer to generate customer-based ideas.

2.2.3 Screening and Business Analysis

While the screening and business analysis are proposed as two different stages in the BAH model, we consider the two stages as one for simplicity of the proposed framework. In the screening stage, initial analysis is done based on the NPS, resources and competition, while in the business analysis stage, ideas are evaluated using quantitative performance criteria. After gathering enough new product ideas through various sources from the idea generation stage, which ideas to pursue will be selected based on the business value they bring. Making a good selection is critical to the future health and success of the business. The point is that product development costs rise substantially with each successive stage in the NPD process (Booz, Allen & Hamilton 1982). The ideas that have been classified as "Go" ideas must be screened further using criteria set up by top management (Cooper & de Brentani, 1984; de Brentani, 1986). These ideas must be described on a standard form that can be accessed by a new product committee. The committee then assesses each idea against a set of criteria, which verify the attractiveness

and visibility of the idea as well as its fit with the institution's strategy, objectives and resources. The ultimate result from screening and evaluation is a ranking of NPD proposals, such that the resources can be allocated to the projects that seem most promising.

After screening, the business analysis is the detailed investigation stage that clearly defines the product and verifies the attractiveness of the project prior to heavy spending. According to Cooper's NewProd studies of new product, it was shown that weakness in the upfront activities seriously compromises the project performance. Inadequate market analysis and a lack of market research, moving directly from an idea into a full-fledged development effort, and failure to spend time and money on the up-front steps, are familiar themes in product failures. The quality of execution of the predevelopment steps is closely tied to the product's financial performance (Cooper, 1980).

In every successive stage of the NPD process, as estimates become more refined and accurate, companies should continue conducting financial evaluation throughout the NPD process, but at this stage it is critical. A review of a costs, potential sales and profit projections of the new product are undertaken in order to determine whether these factors satisfy the institution's objectives or not. If a result from this stage shows that the product meets the objectives, then the new product concept can move to the development stage. According to Griffin (1997) among the firms taking part in study, 75.6% developed formal financial objectives against which performance was measured. The final component of the business analysis stage is the action plan. A detailed plan of action is created for the next stage and tentative plans are developed for all subsequent stages. This critical stage opens the door to a significant commitment of resources and to a full-fledged development program based on financial analysis which forms the base for the CSF and its metrics proposed for this stage.

CSF for Screening and Business Analysis

Up-front homework is a CSF for the screening and business analysis stage as too many new product projects move from the idea stage right into development with little or no early preparation (Rosenau et al., 1996). The results of this approach are usually disastrous. Up-front homework includes activities such as financial analysis, undertaking thorough market and

competitive analyses, research on the customer needs and wants, concept testing, and technical and operations feasibility assessments. Solid pre-development work drives up new product success rates significantly and is strongly correlated to financial performance. All of these activities lead to solid business analysis prior to beginning serious development work. Firms devote on average only seven percent of a project's funding and 16 percent of the person-days to these critical up-front homework activities, which is not enough to make a successful product according to the NewProd (1999) study. The conclusion is that more time and resources must be devoted to the activities that precede the design and development of the product.

As per a study done by Cooper et al. (2000), the most dominant method used by 40.4% of businesses for performance results is a financial approach, followed by strategic approaches and scoring models. Using financial methods, profitability, return, payback or economic value of the projects are determined and projects are judged and rank-ordered on these criterion.

Metrics for Screening and Business Analysis

Financial or economic models treat project evaluation much like a conventional investment decision. The expected commercial value (ECV), net present value (NPV), internal rate of return (IRR), and the profitability index (PI), are metrics that are proposed as being most useful for measuring the success of the screening and business analysis stage. These metrics should be used to rate, rank order, and ultimately select projects. All metrics have their own advantages and disadvantages. For example, the NPV method ignores probabilities and risk; it assumes that financial projections are accurate and financial goals are important. The ECV depends on extensive financial and other quantitative data. These metrics together give clearer details about the project's financial performance to help select the best project from the group.

Tools and Techniques for Screening and Business Analysis

The financial methods of evaluation for the proposed metrics and how they measure the financial performance of each project are explained below.

The Expected Commercial Value (ECV) method seeks to maximize the value or commercial worth of the project, subject to certain budget constraints, and introduces the notion of risks and

probabilities. The ECV method determines the value or commercial worth of each project to the corporation. The calculation of the ECV is based on a decision tree analysis and considers the future stream of earnings from the project, the probabilities of both commercial success and technical success, and both commercialization costs and development costs. Therefore, the expected Customer Value (ECV) measures the value of the project in terms of its expected financial returns from the perspective of the institution's overall commercial strategic objectives. In order to arrive at a prioritized list of projects, the ECV of each project is determined projects are rank ordered accordingly.

The net present value (NPV) criterion for evaluating proposed capital investments involves summing the present values of cash outflows required to support an investment with the present value of the cash inflows resulting from operations of the project. The inflows and outflows are discounted to present value using the firm's required rate of return for the project. If the NPV is positive, it means the project is expected to yield a return in excess of the required rate; if the NPV is zero, the yield is expected to exactly equal the required rate; if the NPV is negative, the yield is expected to be less than the required rate. Hence, only those projects that have a positive or zero NPV meet the criterion for acceptance.

The internal rate of return (IRR) is that rate which exactly equates the present value of the expected after-tax cash inflows with the present value of the after-tax cash outflows. Once the IRR of a project has been determined, it is a simple matter to compare it with the required rate of return to decide whether or not the project is acceptable. If the IRR equals or exceeds the required rate, the project is acceptable. Ranking the projects is also a simple matter. Projects are ranked according to the IRRs: the project with the highest IRR is ranked first and so on.

The profitability index (PI) is the ratio of the present value of the after-tax cash inflows to the outflows. A ratio of one or greater indicates that the project in question has an expected yield equal to or greater than the discount rate. The profitability index is a measure of a project's profitability per dollar of investment. As a result, it is used to rank projects of varying costs and expected economic lives in order of their profitability. Projects are rank-ordered according to this productivity index in order to arrive at the preferred portfolio, with projects at the bottom of the

list placed on hold. In order to ensure that project ideas are carefully screened, and that the business analysis is carefully carried out, these metrics are certain to help select projects so as to maximize the sum of the values of all active projects in the firm's pipeline in terms of business objectives.

2.2.4 Product Development

Once the results of the business case of the new product conform to institutional objectives, the new product team can move on to the development stage, which is made up of activities that range from prototype development to volume ramp up and test marketing. The interaction between the program and project manager is no longer one of selling or buying the concept, but rather one of bringing the product to market on time, within budget, and to the required specifications.

On average, one third of total NPD expenditures are committed during this stage with 40 percent of total NPD time (Cooper, 1999). In the development stage, business case plans are translated into concrete deliverables. What is critical for success at this stage to move through development to launch as quickly as possible is to ensure that the product prototype or final design does indeed meet customer requirements, which requires seeking customer input and feedback throughout the entire development stage. It is important to gain competitive advantage and to enjoy the product's revenues as soon as possible and it also minimizes the impact of a changing environment. Thus, as the product proceeds from one step of the development stage to the next, the new product team should reassess the market, position, product, and technology in order to increase chances of delivering a successful product (Cooper, 1993; Urban & Hauser, 1993). Marketing and R&D functions in particular should collaborate because, while marketing can express the needs of customers, R&D has the capacity of turning a product concept into an actual physical entity. Therefore they should work together to ensure the product meets customer requirements. Cross-functional teams are widely used in companies to help in identifying and solving problems efficiently by coordination of resources and ideas. Customer input and feedback is a critical activity throughout development, both to ensure that the product is right and also to speed development toward a correctly defined target.

CSFs for Product Development

Development of new products often takes years, and much that is unexpected can occur during this time frame. The market may change partway through development, making the original estimates of market size and product acceptance invalid. Customer requirements may shift, rendering the original set of product specifications obsolete. Competitors may introduce similar products in the meantime, creating a less receptive market environment. These and other external changes mean the original product definition and justification are no longer valid.

Reducing development time is a vital competitive weapon and yields competitive advantage; it means that there is less likelihood that the market or competitive situation has changed by time the product reaches the market and it means a quicker realization of profits Cooper (1993, 1999, 2001). Companies that develop products quickly gain many advantages over their competitors: premium prices, valuable market information, leadership reputation with consumers, lower development costs, and accelerated learning (Cooper, 2001). Therefore, the goal of reducing the development time is critical. Most importantly, fast development minimizes the impact of a changing environment. If the development time can be reduced from eighteen months to nine, the odds of things changing are similarly greatly reduced that makes the need to reduce the time during the development stage. Most firms have reduced product development times over the past five years with the average reduction being about the one-third. In short, the challenge here is to shorten development time so as to minimize the chances that the development target has changed.

Seeking customer feedback is a vital activity throughout development stage, both to ensure that the product design is right and also to speed development toward a correctly defined target. The original voice-of-customer research that was done prior to development may not be enough to resolve all the design problems during development (Cooper, 1999). Customer feedback is perhaps the most certain way of seeking continual and honest customer input during the development phase. Seeking customer input should become an integral part of the design team to speed up and make development stage successful.

Metrics for Product Development

Development time is defined as the duration from the start to completion of the development stage, i.e., the length of time to develop a new product after passing business case stage to initial market sales. Precise definitions of the start and end point vary from one institution to another, and may also vary from one project to another within the institution. How quickly the team moves through this stage is critical for the reasons stated earlier, and as such, it is imperative that the team measures their progress according to time.

A cross-functional team is defined as a team consisting of representatives from the various functions involved in product development, usually including members from marketing, R&D, and operations (and perhaps others, such as purchasing, as needed). The most effective development teams also involve suppliers in the early stages of development, and frequently rely on suppliers for a large portion of the subsystem design (Clark & Fujimoto, 1988). Cross-functional teams have replaced a more functional approach in which each team relinquishes project responsibility to a down-stream function (e.g. the engineering team hands-off to the manufacturing team). This paradigm requires frequent communication between functions represented on the team and co-location greatly facilitates this process. Cross-functional teams are essential for timely development, improving design quality, and lowering development costs. Cross-functional integration that really matters occurs when individual design engineers work together with individual marketers or process engineers to solve joint problems in development. True cross-functional integration occurs at the working level. It rests on the foundation of tight linkages in time and in communication between individuals and groups working closely related problems. How these groups work together determines the extent and effectiveness of integration in the design and development of the product (Wheelwright & Clark, 1992).

Related to the above is the degree to which team members are committed, or dedicated, to the project. Since project team members' time commitments are typically spread across a number of projects at any one time because departmental managers are vying for team members' time, team members are often on and off development projects. This creates a discontinuity and increases development time. It is in this stage that it is crucial to have a team with dedicated team

members. A dedicated, accountable team leader, that is not doing too many other projects or other assignments at the same time and held accountable for the result.

Parallel processing involves activities that are undertaken concurrently (rather than sequentially), thus more activities are undertaken in an elapsed period of time. The purpose is to achieve product designs that reflect customer wants as well as manufacturing capabilities and to do so in the shortest possible time. However, due to the need for prerequisite information, not all activities or phases in the NPD process can be overlapped with minimal risk. Therefore, the degree of parallelism must be measured to ensure minimal downstream risk.

The degree of design effort on real customer needs is a qualitative in-process metric which ensures as much as possible that the final design meets customer requirements. This requires seeking customer input and feedback throughout the entire development stage and thus the customer becomes an integral part of the design team to overcome technical problems that arise and that necessitate product design changes during the development stage. Customer needs and wants assessment must be a vital and ongoing activity throughout development, both to ensure that the product is designed right and also to speed development toward a correctly defined target.

Tools and Techniques for Product Development

The literature review has shown that there exist a number of tools and techniques to reduce development times that are consistent with sound management practice.

Dynamic time to market is a tool which can be useful in predicting the end date of the said project as well as in tracking the progress of a project. It works in the following way: when a schedule prediction is made, the prediction date is plotted against the date the prediction was made. By assessing dynamic time to market, the team members will get an early warning of potential late delivery and appropriate action can usually be taken by the team to maintain schedule integrity. Thus projects are kept on schedule to achieve timely product development.

The degree of team cohesiveness gauges the growth of the team as a working group and it is a function of length of time that a team has worked together in a past or present project (Balakrishnan, 1998). It is the extent to which team members are attracted to the team and motivated to remain in it.

Overlapping means doing various activities in parallel rather than doing them sequentially. By overlapping activities, the cycle time, i.e. the total time taken to complete the product development from concept until the product reaches market, can be greatly reduced. Overlapping activities saves time due to 1) parallel processing of activities, 2) better and more timely identification of design problems, and 3) improved communication earlier and throughout the team. This metric serves as an indicator of the degree of concurrency in the process. In general, the higher the number of overlapped activities, the higher the degree of concurrency and the shorter is the development time. A lower number of overlapped activities indicates a lower degree of concurrency in the process and may also indicate opportunities for improving the process to achieve objectives.

2.2.5 Product Testing

The purpose of this stage is to provide final and total validation of the entire project: the commercial viability of the product, its production, and its marketing (Cooper & Kleinshmidt, 1987). Design and testing go hand in hand, with testing being conducted throughout the development stage. Information obtained during testing is used in developing the product. This phase is extremely important in that it may dramatically decrease the chances of failure in launch, since it has the capacity of revealing flaws that could cause market failure (Urban & Hauser, 1993). Studies by Cooper (1998, 1999) show that a test phase that is customer oriented is the critical factor - whether it is done and how well it is executed - is significantly correlated with the new product success. Different types of testing, i.e. concept testing, prototype/development testing, and test marketing, should be conducted in this stage Cooper (1993, 1998, 2001). It should be noted, however, that testing should not be solely restricted to this stage; it must be conducted throughout the NPD process (Ulrich & Eppinger, 2011).

CSF for Product Testing

Product functionality is critical for the testing stage as the aim here is to see whether a product with the attributes called for has been produced. It must be proven that claimed attributes exist and the causes for missing attributes must be found.

Customer acceptance is critical for this stage to gauge whether the product is acceptable to the customer, to measure the customer's level of interest, liking, preferences, and intent to purchase, and to determine those benefits, attributes, and features of the product to which the customer responds. Not only must the product work right in the lab or development department, but, more importantly, it must also work right when the customer uses it. The product must excite and, indeed, delight the customer; who must find it not only acceptable but actually like it better than what he or she is currently buying. In short, the customer reaction must be sufficiently positive so as to establish purchase intent.

Metrics for Product Testing

The performance of a product is how well the product achieves the functionality desired. Product performance is usually measured in such ways as testing physical features, perceptual features, functional modes, and perceived benefits. Feature is those aspects of an offering that create the benefits; they are typically a focal point of NPD. Perceived benefits are the best point in the needs continuum on which to focus conversations with customers because they represent customer-oriented perceptions but are still close enough to supplier-oriented features to permit that linkage to be made by the product developer. Validation and user testing techniques are used to gather data on product performance. These primary research techniques generate quantitative results. At this stage in the NPD process, these are the types of research results necessary to make final critical decisions and reduce the risk of possible failed launches.

Customer-perceived value is measured to determine whether the customer is willing to purchase the tested product or not and to gauge whether the product is acceptable to the customer. Important metrics for this stage are: perceived relative performance, customer satisfaction (Like/Dislike), and the preference score to determine the nature of the competitive situation. These are qualitative metrics, but are very important nonetheless to record the basic likes/dislikes

of the customer early before the product gets launched into the market. Based on the qualitative data, managers can take action to make changes in the product.

Tools and Techniques for Product Testing

Validation testing is of a product model that closely resembles the final product that will be manufactured and sold, and is often called system testing and usually takes place in-house. The purpose of the testing process is to ensure that all product performance requirements and design specifications have been met. The validation test is normally conducted late in the development process to ensure that all of the product design goals have been met. This includes usability, performance, and robustness. Validation tests normally aim to evaluate actual functionality and performance, as is expected in the production version and so activities should be performed in full. It is probable that the validation test is the first opportunity to evaluate all of the component elements of the product together, although elements may have been tested individually already. Thus, the product should be as near to representing the final item as possible, including packaging, documentation and production processes. Also included within validation tests will be any formal evaluation required for certification, safety or legislative purposes.

Data from a validation test is likely to be quantitative, based on measurement of performance. Normally, this is carried out against some benchmark of expected performance or criteria set before. Usability issues may be scored in terms of speed, accuracy or rate of use, but should always be quantified. Issues such as desirability may be measured in terms of preference or user ranking. Data should also be formally recorded, with any failures to comply with expected performance logged and appropriate corrective action determined.

User and field testing is performed by real users or customers, and in some cases, this testing must precede product shipment. This is not to be confused with marketing customer testing, where certain strategies regarding sale and marketing of the product are explored. The purpose of testing is to understand how the product performs in the end-user environment. Customer based testing is indeed complex, and there is no way it can be simulated in laboratories, where use is isolated from users' mistakes, competitive trashing of the concept, and objections by those in the user firm or family whose work or life is disrupted by the change. Products that are entirely new

to the market should receive beta testing because there is no base of data on which to judge customer acceptance.

Test protocols are produced by the institution and can range from rigorous to nonexistent. In the first case, the developer closely monitors and follows up the testing with in-house staff. In the second case the developer may simply contact the client by phone or has as group or individual contact to ask for opinions on the product. The test results attempt to confirm that the user feels the same toward the prototype as toward the verbal concept discussed earlier in the NPD stage. The results of the testing either confirm that the product meets its requirement or show the areas where the product is deficient, and is therefore a critical stage to be considered in the development process.

2.3. Research Gap and Conceptual Framework

2.3.1. Framework of CSFs, Metrics and Tools & Techniques for NPD

The CSFs, metrics, tools and techniques proposed for successful NPD discussed in the previous sections are all summarized in the framework proposed in Table 2.1.

For each stage of the NPD process, the factors that are essential for success for each stage, metrics which can be used to measure the performance of those factors, and tools and techniques to implement the metrics are all detailed in the framework. As a preliminary proposed framework, I believe that any complex NPD project that follows this framework will have an increased chance at success.

Table 2.1 Conceptual Framework of Critical Success Factors and Metrics for Stages of NPD Process

Stage	Critical Success Factor	Metrics	Tools and Technique
New Product Strategy	Clear Strategy	Return on Investment	Financial Analysis
	Well Communicated Strategy	Degree of Communication	Balanced-scorecard as a Communication Tool
Idea Generation	Customer Focused Idea Generation	Number of Customer Focused Ideas Generated	Lead User Methodology
Screening and Business Case	Up-Front Homework	Expected Commercial Value (ECV)	Financial Method of evaluation
		Net Present Value (NPV)	
		Internal Rate of Return (IRR)	
		Productivity Index (PI)	
Development	Speed	Development time	Team Cohesiveness
	Customer feedback	Degree of functional integration	Dynamic Time to Market
		Degree of team commitment	Degree of Parallelism
		Concurrency of activities	
		Degree of design effort on real customer priorities	
Testing	Product Functionality	Product Performance	Validation Testing
	Customer Acceptance	Customer-Perceived Value	User and Field Testing

CHAPTER THREE

3. Research Methodology

3.1. Description of the Study Area

Metal Industry Development Institute is a governmental institution, re-established in 2011 to accomplish a wider objective in that the former mission of the firm was totally changed in order to support and assists the private investors who are engaged in line with the metal and engineering products manufacturing. The institute is located here in Addis Ababa around Gerji area close to Anbessa Garage.

3.2. Research Design

The research design that is followed on this product-oriented thesis is exploratory research. An exploratory study is a valuable means of finding out what is happening, to seek new insights; to as of questions and to asses phenomena's in a new light. It is particularly useful if one wishes to clarify understanding of a problem. is used when the expectations are unknown and the re-searcher needs to define the problem or to develop an approach to the problem.

3.3. Research Approach

The study approach employed is Qualitative focused on literature review and in-depth interviews. Comparing to the quantitative research, the qualitative research goes deeper into the issue and the researcher can gather more detailed information (Mora 2010; Silverman 2005).

The researcher has used different reliable sources such as books, magazines, online articles and other internet sources to create a product development and introduction model. After reviewing the theory and understanding of the main stages of the product introduction process, the researcher analyses the product introduction process that MIDI has been applying during the last five years. From the theoretical review only the relevant information that applies to MIDI's

business case is analyzed and then compared with the existing approach that MIDI has been following so far.

3.4. Target Population and Sampling Method

In this study the researcher used non-probability sampling technique. Because according to Saunders (2009); non probability sampling provides a range of alternative techniques to select samples based on your subjective judgment. From non-probability sampling techniques the researcher used purposive sampling technique. Purposive or judgmental sampling enables you to use your judgment to select cases that will best enable you to answer your research question(s) and to meet your objectives (Saunders, 2009).

The population of the study consisted of three (3) of the top management staffs who manage the overall institutional product development activities and eleven (11) core process owners (Directorate Directors) involved in the management from idea generation to product introduction stages who are selected judgmentally from not less than five hundred (500) employees engaged in the institutional product design and development, and product testing and Introduction processes. The researcher also involved two(2) participants from the support staff, Therefore; the total number of population of the study was about 230. The researcher kept in mind ethical issues in the process of involving the participants and did the best to get the data required for the purpose of the study.

3.5. Data Sources and Types

3.5.1 Primary Data Sources

The primary data was personal interviews and questionnaire for 3 managerial staffs (one General and two Deputy General Directors) at the top management level as well as conducting focus group discussion and through questionnaire to eleven core line managers (Directorate Directors) and two from the support staffs.

3.5.2 Secondary Data Sources

The source of secondary data includes the forms and templates used in product design and development, product testing and launching manuals, the newly developed organizational structure of the institute, and from related books and journals in general.

3.6 Data Collection Procedures

As mentioned in the chapter above the main and most important data comes from the theoretical review and internal analysis of the institution's existing material. Firstly an interview with the management and R&D team is conducted. The interview aim is to gather detailed information about the current product development process in the institution and the future vision on the product development process. All the internal existing materials and researches which, are related to product development and product launch, are reviewed. Secondly, the literature review has been presented. The literature studies are focused in the entire product launch process with a BAH model, which matches the institution's product strategy and the current developing model. This process starts from the idea generation and end up with the launch of the product matching the clients need. By creating a visual concept on the product launch process, it is easier to understand the best practices which companies should use for maximizing their product launch success.

Another important source is the researchers working experience in the institution. During the last year from many investors in the area and a number of workshops meetings, the thesis researcher has collected valuable feedback relating the launch of the institute's new products. The feedback also includes interviews prepared for the institution higher officials. The opinion is very valuable as those have a different relationship with the institute, and approach the metal and engineering industries in a different way.

3.7 Data Analysis Method

After reviewing the literature from different sources, the thesis researcher analyses the current situation at the institute. The existing materials such as product development plan, launching plan, and other related document are analyzed and compared with the literature suggestions. The qualitative research conducted with the R&D and Management team are used to better understand how the institution is managing the product introduction process, and what is expected to being developed in the near future.

3.8. Ethical Considerations

The ethical issues need to be considered in a scientific research were also considered in this study. The study results depend on the data provided by the respondents and the qualitative data obtained from interview and document review and the process is realistic and bias free. In addition, the researcher asked for consent of the interviewees and pledged to keep the confidentiality of the information gathered to conduct this study.

CHAPTER FOUR

4. Results and Discussion

In this chapter the researcher analyses the results which were found during the analysis of the institution's current situation and the theory on the Product Introduction process, studied from different sources. The chapter is divided in two main parts; First analyzing MIDI´s Product Introduction process according to the Stages of new product development (Booz, Allen & Hamilton, 1982). Second, analyzing the Commercialization/Introduction process separately is taken as an important topic of this thesis.

4.1. Results

Majority (85.7%) of respondents was male, the majority of respondents were in the age of 25-35yrs and also the major players of the Innovation activities are a B.Sc. and equivalent educational background (Table 4.1).

Table 4.1: Socio-Demographic Characteristics of Respondents in terms of Gender, Age and Educational Qualification

Parameters	**characteristics**	**frequency**	**Percentage**
Gender	Male	12	85.7
	Female	2	14.3
Total		**14**	**100.0**
Age of respondents	25-35yrs.	7	50.0
	35-44yrs.	4	28.6
	45-54yrs.	3	21.4
Total		**14**	**100.0**
Educational Qualification	B.Sc./B.A/Equivalent	9	64.3
	Masters	5	35.7
Total		**14**	**100.0**

Source: Metal Industry Development Institute (MIDI), Human Resource Management Directorate Office

See the institution background in Table 4.2 shown below.

Table 4.2: Institution's Profile

Parameters	**characteristics**	**frequency**	**percentage**
Year of Establishment	2011		
No. of Employees	Male	127	55.2
	Female	103	44.8
Total		**230**	100.0

Source: Metal Industry Development Institute (MIDI), Human Resource Management Directorate Office.

Though the main objective of the institution is to promote technological innovation and new product introduction, as indicated in Table 4.3, beginning from its establishment only 7 new product were realized from end-to-end

Table 4.3: Institution's Capability to New Product Development and Introduction

Parameters	**characteristics**	**frequency**	**Percentage**
Number of Technology Innovation (Completed)	4	4	33.3
Number of Product Introduced	7	7	58.3
No of NPD under Testing	1	1	8.3
Total	**12**	**12**	**100.0**

Source: Metal Industry Development Institute (MIDI), product development and introduction Directorate Office.

4.2 Discussion

4.2.1 New Product Strategy

Analyzing the existing documents, Business Process Engineering (BPR) document which the causes for the reestablishment and restructuring of the institute, to accomplish the newly born mission, much of the area were assessed and relevant documents were generated and documented. However, regarding the application of those documents helpful from idea generation to product introduction are totally buried or ignored, no one look to them even the

higher management team. Hence, it difficult to say that there is a clean and guiding new product strategy in the institute,

4.2.2 Idea generation process

Qualitatively analyzing the results of the interview with the R&D and management team it was discovered that 60% of ideas come from Manufacturing Industries' requests and 20 % from import data obtained from Ethiopian custom authority, 10% from individual creativity, and around 10% from web sites. From there, the institution develops new products. That is the starting point when many other products are being developed. However, recently, MIDI has started to create product groups that are based only on Client and market research. According to the interviews, the main method used at MIDI is visiting the manufacturing industries. The management team believes that during the visit, the product development team can easily describe the Client needs in technical terms. MIDI's management team sees Client visit as the main inspiration source for the new products ideas.

On theoretical review of the new idea generation process, as per the study done by Booz, Allen and Hamilton (1982), a firm has to generate at least seven ideas to generate one successful. (Griffin, 1997) says that an average of 100 ideas must be generated in order to yield 15.2 successes. At MIDI actually, and again, it difficult to say that exists a real idea generation procedures in real terms. The approach at MIDI with regard to the so called idea generation is making use of reverse engineering. That is to adopt or adapt already valued products. .

The empirical literature review strongly recommends that using both of the routes will help companies to have more high quality ideas coming from all possible sources. Though MIDI has a weak rout of idea generation system at the current state, it should focus mainly on anthropological research**.** This Voice of Client (VOC) method is considered as very effective and expensive. However, taking into consideration the industry in which the institution is involved, and how successful this method has been for MIDI it would be recommendable to continue using the same method even in the future. From the interviews, it was also found that other VOC methods recommended from the theoretical review such as lead user analysis and Product value

analyses are implemented at MIDI when gathering ideas for new products. For instance, MIDI works closely with leading companies in the metal and engineering industries which at the same time are the end-users of MIDI products. The cooperation brings new innovative products that fulfill the end-user need and make them easily accepted by the Clients.

Internal search was one of the important methods suggested from the theory. At MIDI this method has not been used very often. The brainstorming normally comes after the Client visits, however using the general knowledge and ideas which employees may have could be implemented regularly in the near future. During the last few years, the institute has been involved in basic metals products promotion which is mainly focused supporting the construction subsector. MIDI has not been cooperating yet with engineering industries, which would be a valuable contribution for the idea generation and product development process.

From the interview was found that competitive products are analyzed during the process but only from the physical description. MIDI ´s philosophy is that all solutions offered should be initialized from Client's needs.

MIDI's strategy should be to find solutions for Client problems and not to improve existing products. However, as mentioned above, existing products are reviewed naturally when analyzing Client needs. MIDI needs to know the solutions that Clients are using and in most of cases these solutions are competitive products. MIDI studies the existing solutions and adds benefits and Client values. The study has been adopted to fit to the institution strategy, but the concept is integrated and works fine. Patent search is another method, which MIDI has not been implementing yet. However considering the institution size and resources required in implementing this method would be advisable to keep in hold and implement this method in the future. This topic was mentioned and discussed in the meeting with the management of MIDI.

From the interviews it was also found out that evaluation of generated ideas at MIDI is done by answering the following question:

1- Is there a need for it?

2- Does it fit to the current scope and business strategy?

3- How easy is to do and what the risks are?

4- Is Clients satisfied with our product?

The approach that MIDI is following has very similar approach comparing to the suggested method. However, the four questions are not officially documented into a standardized evaluation process from where everyone involved in the institution could follow when evaluating the ideas.

4.2.3 Screening and Building Business Case

From the theoretical review, it was found that there are three assessments which should be done before preparing for the development phase; preliminary need or environment assessment, preliminary technical assessment and preliminary financial assessment. From the interview answers and study of the current product development plan it was discovered that the three initial assessments are partially made when evaluating the ideas. From the user need prospective, MIDI's R&D and management team have lacking the necessary knowledge to make the first preliminary assessment. However, considering the size of the institution and the limited group of Clients, it would be more time and cost effective that the preliminary studies are made at the same time with the full analysis conducted before the development phase.

It is also important to mention that the technical preliminary assessment is not necessary for all products which MIDI will introduce. The technical assessment will depend on the product strategy. For instance, if MIDI decides to purchase and resell other companies products as a tactical decision, the technical feasibility, manufacturing process and intellectual properties are not studied. For products which MIDI is designing and developing, technical assessment shall be conducted.

Building the business case is the last pre-development stage and, according to (Cooper, 2001), it is a very important stage on the Product Introduction process. From the interviews, it was

confirmed that at the idea generation stage, MIDI conducts a user needs and wants study. However such study is not documented and analyzed in depth on the further stages. The documentation of the studies should be taken into consideration as it may help to give more effective evaluation on the needs of the Client. The studies can also be re-used in development of similar products, saving time and removing unnecessary costs that do not increase the product value for which the Client is paying.

MIDI's management team emphasizes the importance of knowing the existing products in order to develop new products. First, MIDI analyses the existing products that do not fulfill the Clients need, then assures that new solutions add value for the Clients and fulfill their need at 100%. Considering the industry, MIDI's size and the type of products that it offers should be clear that completing the Clients need analysis at this stage according to the practice advised by the theory. In the theoretical review also it is strongly advised that an in-depth market analysis should be conducted before the product goes to development. Once again the researcher found out that such analysis are made during the first preliminary stages but are not documented or studied in the further stages.

As a conclusion the researcher suggests that the preliminary studies and deeper analysis should be conducted at the same time. The Booz, Allen and Hamilton model allows MIDI to modify the stages according to the Client needs. Considering MIDI's limited resources and the relatively small number of products Introduction each year, it is recommended that stage two and three should be completed at the same time. There will be no need for MIDI to firstly make a preliminary research and later on in depth analysis. The entire study may be done at once, bringing all the necessary information needed to proceed in the development stage.

4.2.4. Design, Development and Testing

From the interview and questionnaire to the management the researcher found out that MIDI has already built an efficient product testing network. After designing and developing the product the Clients are called and with their presence testing is conducted and then feedback collected from the clients then finalize the newly introduced Product. As presented in the theoretical chapter

continuous testing with the Clients is very important. The network which MIDI has built and the technique of testing the products with Clients (the end-users of the product), is the best approach the institute could take.

The issue on the testing practice in MIDI, discovered during the interview was related to the user need testing. Post delivery testing is a new practice, which the institution has not applied directly when introducing a new product. The new product has been introduced globally, using one strategy for all markets. From the theoretical review it was strongly recommended that the Product Introduction should be firstly tested in a smaller scale before going global. A market test will help to test the marketing strategy and how attractive is the product to the Clients or end-users. By evaluating the theory suggestions and institution's long term ambition the researcher strongly recommends a structured market testing for future Product Introduction. As different markets may have different requirements the Introduction strategy may vary from one country to another. For such reason, small scale testing may be essential for reducing the risk of a Product Introduction failure.

The development phase already exists in MIDI and it is well structured consisting of a Design studio and workshops equipped with conventional and modern machine tools, and more importantly staffed with skilled engineers. MIDI's new product development managers have developed such documented strategy, and surprisingly it is partially built based on the BAH model. As the development process has been structured according to institution's need by following the BAH model guidelines, the researcher does not recommend changes in this phase. The existing strategy is describing all the necessary actions required during the development of the new product, including feasibility study, prototype design, in-house testing, technical assessment etc.

However, the management team should consider the current finding, from the theoretical review of the development phase. For instance, it was found, that it is very important to pay attention to the economics of scale, importance of time and resource management.

4.2.5. New Product Introduction

The Introduction of the new products is the final stage, which introduces the finalized products to the end-user. According to MIDI's management, this is the stage in which the institution has more difficulties and needs to be further developed.

At the moment, new product success still remains the critical challenge for MIDI. Actually these area is not only for MIDI, but many companies are aware of the major role new products must play in their future and quest for prosperity: companies are constantly searching for ways to revitalize, restructure and redesign their NPD practices and processes for better results.

The framework discussed in the literature review proposes that to achieve success, NPD firms should have a clear and well communicated new product strategy. These firms should have well defined new product arenas along with long term trust, with clear goals. Successful businesses and teams of NPD have a dedication towards the voice of the customer. It is critical that firm should gather as many ideas as possible and a large number of these should come from clients so that the firm can be in a position to design and develop winning new products. Up-front homework prior to the initiation of product design and development is found to be a key factor in a firm's success. The quality of execution of the pre-development steps, initial screening, preliminary market and technical studies and business analysis, is closely tied to the products financial performance. Firms should try to shorten the development time so as to minimize the chances that the development and customer needs have changed when the product comes into the market. It is important to verify and validate product performance requirements and design specifications along with customer's acceptance before launching the product into the market via validation and user field testing.

From the analysis of the current MIDI's self sale materials the researcher discovered that the majority of them recommended by the theory is not available for the existing promotional activity. . The only materials that are fully completed are the institution presentation that includes the technology and products and the videos of each existing products. The other materials are either in creating process or not applied at all. The researcher strongly believes that an immediate

focus in creating such materials for each existing product is necessary. For the new products which MIDI is planning for the future, the product promotion workers team must exists and have available some of the most basic documents such as product presentation, data-sheets, frequently asked questions, technical report etc. A well-prepared promotional team is essential for the success of a Product Introduction.

From the feedback collected by the researcher during this study, the majority of Clients and end-users asked continuously for documents that prove the superiority of MIDI's products towards the existing ones. Client reference and technical details were also among top most requested documents. Moreover, from the interviews with the assembly and sales partners the researcher confirms that Client reference and clear details are very important for the Clients. The partners' opinion is very important, as they are the connecting bridge between MIDI and the end users. Recommended Product Development & Introduction Process for MIDI is shown in Figure 4.1

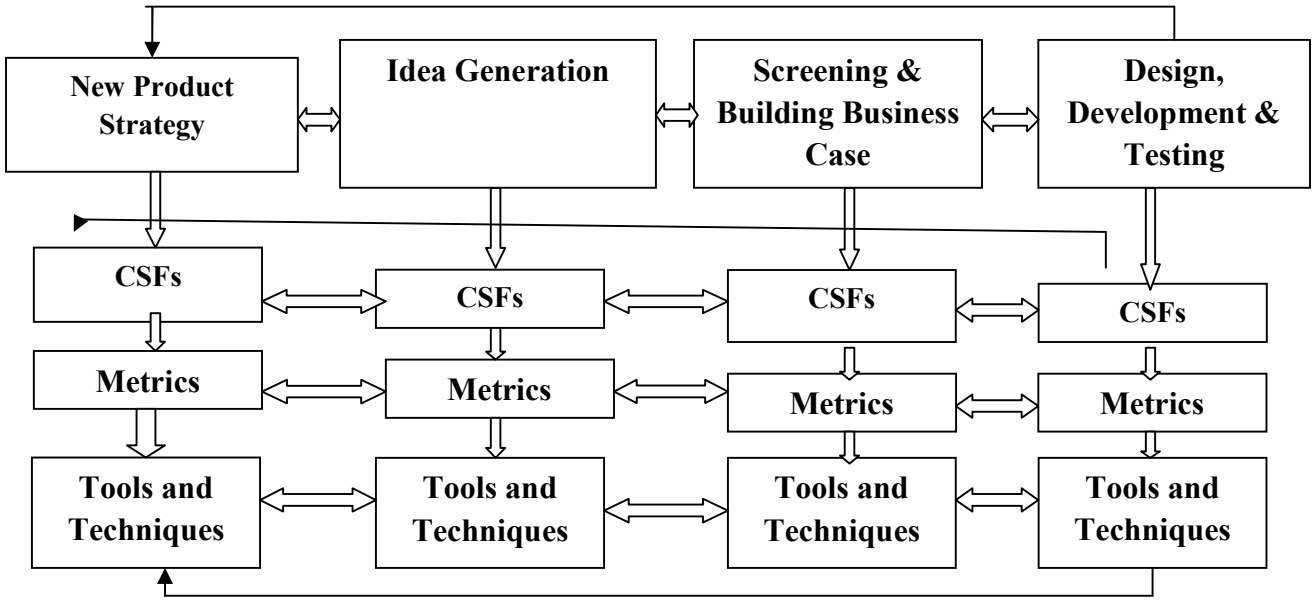

Figure 4.1 Newly Developed Product Development & Introduction Process for MIDI

CHAPTER FIVE

5. Conclusions and Recommendations

5.1. Introduction

In this chapter, the researcher gives a summary and conclusion of the study‘s findings about Technological Innovation and/or New Product Development, and Product Introduction and/or Product Launch as in the case at MIDI: including the critical success factors, the metrics, and tools and techniques towards new product development success. Finally, recommendations on how MIDI should improve its New Product development effort. The overall objective of this study was to fill the gaps of new product development and introduction knowhow in the nation in general, at MIDI in particular and consulting senior management of NPD motivated business operators.

The researcher adopted a qualitative research design to study the NPD efforts and to see the existing organizational setups in line with the support of same at MIDI by using in-depth interview, focus group discussion, document review and site visit. By using these methods everything in relation to New Product Development and Introduction processes were observed.

Eleven core process managers, three upper level managers at a Deputy General Manager Rank, one General Managers and two support directorates who are managing the entire organization in relation to NPD and new product introduction activities were purposively selected for the study. By the help of interview and questionnaire relevant data were collected. The data was analyzed qualitatively by using ideas from different literature, respondent‘s point of view and different documents for validating the result.

As a result MIDI’s status regarding NPD was explored and analyzed and attempted to identify ways that can help to improve the performance when developing new products, mainly through the study of factors that are critical to success. These factors were identified through an extensive study of the practices and performance of successful firms presented in the NPD literature. The

CSFs which have been described in the literature are generally defined for the overall development process, rather than specifically addressing each stage. To overcome this problem, this study sought out CSFs for each stage of the process. Presumably, from the local context, no other study to date has developed such a framework, which can be crucial for NPD success.

5.2. Conclusions

In this report the researcher presented and discussed the Product Introduction as an entire process from the idea to the Introduction of the product into the end-user. During the study of MIDI's current situation, it is observed that Product Introduction process has got main difficulty in that the process of New Product introduction one way or the other may not be suitable to transfer same into the hands of the Client. The result of the analysis also shows that using a structured approach organized in phases practically has not been made effective to the previous product developments practice. However, in case of MIDI's practice such method has not been documented or used consistently in all projects, the researcher created a general map, which at the same time is the suggested product development and Introduction process. The final created process is based on the BAH model, that helps for theoretical review of product development and Introduction process and analysis of the institution's business and strategy.

It is important to note that in the recommended product development and Introduction process has been adapted as closely as possible to the existing development process that MIDI has been following during the last five years. This has been done for two reasons; Firstly, the activities which MIDI has been executing on the previous Product Introductions are in the same line with the theoretical suggestions for a successful Product Introduction. Secondly, the product development process which MIDI has been following so far has partially been successful in delivering innovative (re-engineered) products. Moreover, improvements and new suggestions which suit MIDI's strategy by considering its resources are included in the new suggested process.

5.3. Recommendations

Several different research directions could provide additional useful information both to firms finding CSF and measuring product development success as well as to academics performing research in this area. MIDI should work hard in the direction of imitating different technology from partners and being focused in technology transfer, knowledge creation and management at large to manage projects of NPD nature with internal capability in the near future.

5.4 Suggestions for Further Research

I suggest that the first research opportunity exists in implementing or testing the proposed framework. This would be useful to do over the longer term both among the community of NPD companies in the nation and through academic research to determine the impact of this research on both practice and research.

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Attachments

Attachment 1

Questionnaire

This questionnaire is prepared to assess and gather the necessary information for the study entitled "Technology Innovation and New Product Introduction Practice in Ethiopia". In the light of the above, Metal Industry Development, the leading government owned Institute, which established to support private investors in line with the stated objective of the study is selected as a case. The information you provide will only serve for academic purpose and will be kept confidential. Here is my mobile phone No. +251911-103684.

Questionnaire for Management and R&D team (interview in form of an open conversation)

Idea Generation for new Product Introduction:

1- Where do the new product ideas come from?

_____

_____

2- Where should they be coming from?

_____

_____

3- How do you evaluate and implement the new ideas which you received?

_____

_____

_____

4- Do you have an Idea generation system which you use regularly? Describe the system, if it exists.

_____

_____

_____

Studies

1- Does Your Institute (Metal Industry Development Institute) makes user needs and wants study? If yes, describe the method you employed.

_____

_____

_____

2- Do you study other governmental institutions or private organizations engaged in the same business as you do? Please make use of table to list organizations, their competitive edge and practice against yours. (for example)

No.	Name of Organization / Competitive parameters	MIDI	Other institution … Be specific to mention their names	Private organizations … Be specific to mention their names
1	capacity			
2	skill			
3	quality			
4	standard			
…	Efficiency, effectiveness, productivity…			

3- Do you go to Client through face to face meetings or do you create concept solutions internally, and then make market research to test the product concept?

_____

_____

_____

4- Are you willing to try a **user need and want** study in the next new product project?

_____

_____

Testing

1- Could you briefly describe the testing process at your institute?

_____

_____

_____

2- What are the types of testing you are currently applying before and during the Introduction of the new products?

_____

_____

3- Are you using concept testing effectively when developing new products?

_____

_____

4- Do you take the necessary time for concept testing before going to development?

_____

_____

Development

1- Do you follow any development model? Describe if there exists any.

_____

_____

2- Do you involve the Clients during the development phase? (Model) if yes, how?

_____

_____

3- How testing is done during the product development?

_____

_____

New Product Introduction process

What are the obstacles you are facing during new product introduction process?

_____

_____

Attachment 2

Content of the interview with Marketing and Product design and development (interview in form of an open conversation)

1. How effective do you see the promotion of your institute to the existing products? What could be done differently?

2. What are the advantages and disadvantages of your institute new products compared to the existing products?

3. What are the difficulties you are facing when introducing your institute products to your Clients?

4. Is your institute offering all the necessary supporting material, necessary to promote the products to your Clients? What is good and what could be improved in this aspect?

5. In your opinion, keeping in mind your institute products, what is the best way to attract the Client attention when Introducing new products?

7. How would you evaluate your institute current product promotion activities? How about the pricing?