New Product Development for Cement Industry

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Abstract: For all manufacturing companies, there is always a requirement of new product development or upgrading the features in their existing product for market survival as well as for fulfill the customer needs. In view of that, for a cement manufacturing company, work required on water repellent based cement. In this research, starting from market and ground survey and list out the customer pain / issues with existing product. Based on the feedback, introduced PWRT technology (In-house made) helped for the best impermeability mixture by improving the particle size distribution and fineness of the product. It significantly reduces water permeation to concrete, which results in dry walls and healthy indoor climate. With proper cost and quality benchmark analysis, product was made. It's give several advantage like- weather and corrosion resistance, high durability and long life of paint and putty.

After the complete study of new product development, it has been found that with paying 1.66 % higher than the original cost, will have Strong, Water resistant, Free from Efflorescence Healthy home for 1000 Sq. feet house.

Index Terms: PWRT, Service quality; durability; water resistant, HOQ.

1. INTRODUCTION

New product development is the complete process of bringing a new product or Service to the market till its consumption and feedback from the end user of the business chain through the systematic procedure and parameter.

For Cement industry, it has been observed that, there is need of Innovation in Cement manufacturing process and Cement Product, which is not focused since long decade. No any major changes observed in Cement Quality, hence planned for a new product, which have some specific advantage over the existing product.

Started this research work with Market feedback and Survey, laboratory trials, Cost & Quality analysis with market potentiality and after that product testing with outcome and final conclusion.

In this research data, All details and testing data is collected from M/s JK Cement Limited, Nimbahera factory.

2. LITERATURE REVIEW

CLARK K., FUJIMOTO T. [1]:- New product development covers the complete process of bringing a new product into market. A central aspect of new product development is product design, along with various business considerations.

Hayhurst M., [2]:- New product development is described broadly as the transformation of a Market opportunity into a product available for sale quality.

Figure 1: New Product development by **Hayhurst** (1968) [2]

Ian C Goulding "European journal of marketing, 17-1983 [4]" :- This paper states that the emergence of a formalized new product development function can be attributed to the needs of companies in the capitalist system to maintain a competitive advantage in the markets in which they operate, this being a prerequisite for corporate survival and growth.

Anand Sharma, Jayant Malhotra -21.1 [5]:- Applies a combined approach based on market survey and analysis to improvement in existing product and explore the future need.

Esen Gurbuz Cat 12/2 , [2018] :- This paper describe that , NPD brings considerable profits to the businesses if new product is introduced to the market at the right time, is priced at the suitable amount and targets suitable customer group.

HL Khalid [6]:- This case study described a combined approach based on gap analysis, Customer need, and Model theory to identify the need / service improvement.

Sameer S Pujari, Vol 1. [8]:- The technical, industrial and commercial steps which lead to the marketing of new manufactured Products"

Adele Berndt [9]:- This paper states that, a framework of critical success factors, metrics, and tools and techniques for implementing metrics for each stage of the new product development (NPD) process.

3. RESEARCH METHODOLOGY

Step 1: Design questionnaire and Feedback taken through Survey: --

In this research, prepared a set of 10 questions based on Cement strength, Quality parameter and testing procedure & manufacturing of cement and take feedback from random people.

For this survey, we have visited 10 Major cities (Jaipur, Delhi, Jodhpur, Chandigarh, Agra, Ahmedabad, Kanpur, Indore, Kota, Udaipur)

Total 2500+ Sample taken during this survey.

Sample: -

Sr. No	Question	Yes	NO
1	Are you understand about cement strength		
2	Are you aware about cement Quality parameter		
3	Have you faced / see any water seepage issue in your life		
4	Do you know about the solution of water seepage or ingress of water problem		
5	Have any idea about water proof product		

Results: -

1. **Yes: - 18 % No: - 82 %**
2. **Yes: - 12% No: - 88 %**
3. **Yes: - 77 % No: - 23 %**
4. **Yes: - 09 % No: - 91 %**
5. **Yes: - 11 % No:- 89 %**

Collection of Problem / Images: -

In this research, visited 10 major city and collect pictures and data, where water seepage problem occur and some of construction area, where people understand the same.

Building owner are requested to respond on the issue faced by them and in that, observed that, most of the person facing following problem: -

1. Dampness
2. Growth of algae
3. Rusting
4. Efflorescence
5. Deterioration of Paint, Putty
6. De bonding of Tiles from walls and floors
7. Loss of strength.

Step 2: MARKET SURVEY OUTCOME

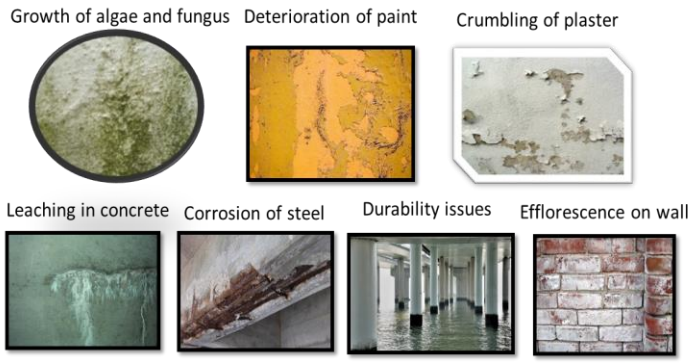

Figure 2: Market Survey

Main Observation that, during rainy season, water penetration and seepage on building problems is increases

Step 3: - SWOT ANALYSIS

Strengths

- Infrastructure available i.e. R & D Lab
- Well established brand Image
- Adequate road dispatch capability
- Adequate limestone reserves are available for about 40 - 45 years and new sites available
- Mix of experienced & young professionals

Weaknesses

- Water seepage or ingress of water causes damage to a building every day
- Life cycle of product
- High energy consumption
- Dependency on natural resources

Opportunities

- Source of growth
- Take advantage of market
- Improvements and revisions to existing products
- Composite cement production
- Capacity increase

Threats

- Government policies and regulations like EC norms
- Pet coke & coal availabilities
- Availability of additives/Price of additives
- Mining (Blasting) & manufacturing activities close to villages & town
- Aspirations of stake holder

Step 4:- PWR TECHNOLOGY

PWRT is a new breakthrough technology in cement production to improve the performance of the cement. It gives systematic and advance distribution of micro particles for denser and leak-proof concrete

Cement Manufactured with PWRT exhibits resistance to penetration of water in a mortar, plaster & Concrete. This property is incorporated by modifying the particle size distribution and fineness of cement through an innovative technique.

This is not a technology which produces the cement, with higher fineness. Two cements with same fineness can perform differently under same conditions.

PWRT increases the percentage of micro particle. PWRT also ensures optimal ratio of fine and active particles in the cement to give the optimum performance in the field.

It significantly reduces water permeation to concrete or Mortar, which results in dry walls and healthy indoor climate, this product can be used in all applications like foundations, Masonry, Plaster& Concrete making etc.

It is an Innovative solution to all problems of water seepage in Foundations Masonry, Plaster and Slabs.

It Gives: -

- Denser concrete, Speedy work
- Better workability, Better Durability
- Resistance to chemical attack

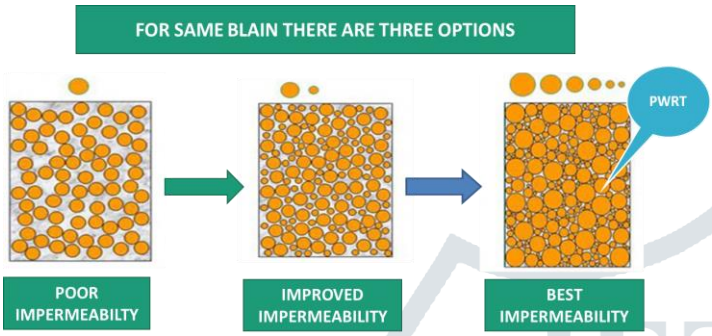

Figure 3: HOW PWRT WORKS

Step 5: - COST ANALYSIS

After analyzed the cost data (Table 1), it been observed that, New product cost is higher than PPC product.

In that case, we have planned a different market strategy to introduce this product in market with its key advantage.

Table 1: Cost Comparison of new product with Existing Product (PPC, OPC-43 and OPC-53)

Parameters	New Product	PPC	OPC-43	OPC-53
Input material Ratio (% of cement)				
Clinker consumption	75.50	66.74	88.36	88.36
Gypsum	6.50	6.94	6.78	6.78
Flyash / Performance Improver	18.00	26.32	4.86	4.86
Total input material	100.00	100.00	100.00	100.00
Input Material Cost (Rs./ MT of specific material)				
Clinker	2007	2007	2007	2007
Gypsum	1228	1228	1228	1228
Flyash / Performance Improver	1014	1014	233	233
Input Material Cost (Rs./ T of Cement)				
Clinker consumption	1515.29	1339.47	1773.39	1773.39
Gypsum	79.82	85.22	83.26	83.26
Flyash / Performance Improver	182.52	266.88	11.32	11.32
Total input material Cost (A)	1777.63	1691.58	1867.97	1867.97
Power cost in Grinding				
Specific Power consumption	31.50	29.50	30.40	35.40
Power cost (Rs,/Kwh)	5.23	5.23	5.23	5.23
Power cost (Rs./MT of Cement) (B)	164.75	154.29	158.99	185.14
Total Cost (Material + Power) Rs./MT of Cement (A+B)	1942.37	1845.86	2026.96	2053.11
Cost of new product higher than PPC Cement				96.51
Cost of new product Lower than OPC-43 Cement				-84.59
Cost of new product Lower than OPC-53 Cement				-110.74

Step 6:- QUALITY PARAMETER ANALYSIS

From the Quality data analysis, It has been observed that Particle size distribution and fineness is on higher side in new

Table 3: Quality Data analysis

Chemical Parameters	New Product	Old Product	Remarks if any
LSF	0.8-1.02	0.8	
A/M	> 0.66	1.5	
IR (%)	< 2 %	4.0	
Mgo %	< 5 %	0.85	
SO3 %	< 3.5 %	2.4	
LOI %	< 4 %	4.0	
Chloride	< 0.1 %	0.03	
Chloride for prestressed structure			
C3A %	< 10 %	NA	
C3S %	> 48	NA	
Physical Parameters			
Fineness (m2/kg)	> 370	> 230	Higher Fineness
Autoclave Expansion (%)	< 0.8	1	
Initial Setting time (Minutes)	> 60	140	
Final Setting time (Minutes)	< 600	180	
Compressive Strength			
1 day	> 17	25	
3 day	> 27	34	
7 day	> 38	45	
28 day	> 53	56	
** Study the sample in laboratory for cement strength till 28 days*			

Step 7: - PRODUCT TESTING

Final trial taken in laboratory for Water Repellent Hydraulic Cement having an integral Water repellent property at the cement particle level, PWRT (Particle level Water Repellent Technology), due to which it exhibits resistance to penetration of water in a mortar, plaster & Concrete .

This property is incorporated on the Cement Particles during its manufacturing process through in house developed technology by improving the particle size distribution and fineness. The Cement particles react with water and subsequently repel water resulting in resistance to water permeation/seepage in mortar and concrete

This product developed as an unique product. The cement has intrinsic properties to resist water seepage. It is an Innovative solution to all problems of water seepage problems in wall masonry, foundations and walls.

It significantly reduces water permeation to concrete, which results in dry walls and healthy indoor climate, The Cement can be used in all applications like foundations, Masonry & Concrete making etc.

Figure 4:

4. RESULTS

After final quality analysis and check the cost viability of the product, we have successfully launched new product within time frame which was decided in beginning.

The key fact of this product is: -

- It is a Water Repellent Cement having an integral Water repellent property at the cement particle level.
- It is manufactured through an in house developed technology called PWRT (Particle level Water Repellent Technology). PWRT is a result of continuous and extensive efforts by us.
- This technology gives a product which produces best & durable concrete and mortar for construction.
- Due to environmental (Air Water and Soil) pollution durability of any structure was always a question. This product answer for durability of any structure.
- It is Green product.

To calculate the actual benefits (Cost as well as Quality) on using this product, Constructed 1000 Sq ft house (@ Resident area).

Table 3 showing the brief analysis for this: -

The average construction cost of 1000 sq ft house is following: -

- **Table 3:**

Parameters	Normal cement	PWRT Based Cement
Cement rate per Bag (Rs)*	345	400
Cement cost per Kg (Rs)	6.9	8
Per Sq Ft cement consumption (Rs)	20	20
Cost of cement per sq. ft (Rs)	138	160
Average cost of construction per sq ft (Rs)	1300	1322
Total cost of the construction (without land) (Rs) 1000 sq ft	1300000	1322000
Difference (Rs)		22000

- *Cost of bag is indicative only it may vary from place to place.

Some Key advantages and benefits: -

Weather Resistance: Due to advanced technology this product gives excellent weather resistance to structure build with it.

Corrosion Resistance: Reduction of micro pores and channels plays a vital role in preventing ingress of oxygen and water in concrete and save reinforcement steel from corrosion.

UV Resistance: It's makes concrete UV resistant. Therefore, it helps in keeping surface less warm, as well as reduced chances of shrinkage cracks.

Protection from dampness: It reduces micro pores and channels in concrete and provides protection from dampness.

Reduced Salt Effloresces: With excellent water penetration resistance, this prevention of salt effloresces on surface of mortar and concrete.

Higher Durability: Water is the main source of ingress of harmful salts, gases, micro- organisms in the building and these causes deterioration of building. With excellent water penetration resistance, it gives higher durability to building and ensure for longer service life.

5. CONCLUSIONS

At the just Rs.22000 extra which is 1.66 % of the total cost of the construction we get, a long lasting, Durable, Strong, Water resistant, Free from Efflorescence Healthy (free from fungus due to moisture) home. In addition of this, the house constructed with this product will also give saving in putty and paint consumption. It will also increase the life of paint which lead to further saving as we require to repaint the house at longer time duration.

So it is always a wise decision to use this product for all places.

6. REFERENCES

[1] CLARK K., FUJIMOTO T. [1991] - Product Development Performance: Strategy, Organization and Management in the World Auto Industry, Boston: Harvard Business School Press.

[2] Hayhurst M., [1968] – "New product development for a manufacturing unit / factory."

[3] Arvind Mehra, S.K. Rathore, [2009], "Need base product Development and Market strategy in India "NIT International Journal of Mechanical Engineering, Vol. 1, no. 2

[4] Nadia Bhuiyan, [2011], "A framework for successful new product development ", Journal of Industrial engineering and management, Concordia University CANADA) Vol.10, Accepted Nov-2011.

[5] Anand Sharma, Jayant Malhotra, [2004] "Identification and Categorization of product, New product development process and Customer need philosophy for an Automobile Company", International Journal of Engineering Research & Technology, Vol.3 - Issue 6.

[6] HL, Khalid, [2008] "An empirical analysis after product life cycle and customer satisfaction", Management and marketing challenges for the knowledge society, vol.6, no.4, pp. 561-572.

[7] Central Advisory Council on Science and Technology, 1968, Chapter -12.

[8] Sameer S Pujari , [2011], "Customer Satisfaction for Designing Attractive Qualities of Healthcare Services in In", MIT International Journal of Mechanical Engineering , vol. 1, no. 2 .

[9] Adele Berndt., [2009], "Need base assessment for Improving the way of identification of customer requirements in South Korea ", International Journal of Business and Social Science, Vol. 8, No. 3.

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