An Empirical Model for Product Launches in Industrial Market and Exit under Market Improbability

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Abstract
This paper investigates the problem of a firm that is uncertain about the demand; and hence profitability of the new product is under question! The proposed model will help the decision makers of an organization, to refer syneadoche guidelines elucidated in research, about the true product profitability from the observed case studies. This can help the organization to make decision about whether to scrap the product or continue the future endeavor. Multivariate methods are used to probe these success or failure probabilities. The role of a product strategy and the need for a strong industrial market is clearly defined. This model can predict the demand of available industrial market; and it can guide about launching of product or exit policy, depending on the firm’s demand uncertainty.
It shows that, a large share of new products can survive in industrial market, if proper module is available for creation of business foot print.
Case studies demonstrate that, the value of reducing uncertainty can be more; and that, under higher uncertainty firms should strongly increase the fraction of all new product opportunities launched, even if their point estimate of profits is negative. Alternative, simpler decisive rules are explained to lead to large profits and losses, compared to our method.

Keywords: Industrial Product Strategy, Product Launch, Product Exit, Product Development, Product Performance, Bearing Industry

Paper type: Research Paper

Introduction
The role product development in Industrial market as per Booz, Allen and Hamilton (1980), are for repositioning of market segment, cost reduction, adding advantage to the customers in terms of high performance, safety, and easy availability.
According to Kotler (1997: 37) today’s organisations are facing their toughest competition ever and organisations should strive to retain customers by developing new products to meet customer expectation.
‘Industrial new product launch are ordinary in domestic and overseas most markets,’ as per Günter J. Hitsch (2006). ‘New products are of major importance for companies’ performance & firm aims at achieving certain sales and performance objectives,’ as refereed by Dr. R. K Srivastava, (2006). Steven D Eppinger & Karl T Ulrich, (2009) suggests, ‘successful launch requires considerable financial resources, thus is a risky venture.’
Even if product is successfully launched in the market, it is equally important to remain till it completes its life cycle and sustain profitability through out entire life cycle in market as elucidated by Hory Sankar (2009).
As per Harrington, J. E. (1995) firms are not sure on market demand and profitability of their new products and many times products are scrapped with preconceived wrong opinion. “Many of these new products “fail,” i.e. exit from the market, soon after product launch”, according to R.G. Cooper (@2007). As observed by Weiss, C.R., Wittkopp, A. (2003b), & Hyun —Sook Lee “Close to 50% of all new products are scrapped within span of initial one to -two years after their introduction.”

Roberto Vergant, (2009) & Margaret J Wheatley (2006) state, that product failures are costly, as the development costs and marketing costs during the launch period can no longer be recovered. Therefore always there will be pressure on attainable profits from noticeable enhancements in innovation pace, as per by Michael E Porter (2004.p 194-196) which again is due to reduced product life cycle times, fast technological changes and ever-changing customer needs. Thus, higher number of failures of launched products is not surprising!

It is important for firm to learn about true profitability of their products, decision making process to launch or scrap a product based on demand uncertainty as per Michael E Porter (2004). There is need of research solution in respect with reduction in the demand uncertainty, of industrial market.

According to Erdem, T., M. P. Keane (1996), if new product have high exit rates that indicates firms use suboptimal product launch strategies, or may be launch products for reasons that are not related to demand uncertainty.’

Proposed paper addresses these and related issues, through a model of a decision maker (a firm), who decides whether to launch a new product; and after the product launch, whether the product should be scrapped or to be continued in the market.

The model is tested with actual data, and then is used to predict optimal launch behavior and the associated stream of profits. The model allows us to calculate the expected profit from a product under some level of demand uncertainty.

Finally, the author implies through this research that, the stakeholders in some firms should not only be concerned about high product exit rates, but also about low exit rates.

Study is conducted about understanding, how the product launching decision are taken based on the market influence, and when product to kill from market presence. The strategy of new product launch process is a key for sustaining product life and that can influence market development issue and it is equally important for firm to know by when product must exist from market. This research is in respect with the factors influencing the product success, milestones in understanding factors related to the successful introduction of new products in industrial market and withdraw from market before customer decline to use. The Module proposed in this research papers will be helpful for creation of business foot print for organization in Industrial market.

The research includes data collection and careful analysis of case studies, which have helped in understanding and testing the impact of ‘Product Launch in Industrial Market and Exit Under Market Improbability’ for high end engineering products.

The research exhibit an empirical study to verify the feasibility of application of ‘Empirical Model for Product launch in Industrial Market and Exit under Market Improbability’ for the bearing industry. Through the research process two hypotheses are proposed:

The first hypothesis is -By applying Empirical Model for Product launch in Industrial Market whether there is a probability for profitability.

The second hypothesis-Empirical Model for Product launch in Industrial Market would predict the product exit under market improbability.

The research consists three parts and the first parts is to analyse the data of the product launch and its consequences for the optimal launch and product exit decision; and the amount of compensation which can be reduced by a firm, with or without this Model; The second part describes the identification for the early exit factors and takes corrective actions; and third part is to Propose a new model for product launch and exit strategy.
Literature Review

Product launch:
As Product launch is door to full commercialization-market and operations to start production,” as stated by Robert G. Cooper, 2001. It is the final point at which the organization can decide to stop the project. For product success, it is important to lay down well thought plan of action, which is backed by ample resources, and course of action to face the unforeseen events.

Drivers for product launch:
New products are the key to corporate prosperity, to derive revenue, maintain the bottom line and market share. ‘It is possible to achieve by using various drivers for product launching,” as suggested by Dr. Robert G. Kooper (2001, p 8-10) of Winning Product.

The first driver is ‘Advanced Technology,’ which gives exponential increase in know-how, helps in giving such a novelty factor to the product, which has not been dreamed of in decades; and this driver makes it possible to provide solutions as per customers’ demands.

The second driver is “Changing customers” needs”. Customers expect new product with significant change.

Third driver is “Shortening product’s life cycle,” which arises out of increasing pace of technological change coupled with change in market demands.

Fourth driver in product launchings is “Increased world competition,” i.e. access to foreign markets like never before. At the same time, our domestic market has also become a part of international market, with competitive pricing.

Product life cycle [PLC]:
Michale E Porter (2004, p 194-196) from Competitive Advantage, states that, “PLC in the frame work of product innovation ultimately yields a “dominant design,” where optimal product configuration is reached.” As the product design stabilises, increasingly automated production methods are employed; and process of innovation takes over, as the dominant innovation mode lowers the cost. Ultimately innovation of both the types begins to slow down. Therefore the concept of “dematurity” has been added to the frame work, to predict the possibility that, major technological changes can throw the industry back into a fluid state.


As per Michael Grieves, 2006, p.39.2006, & Clayton M. Christensen and Michael E. Raynor, (2003), ‘Product Lifecycle Management (PLM) is an integrated, information-driven approach comprised of people, processes/practices, and technology to all aspects of a product’s life, from its design through manufacture, deployment and maintenance-culminating in the product’s removal from service and final disposal.’ By trading product information for wasted time, energy, and material across the entire organisation and into the supply chain, PLM drives the next generation of lean thinking. As per bearing life cycle in industrial application-BL-011-2009, for industrial application, product life cycle can be considered as five years based on experiences of bearing manufacturers.

Factors affecting in industrial product development launch:
Ashok Ganguly [1999, p136-160, Business-driven R&D] suggests that, ‘Industrial product development is most neglected area in India.’ The First factor is Human factor, which occupies a pivotal place in industrial R&D and product launch. The second factor is philosophy of business driven R&D evolved from mandate, which has ownership both in research and in the operating business. It receives complete support and commitment at all levels of management. Third factor is identification of business priorities, which are converted in real life of product launch and
service by & large and is applicable maximum for five years in the industrial application based on data generated from 25 years by author

**Requirement of industrial product services:**
P.Kotler (p.225, 1996) on Marketing, advises to consider industrial services’ aspects on product development and launches. For example service reliability and accuracy designed to exceed customer expectations can be one of the major strategies. Price and performance time of the product should be less, for the convenience of customer operations. Three to five years flexibility in service availability can be considered while designing the industrial product service strategy and this conclusion was drawn based on more than 800 industries study data.

**Benefits of PLM study:**
According to Clayton M. Christensen, (2002) and C.K.Prahlad & M.S.Krishnan, (2008), “In industry, the usefulness of PLM tools is widely accepted for clients to take up the solutions. Companies are hesitant in investing in products that don’t have documented benefits or easily calculable returns. The return on investment for PLM solutions is difficult to calculate as it influences the outcomes of products, and these products are themselves influenced by various factors.” However it is made possible by Bearing Industries by creation of data bank, based on experience and made their own internal specification such as bearing life cycle in Industrial application-BL-011-2009 & QS 044 of Organization internal specification. These studies are generated by Bearing Industries by building data bank from 1980 to 2009 & are useful to identify the Product life cycle and can be used as alarm for exit of product under unfavourable conditions for the customers.

**The aggressive product launch:**
“New product launch includes trade show participation (Guiltinan 1999, Hultink et al. 2000), product demonstrations (Guiltinan 1999), distribution channel arrangements (Guiltinan 1999, Hultink et al. 2000, Di Benedetto 1999), soliciting and acting on to customer feedback (Di Robert G. Cooper (2001), and undertaking product trials (Senese 2002). Product launch aggressiveness refers to, how much effort a firm puts into the product launch. It is a measure of the intensity and complexity of the launch actions carried out by the company, while introducing a new product. Launch volume is defined as the total number of actions that support a product launch. Product launches where firms undertake large numbers of actions and are more aggressive. Launch diversity is defined as the extent to which a product launch is comprised of actions of many different types. New product launches consisting of many action types, are more aggressive. Launch duration is defined as the time elapsed from the start to the end of a sequence of uninterrupted action events.

**Setting product launch goal:** Dr. Robr G. Kooper (2001 p.140 to142)Winning Product 2001) describe three criteria while setting product launch goal. The first criteria is “prospector businesses”, it covers, percentage from new product, percentage of sale and ability to open new window for opportunity. The second criterion is “analyzer enterprises,” which covers ROI (Return on Investment) and success rate. Also, it is necessary for an organization to confirm innovation efforts, fits or support the overall business strategy.

**Life of ball bearing:**
According to ISO: 281(E),(2007-02-15) suppliers of ball bearings often provide a formula for predicting the tenth percentile of bearing life based on load and number of revolutions:
\[ L_{10} = \left( \frac{C}{P} \right)^n \times 10^6 = \text{Number of Revolution} \]

\( C = \text{Basic dynamic load rating} \)

\( P = \text{Equivalent radial load} \)

\( n = 3 \) for ball bearings

Life in hours \( [L_h] = [L_{10} \times \text{Rotation per minutes of bearing, RPM}] \times [60] \)

\[ L_h = (L_{10} / \text{RPM}) \times 60 = \text{Life in hours} \]

Five years is the life span considered for ball bearings in industrial applications, as stated in the internal organization specifications, created over experience of 35 years in bearing life cycle in the industrial application - BL-011-2009.

**Product profitability in bearing:**

Angela Clarke, (April 2006), SKF, Annual Report 2007-2008; & FAG, Annual Report 2007-2008; provide guide line for rolling bearing minimum profit margin, and that must be average 12.5% across the world & considered upto three years of ROI [Return on investment].

**Product exit in the bearing industry:**

As suggested by R.K.Srivastava, (2006) & S.T.Salunke (ISSN 2231-1009 p.23-35), in this industry product introductions have always been common and, on average, 10 new brands were rolled out every year. Secondly, the industry, relatively speaking, is a “simple” industry; that is, complicated dynamic factors, such as technological progress, or dynamic price discrimination, which are commonly employed over the life cycle of a high-tech durable product, are absent here.

After five years of Industrial application, ball bearings are upgraded; and to reduce the sales after service as per internal organization, specifications are created over experience of 35 years in the industrial application - BL-011-2009. As observed by Roberto Vergant, (2009), ‘by and large people like the change after five years.’

**Gap Analysis**

Based on the literature survey, lot of research is done on production launch and exit under market uncertainty, in automotive segment; however, the bearing industry is yet to develop a model on industrial market product launch and exit based on market conditions.

In India there is need of single model, that can demonstrate product launching strategy & also can describe discontinuance of the product at the appropriate market situation.

In the bearing industry, there is very less probability for blue ocean strategy in business development and competition is very high. Also investment is very high for development of products. Accordingly Dependent variable are sales, cost of product, profitability & investment cost for development new products. The other independent variable - Success of new product, Field performance.

Hence there is need of research on constructing a model for selection of new product at enquiry stage, for creation of global business footprint for Indian entrepreneurs or stake holders.

**Theoretical Construction**

“Development of product involves very high investment and, product validation as per customers’ requirements, ranges from one to four years,” as observed by Anthony Marsh, (September 2006) & S.T.Salunke (25 Dec 2008 Thesis). This research is exploratory. It starts from the premise described in literature review that, product decisions which must be mutually reinforcing to the produce NPD success. Two research questions crop up out of it. Firstly, how...
the industrial product strategies and tactics can be linked with the product launch? Secondly, how a particular strategy relates to the exit of product performance? Therefore for long-term survival of the firm, to a great extent depends on the ability to successfully select new product development strategic criteria on product launch. Also, process of converting and integrating new product development ideas in to standardised policies for product launch for smooth execution and success in generation of business are important. For screening of product life cycle, ROI, Price, Target and ROI require correlation. From correlation, there is need to derive sustainability in market and the exit time frame for taking out product from market. Accordingly need of research and theoretical construction is elucidated in FIG-1

Figure 1: Need of Research

**Objective of Research**
In India there are about 54 large and medium ball bearing organizations which together turn out over 100 million bearings every year as observed in Indian Bearing Association News Bulletin (2010).

*Almost all the units have foreign collaboration. The Indian bearings industry manufactures around 500 types of bearings as against over 30,000 types of bearings being used in the automotive and industrial segment. Most of these are only of standard type and are used mainly in simple technology products (fans, electric motors, water pumps, etc.), and by the automotive sector.* However, there no scientific process for product launch nor firm aware by when they have to with draw product from market.

The objective of this paper is to develop and test a model that relates product launches in Industrial Market and exit under market improbability. Looking at business requirement of rolling bearing industry, the first objective of research is to construct a model for product launch in industrial market and confirm usefulness of this model by verifying the profitability and suitability of this model for selection of product launch and exit strategy.

The second objective of research is to test this model on the newly launched product and check whether it is possible to predict exit under market improbability. Test result can confirm, whether model is suitable for prediction of product exit under market improbability.

The third objective is to confirm, whether the model will help in creation of knowledge bank of organization for constructing future business foot print.
Hypothesis
From the literature review [2.2] on Drivers for product launch and [2.4] on factors affecting the Industrial product launch, & as described in Gap analysis [3] the first hypothesis is to see the impact by using products developed in empirical model for product launch in industrial market and check the probability of profitability and confirm if model is useful for business strategy (H1).
As elaborately described in literature review [2.3] Product life cycle ,[2.6] Benefit of PLM study, Life of ball bearing [2.8], & [2.10] Product exit in the bearing industry Another Hypothesis can emerge to verify whether the proposed Model for Industrial Market would predict about product exit under market improbable. Based on the test result of hypotheses, it is possible to evaluate the effectiveness of proposed model, (H2).

Research Methodology
The research model can be used to assess the value of improved information about product profitability. This value directly implies the optimal demand for information, in the form of market research. Secondly, it investigates how the degree of demand uncertainty influences a rational firm’s willingness to launch new products; and at the same time, “tolerate” product failures.

Research design:
As described in topic Gap analysis [3] and theoretical construct [4], RESERACH MODEL is described in Fig-2.

Brief description of Fig 2 is divided in three phases as shown below:

Input parameters of Module Phase A:
Various input criteria are described for processing the analysis part. “The first check at product design stage bearing is giving life” as observed in ISO: 281. The second check point is as elaborated in topic literature review [2.3], life cycle is considered as five years in industrial application.

Third parameter elucidates the calculation of return on investment as stated by Anthony Marsh (September 2006), and he recommends three years time for mass production batches. Fourth parameter is “Estimated quantity of product to be sold during a time period of five years,” and estimated quantity is decided based on market survey for each product. Questionnaire is prepared as per Annexure-A and is evaluated for samples size developed from years in 2006 and checked results in May 2011.
As observed in *Bearing Industry QC 044*, internal specification data collected for developed product and scaling is based on experience of organization 35 years in this business. The team provides rating on a scale of 1-5 against the list of each critical factor for products as shown in Annexure-A. The cumulative maximum rating each product can score is 5 X 5 = 25 scale. According to *QS 044 NRB*, no specific sample size is required for rating and matrix as shown in Annexure A, TABLE-1. Questionnaire for survey can be used for single to infinite numbers of sample. Research Model recommends a minimum rating of 17.5. Rating is acceptable based on the return on investment within three years. It should derive profit margin of 12.5% by the Bearings Company and accordingly the product is expected to be sold against expected quantity, as observed by internal specification *QC-044* derived by organization. Cross functional team gave the rating for each product as per Questionnaire shown in Annexure-A, and evaluated the product performance from business strategy form in May 2011.

**Analysis part Phase B:**
In this phase three criteria are verified, and those are [A] Quantity sold, [B] Duration & [C] Profit.

**Output Phase C:**
This phase covers two aspects - one is to verify actual Return on investment in three years, covered by each product supplied so far to the customers. The criteria is “end of life of product,” that means customer has stopped usage of products and has changed the design.
The paper describes the feasibility of empirical model for product launch in industrial market and exit under market improbability for the bearing industry. The following two hypotheses are emerged as described in Introduction:

**Hypothesis-1:** By applying empirical model for product launch in industrial market, there arises a probability for profitability.

**Hypothesis-2:** Empirical Model for Product launch in Industrial Market would predict about the product exit under market improbability.

**Method for Testing Hypothesis -1:**
As illustrated by C.K Kothari, (2009, p.190, 219, 220) & Fred N Kerlinger (2009, 11th print), first hypothesis will be tested by static test “z” because data is on the basis of presence with sample distribution from binomial probability distribution.

\[
Z = \frac{\hat{p} - p}{\sqrt{p.q/n}}
\]

*Z= Test statistic*

*P= Represents probability of success*

*\(\hat{p}\)= Represents sample proportion*

*q= Represents probability of failure*

*n= Total sample size*

Accordingly analysis was done for the product, which was developed five years back, with two sided test, for variance of success must be less than 20 percent and test be for 5 percent level of significance.

**Method for Testing Hypothesis -2:**
This hypothesis will be tested by correlation coefficient T-Test and calculates test statistics as under:

\[
t = r_{yx} \sqrt{n-2/1-r_{yx}^2}
\]

with (n-2) degree of freedom \(r_{yx}\) being coefficient of simple correlation between x and y. Calculated value of t, compared to table value and calculated value is less than the table value. Thus null hypothesis can be accepted at given significance. 

[Ref: C.K Kothari, (2009, p.228, 337, Table-2) & Fred N Kerlinger (2009, 11th print)].

**Sample Profile:**

\[
n = Z^2 \sigma^2 /e^2
\]

*Wherein*

\(Z = \) The value of standard variant at a given confidence level and it is 1.96 for a 95% confidence level

\(n = \) Size of sample

\(e = \) Acceptable error

\(\sigma = \) Standard deviation of population
The difference between \( \mu \) mean of population and sample mean to be kept in \( +/ -3 \) of the sample mean with 95% confidence, then \( \epsilon = \) Acceptable error will be 2. Accordingly \( \sigma = 5 \) as standard deviation of population for bearing is developed with new module.

\[
n = 1.96^2 \times \frac{2.5^2}{\sigma^2} / 23
\]

24 new products developed and supplied in market are considered as sample size

As per Annexure –A questionnaire prepared that covers life of product as per ISO281, ROI for span of three years, life cycle of products and evaluations of quantity sold as estimated in five years.

Samples were selected for product launched in year 2006 and monitored till May 2010 for various criteria derived in Annexure-C.

Result Analysis:

Life calculation of a product:

As per literature review topic [2.8], bearing life is calculated for all 24 new products and verified product life is confirming to ISO 281

\[
L_{10} = \left( \frac{C}{P} \right)^n \times 10^6 = \text{Number of Revolution}
\]

\[
Lh = \left( L_{10}/\text{RPM} \right) \times 60 = \text{Life in hours}
\]

For example product named 6202, is designed for Dynamic load rating = 5400N and actual load on bearing is 1080 N at 1700 RPM. The life in hours will be

\[
L_{10} = \left( \frac{5400}{1080} \right)^3 \times 10^6 = 125 \times 10^6 \text{Number of Revolution}
\]

\[
Lh = \left( 125 \times 10^6 /1700 \right) / 60 = 1225.5 \text{ hours}
\]

In actual test if bearing performs as per ISO calculations, then rating scale value will be 5, which is considered as maximum scale. According to this analogy, life is calculated and tested in lab for all 24 samples, refer Annexure-B in bearing Industry of India.

Calculation scaling for ROI [Return on investment]:

For ROI period is considered three years as elucidated in literature review topic (2.9), for Product profitability. Product sold after 2006, verified for ROI, and rating 5 is applicable if ROI is covered in the span of three years.

Calculation for ROI of 24 samples size-

Development cost per product=Rs 250000/- (A), Sample quantity=(B)=24
Cost of development for 24 samples size(C)=(A) x (B)=250000X24=Rs 600000
Average product cost =Rs 82/-, Profit per new product at 12.5% rate=(P)=Rs 10.25/-
Product sold from 2006 to 2009 =(Annual quantity of each size) x (Number of year 3) x (Total sample size 24s)=10000X3X24=720000

Profit on 720000=10.25X720000=Rs 7380000=P1
Return on investment within three years = \( P1 - P = 7380000 - 600000 = 1380000 \)

Rating scales given for each sample as per Annexure-C based on ROI.

**Verification of product life cycle:**
As referred in literature review topic on Product life cycle [2.3] and Life of ball bearing [2.8], the life cycle of product is five years. If product covers five years, the rating will be five. Accordingly verification was conducted for 24 products, sold from 2006; and rating given in Annexure C is for sample lot of 24 products. Basically all 24 types of products before launch, tested as per ISO 281 for life in test lab. Then confirmed product was saleable in market till five years from date of launch and ensured after five years customer replaced the product.

**Possibility of predicting exit of product:**
As refereed in literature review [2.3], product life cycle is recommended, in [2.8] life of ball bearing is mentioned and in [2.10] product exit topic is dealt with; wherein products are discontinued after five years. Survey is done at customer site and checked whether customer is using the product or has discontinued it’s usage. Accordingly, if product no more exits after five years, then rating will be five. Accordingly verification conducted for 24 products sold from 2006 and rating is given in Annexure C.

Data is collected for 24 products [samples] sold from 2006 to 2011. Collected data is verified, whether it is matching as per estimated projected quantity and is as projected during development stage by marketing. If products are sold as per estimated quantity, then rating will be maximum that is 5.

**Acceptable criteria of Module:**
Average rating of five different scales for Research Model is calculated and it recommends a minimum rating of 17.5 for declaring successful or failed product as per this new Module. Criteria of rating and explanation are given in Annexure A. If product is below than 17.5 scale, then this Model is not suitable.

As per Annexure-A, minimum rating of 17.5 is acceptable based on the return on investment within three years and a profit margin of 12.5% by the bearings company and product sold against expected quantity [Ref : QS 044 NRB , Neal Lurie @ Copyright, [2004].

**To test Hypotheses 1**
Test whether applying Empirical Model for Product launch in industrial market will have a probability for profitability.

Now Hypothesis is tested for 24 new products, and out of them four products scored less than 17.5 scales.

**Average scaling**
Average of 24 product rating scale is =21.66,
Average of four products scored less than 17.5 scale =16.475,
Average of 20 products scored above 17.5 scale =22.715
Significance variation = 22.715-21.66=1.055 this value is 1.055X100/22.715=4.644% which is less than 10% level

**The null hypothesis is**
\[ H_0 : P = \text{probability of success scale} = 22.715 = 0.22715 \]
\[ H_a : P \neq 22.715 = 0.22715 \]
Represent sample proportion \( P^\wedge = 4/24 = 0.1666 \)

Represent probability of success scale \( P = 22.715 = 0.22715 \)

Total sample size \( n = 24 \)

Represent probability of failure \( q = 16.475 = 0.16475 \)

First Hypothesis will be tested by static test “z” because data is on the basis of presence with sample distribution from binomial probability distribution.

\[
Z = \frac{P^\wedge - P}{\sqrt{p.q/n}}
\]

\[
Z = \frac{0.1666 - 0.22715}{\sqrt{0.1666 \times 0.22715 / 24}} = -1.5248
\]

As \( H_a \) is two-sided, it can determine the rejection region applying two-tailed test at 10 percent level, which comes under using normal curve table:

\( R: |Z| > 1.645 \)

The observed value of \( z \) is -1.5248 which is in the acceptance region and as such \( H_0 \) is accepted. Thus the null hypothesis can not be rejected at 10 percent level of significance.

Accordingly, test concludes that out of 24 products 20 products gained the profit. Hence it proves Hypothesis (1) is correct and by applying “Empirical Model for Product Launch in Industrial Market” for product launch, organization will get profitability.

As described in topic Gap analysis [3], Theoretical contraction [4] and Objective of research [5] research model is capable to predict profitability ,return on investment and forecast quantity required in market.

To test Hypotheses 2

Test is conducted, whether empirical model for product launch in industrial market would predict for product exit under market improbability. By correlation coefficient T-Test and test statistic are calculated as under-

Represent probability of failure \( = 16.475 = 0.16475 \)

\( H_1 : P = \) probability of success scale \( = 0.16475 \) reflects probability of prediction of product for exit

\( and H_a : P \neq 0.16475 \)

\[
\hat{t} = \hat{r}_{yx} \sqrt{n-2/1-r^2_{yx}}
\]

[Ref:-C K Kothari, (2009, p.195, 196,228)]

\( n = \) Sample size \( = 24 \)

\( r_{xy} = 5 \) Degree of freedom for correlation between x and y \( = 0.5 \)

Significance variation \( = 22.715 - 21.66 = 1.055 \) this value is \( 1.055 \times 100/22.715 = 4.644\% \)

=0.02 is considered as level of significance for two tailed test.

\[
\hat{t} = 0.5 \sqrt{24-2/1-0.5 \times 0.5} = 2.708
\]
Calculated value “t” compared table value [Ref: C.K Kothari, (2009, p.337, Table-2)] & calculated values 2.708 is less than the table value, 3.365, null hypothesis \( H_1 \) can be accepted at given significance.

Accordingly out of 24 samples, four samples discontinued / were killed because of market improbability.

As described in topic Product life cycle [2.3], Product exit [2.10] [4] and Objective of research [5], research model is capable to predict, by when firm should take out their product from Industrial market before customers stop using the same.

Hence it proves Hypothesis (2) is correct and by applying “Empirical Model for Product Launch in Industrial Market,” organization can predict about exit of product under unfavourable market conditions.

Calibration of Hypothesis (1) and (2) are based on actual data generated by organization from 2006 to 2011. Hence it confirms that, Hypothesis test results are matching with actual validation of results of product as observed by customers.

From above test it is confirmed that, “Empirical Model for Product Launches in Industrial Market and Exit Under Market Improbability,” is suitable (suitable / unsuitable — please confirm) for bearing industry and other high technology end products used in industrial application and market. The other supporting base for this statement is “bearing is most complicated high end technological product.”

Organization has created data with usage of this module for the products launched in 2006 and used it for business selection. Based on this, the organization could developed VISION 2020 and foot print of business at global level.

**Ethical Consideration**

It was well informed to all the participants who were involved in research process and were well aware about the procedures and about the importance of risks involved in research. Considering this, all members of research participants were requested on completion of feedback sincerely.

Three approaches used to help research participant and to protect the confidentiality.

As described in introduction, literature review and research analysis, the content of rating scale, organization data must be kept confidential. Accordingly all participants confirmed that, they will not disclose information pertaining to research, to anyone who is not directly involved in the study.

All participants and researcher will remain anonymous till completion of research and also it was informed to the customers.

To collect practically accurate information and for authenticity of data, personal involvement, interview, teleconferencing and participants’ observation was arranged.

While conducting research, focus was on life cycle of product, safety of team and safety of equipments in terms of physical and psychological harm.

**Conclusions H1 and H2 Conclusion**

The outcome of research confirms “An Empirical Model for Product Launches in Industrial Market and Exit Under Market Improbability” can be used as effective product launch strategy. Also, this module will help to define product life cycle at the beginning of development, so that organization can predict right time to exit or kill the product under market improbability. Selection of new products using this module will assure a higher success rate and will alarm for exit of product from market.

Model is accepted and it is concluded that, the variance of given distribution can be considered 10 percent level of significance for product launch.
Empirical Model for Product Exit under Market Improbability, is acceptable for alarming product exit / killing time at 5 degrees of freedom, with correlation between successful and failed products usage of this module.

Till the end of Oct 2011, organization generated study and data for product developed from 2006 onwards. This data is used in creation of VISION-2020 and foot print of business at global level. To expand the effectiveness of this module, it can be applied to other non engineering industrial products or in automotive industry etc. for further study and research.

Limitation of the Study
This model is tested on ball bearings used in industrial application and further testing is required on automotive product, service industries and consumer durables; and the accuracy of this module is assessed.

Further testing is required separately on other bearing products like cylindrical roller bearings, spherical roller bearings, needle roller bearings, tapered roller bearings and other high engineered industrial products.

This research can hopefully support the future research results that can be transformed into practicable implementation in all types of bearing products or engineering products. Impact of non technological categories like logistics, value chain, and administration on innovation can have further scope for innovation.

References

Angela Clarke, April 2006. Technology Management, WMG Module, presented on 10-14 April 2006, at Mumbai, India.


Booz, Allen and Hamilton, New Product Management for the 1908’s.

Clayton M. Christensen, 2002. Innovator’s Dilemma. New York, Parpercollins (is it Harper Collins?).


Corresponding Author
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TABLE-1 Questionnaire for survey – New ball bearing in industrial application

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<tr>
<th>Questions</th>
<th>Target rating scale</th>
<th>Actual rating</th>
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<td>Dose theoretical life of product is confirming with ISO 281 standards?</td>
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<tr>
<td>Is it possible to achieve return on investment within three years?</td>
<td>5</td>
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<tr>
<td>Dose product life cycle crossed five years at the same customer?</td>
<td>5</td>
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<tr>
<td>Is product replaced by customer after five years?</td>
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<tr>
<td>Whether the product sold as per estimated projected quantity was considered during development stage?</td>
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<td>Total</td>
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Research Model recommends a minimum rating of 17.5. Rating is acceptable based on the return on investment within three years and a profit margin of 12.5% by the bearings company and product sold against expected quantity. [Ref: QS 044 NRB, Neal Lurie @ Copyright, [2004] & Johns, Rodney D. And Siskin, Bernard R., *Quantitative Techniques for Business Decisions* [1977, p.374-375]

Annexure-B

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Product’s lifetime (in years)
## TABLE -2 Product data and rating on Questionnaire survey

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<th>Bearing type [Launched in 2006]</th>
<th>Dynamic load rating ([C]) in N</th>
<th>Actual load ([P])</th>
<th>Field RPM</th>
<th>Life in hours</th>
<th>Questionnaire for survey – New ball bearing in Industrial application - Rating scale ([5]) with least count 0.1</th>
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</table>

1) Field RMP is less by 20 times of limiting speed.
2) Actual load is 20% of Dynamic load rating.
3) Base formula \(L10 = (\frac{C}{P}) K \times 10^6\) revolutions where, \(C = \) Basic load rating, \(P = \) Equivalent radial load.
4) Average of 24 product is = 21.66, Average of four products scored less than 17.5 scale =16.475, Average of 20 products scored above 17.5 scale = 22.715.
5) Ref-[ISO-281 & Internal specification Bearing Industry Organizational Sales Forecast BRB - 11/May 2011].