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Influence of Research and Development (R&D) Cost on Profitability: A Study of Indian Pharmaceutical Sector

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Abstract: *The Indian Pharmaceutical Industry (Ipi) Is The World's Second-Largest Industry By Volume And Is Likely To Lead The Manufacturing Sector Of India. It Meets Around 70% Of The Domestic Demand For Bulk Drugs, Drug Intermediates, And Pharmaceutical Formulations. But Till Now Public Attention In This Country Has Been Focused So Much On The Profitability And Liquidity Of Corporate Finances. Furthermore, No Studies Were Made On Pharmaceutical Industry In Connection With Examining The Relationships Between R&D Cost And Profitability. Keeping Above Facts In View, This Research Work Focuses On Various R&D Activities And Business Strategies Adopted By Indian Pharma Industry To Sustain Business In Terms Of Profitability. This Study Will Be Beneficial To Companies As It Brings Out The Effect Of Investment In R&D On These Key Company Performance Indicators. This Can Be A Valuable Tool For Companies In Making Decisions Regarding Allocation Of Investment Funds.*

Key Words*: Pharmaceutical Industry, R&D Cost, Profitability*

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I. Introduction

The Indian Pharmaceutical Industry (Ipi) Is The World's Second-Largest Industry By Volume And Is Likely To Lead The Manufacturing Sector Of India. It Meets Around 70% Of The Domestic Demand For Bulk Drugs, Drug Intermediates, And Pharmaceutical Formulations. There Are About 250 Large Units And About 8000 Small Scale Units, Which Form The Major Empire Of Pharmaceutical Industry In India (Including 5 Central Public Sector Units). These Units Produce The Large Range Of Pharmaceutical Formulations, Like Medicines Ready For Consumption By Patients And About 350 Bulk Drugs, Including Chemicals Having Therapeutic Value And Used For Production Of Pharmaceutical Formulations. The Domestic Market Was Worth Us$ 12.26 Billion.

Both The Indian Central And State Governments Have Recognized Research And Development As An Important Driver In The Growth Of Their Pharma Businesses And Conferred Tax Deductions For Expenses Related To Same. They Have Granted Other Concessions And Other Financial Assistance Like Reduced Interest Rates For Export Financing And A Cut In The Number Of Drugs Under Price Control. In Spite Of This, R&D Expenditure As Percentage Of Sales Turnover (R&D Intensity) Of Indian Pharmaceuticals Industry Remained Less Than 2 Per Cent Throughout The Period Till The Beginning Of The New Millenniums As Against The Global Pharmaceuticals Innovative Firms Spending Of 15 Percent. Perhaps The Low R&D Intensity Is Explained By The Fact That Indian Companies Were Engaged Primarily In The Manufacture Of Generics And Development Of Non-Infringing Processes And Not In New Drug Development, Which Involves Huge Investments. The Process Patent Regime Under The Patents Act 1970 Enabled Indian Companies To Manufacture And Market Patented Drugs Using Non-Infringing Processes. However, Now That India Is Entering Into The Patent Protection Area, Many Companies Are Spending Relatively More On R & D. But R&D Spending By Itself Doesn't Guarantee Profitability And Strong Stock Performance. Some Companies See A Payoff From Spending Heavily On R&D When Projects Are Deemed To Be Successful. On The Other Hand, Companies Can Also Suffer From Poor Performance Losses Even After Investing A Great Deal Of Money Each Year In R&D.

Again, The Reason For Using Research And Development Expenditures As A Measure Of Innovation By A Firm Is That As Firms Spend More Funds On Research And Development They Are Providing Their Researchers With More Resources At Their Disposal, Which Should Result In A Better Likelihood Of Innovating Successfully. When Firms Innovate, They Receive Patents, Which Give Them A Temporary Monopoly Over The Market, Which Provides Excess Profits. The Excess Profits Will In Turn Raise Market Value. If A Positive Correlation Is Found Between Market Value And Research And Development Expenditures, It Will Give Support That Innovation Is In Fact A Driving Force Of A Capitalistic Economy As Stated By Schumpeter.

II. Research Problem

The Indian Pharmaceutical Industry Ought To Have Its Visibility In Global Market And Capacity To Compete With The Pharmaceutical Companies From The Developed Countries Like; Europe, Japan, And United States. For Decades, It Was Happily Producing Generic Drugs And Combination Medicines Of Questionable Efficacy And Raking In Huge Profits. The Phasing Out Of Process Patents In 2005 Changed The Landscape. The Pharmaceutical Companies Are Forced Now To Look At R&D, Something They Had Long Neglected. Faced With This Situation, The Big Players Started Looking To Develop The R&D Facility, As It Is The Only Way Out Of A Possible Crisis. In This Light, Main Objective Of This Research Work Is To Assess The Impact Of Investment In R&D Cost Over Profitability Because The Efficiency Of A Business Concern Is Measured By The Amount Of Profits Earned. The Larger The Profits, The More Efficient And Profitable The Business Becomes. To Have A Good Grasp Of This Situation, Answer To The Following Two Research Question Is Imperative.

- Does R&D Cost Contribute In Any Way To The Profitability Of The Indian Pharmaceutical Industry And To What Extent Is Its Contribution?
- **Purpose Of The Study**
  The Aforementioned Question Can Best Be Comprehended Through The Purpose Of This Research Study Which Encompasses The Following.
- Exploring The Relationship Between R&D Costs And Profitability In Indian Pharmaceutical Sector.

III. Literature Review

Considerable Attention Has Been Devoted To Measurement Of The Level Of Research And Development Activity And Its Relationship To Profitability. The Relationship Between R&D Outlays And Profitability Has Been Emphasized By **Grabowski & Mueller** (1988), **Hirschey** (1982), And **Roberts & Hauptman** (1987). **Branch's** (1974) Study Of Seven Industries Found That Changes In R&D Outlays Ware Significantly Related To Changes In Profits. **Schoeffler** (1977) Determined That High R&D Outlays Are Negatively Correlated With Profits If The Market Is Growing Rapidly And That R&D Outlays Have A Positive Effect On Performance Only If The Firm Is In A Strong Position To Begin With. A Study Of 727 Companies For Years 1983 To 1987 Found That R&D Intensity (I.E., R&D Outlays/Sales Revenues) Did Not Correlate Significantly With Return On Sales Or Return On Assets (**Morbey & Reither,** 1990). A Weak Relationship Between Research Intensity And Profit Growth Was Found In Computer, Paper And Machinery Industries.

In Contrast, A Study Of Growth, Productivity, And Profitability Measures For Twenty-Six Consumer Durable Manufacturing Companies, Twenty-Six Nondurable Consumer Products Manufacturing, And Twenty Producer Durables Companies For 1991 Found R&D/Sales And R&D/Employee Positively Related To Return On Assets For The Nondurable Consumer Companies And Negatively Related To Return On Assets For The Producer Durables Companies (**House & Fries**, 1992). R&D/Employee May Be A Better Measure Of Research Activity In Many Instances Since The Number Of Employees Has Less Short Term Variability Than Sales Revenue. In A Study Of 134 Companies (1978-1987), R&D/Employee Was Found To Be Positively Correlated With Profit Margin And Sales Per Employee But Not Return On Assets While R&D/Sales Revenue Was Not Correlated With Return On Sales, Return On Assets, Or Sales/Employee (**Morbey & Reithner**, 1990). **Grilches** (1987) Found That The Level Of R&D Activity Contributes Significantly To Productivity Growth In Larger U.S. Manufacturing Companies.

Under This Backdrop, This Section Explores The Relationship Between R& D Expenditure And Profitability In The Pharmaceutical Industry. This Subject Is Relevant Because Many Firms In The Pharmaceutical Industry In India And Other Developed Countries Throughout The World Currently Spend Heavily On R&D In Order To Remain Competitive. However Some Commentators In The Recent Debates On Healthcare Cost And Healthcare Reform Contend That The High R & D Expenditure In The Industry Is Part Of The High Healthcare Cost Problems (**Mcclatchy Tribune Business News**, 2008; **Worldwide Biotech**, 2008).

IV. Methods Of Investigation

Basically, The Statistical Measures Which Have Been Applied Are Mean, Standard Deviation Etc. These Measures Are The Fundamental Measures Applied To Know The Present Status And R&D Investment Pattern In Sample Companies.

Second Part Of The Study Emphasizes On Establishing A Relationship Between R&D Cost And Market Value Of The Selected Pharmaceutical Companies In Indian Context Using Regression And Correlation Analysis.

V. Analysis& Findings

Trend Of R&D Cost In Indian Pharmaceutical Industry

Table-1

Trend Of R&D Cost In Indian Pharmaceutical Industry
(Rs. Crores)

Company	Period						Mean	Std Devn	Growth
	2007	2008	2009	2010	2011	2012			
Celestial Biolab	8.6	8.4	21	35.4	39.4	63.8	29.43	21.28	0.49
Amrutanjan	12.3	86.3	24	7.8	6.4	0.6	22.9	32.03	-0.45
Suven Life Sc	270.4	300.6	344.6	366	333.8	336.8	325.37	34.23	0.04
Marksans	54.2	2.4	0.6	0.5	Na	Na	14.43	26.53	Na
Natcopharma	81.95	75.94	115.2	77.9	110.5	84.3	90.97	17.27	0.01
Neuland Labs.	252.3	259.8	206.7	117.9	118.8	121.3	179.47	68.34	-0.14
Fres.Kabionco.	357.1	262.3	307.3	347	850.7	723.7	474.68	247.65	0.15
Ajanta Pharma	174.4	314.1	223.9	219.6	478.8	395.4	301.03	117.72	0.18
Dishman Phar	99.1	21.8	69.8	82.2	86.3	138.7	82.98	38.19	0.07
Indoco Remedies	110.7	101.4	111.3	125.7	113.3	173.2	122.6	25.98	0.09
Aarti Drugs	35.4	52.7	29.4	49.9	68.1	56.4	48.65	14.16	0.10
Hikal	79.8	81.6	79.6	83.6	102	133.4	93.33	21.38	0.11
Plethico Pharma.	279	176.4	180.9	134.7	83.7	25.2	146.65	87.67	-0.38
Merck	14.8	15.6	20.4	28.5	33.9	64.2	29.57	18.53	0.34
Shasun Pharma	218.4	207	166.9	202.4	142.7	116.3	175.62	40.52	-0.12
Fdc	63	117.6	211	193	208.1	204.3	166.17	61.55	0.27
Arcolab	375	532.5	580.5	152.5	1103.7	1223.8	661.33	418.59	0.27
J B Chem	121.3	107.8	60.1	97.4	113.6	156.5	109.45	31.48	0.05
Unichem Labs	228.3	327.1	302.1	317.8	663.5	591.6	405.07	177.27	0.21
Elder Pharma	34	43.4	45.1	53.9	49	51.5	46.15	7.11	0.09
Alembic	345.4	462.4	476.9	490.4	18.5	18.5	302.02	225.58	-0.44
Pfizer	238	245.8	283.5	292.7	106.7	64.7	205.23	95.87	-0.23
Abbott India	35.5	50.2	12.1	18.6	13.4	17.8	24.6	15.09	-0.13
Glenmark Pharma.	513.7	659.1	619.1	518.6	659.2	796.5	627.7	105.3	0.09
Biocon	478.7	646.5	743.8	753.8	520	377	586.63	152.49	-0.05
Divi's Lab.	102.8	114.7	119.6	214.5	216.6	282.7	175.15	73.22	0.22
Sanofi India	45.3	50.1	132.3	55.2	67.4	41.7	65.33	34.01	-0.02
To'pharma	1121.4	1131.7	1150.3	1195.5	1336.5	1246.4	1196.97	82.54	0.02
Ipca Labs	328.3	429.2	502.2	572.8	779.6	779.6	565.28	184.7	0.19
Wockhardt	1278.6	1267.4	1104.7	1198.7	1101.9	1738.2	1281.58	236.28	0.06
Cadila Health.	1560	1618	1895	2178	3017	4007	2379.17	957.28	0.21
Glaxosmit Pharma	58.1	126.8	80.2	54.4	38.7	24.6	63.8	36.13	-0.16
Sun Pharma.	1882.8	1443.9	1511	1436.7	1592	2008.7	1645.85	242.25	0.01
Jubilant Life	526	708.4	1512.8	880	799.4	1047.7	912.38	341.62	0.15
A'pharma	967.1	1175.1	1032.3	1014.8	1757.2	1989	1322.58	438.2	0.16
Lupin	1421.4	1933.7	2669.1	4251.1	5475.6	6161.6	3652.08	1943.03	0.34
Dr Reddy's Labs	2928	4372	4578	4271	6247	6651	4841.17	1380.33	0.18
Ranbaxy	4605.1	4713.8	4943.8	4978.9	4702.1	4937	4813.45	158.35	0.01
Cipla	1757.3	2340.1	2515	2626.8	2848.5	3238.3	2554.33	498.46	0.13
Max	4605.1	4713.8	4943.8	4978.9	6247	6651			
Min	8.6	2.4	0.6	0.5	6.4	0.6			
Total	23063.55	26583.64	28982.1	29696.2	36003.6	40089			
Average	591.37	681.63	743.13	761.44	947.46	1054.97			

Source:*Computed By The Researcher From Various Annual Reports Of Companies*

The Table-5.1 Portrays The R&D Cost Incurred By Sample Companies In Indian Pharmaceutical Sector During Period 2007-12. From The Table, It Is Observed That The Volume Of R&D Cost Have Fairly Increased From Rs.23063.5 Crores To Rs. 40089 Crores With Cumulative Growth Rate Of 12 Percent Per Annum In Indian Pharmaceutical Sector During The Period Of Our Investigation. The Highest R&D Investment Was Found To Be Rs. 6651 Cores In 2012 For Dr Reddy's Labs, Whereas Lowest Was Established In The Year 2010 For Marksans Pharma Ltd. However, We Noticed Highest Cumulative Growth In Case Of Celestial Biolab Ltd (About 49 Percent Per Annum) Followed By Lupin With 34 Percent And Lowest With A Very Popular Company In Indian Pharma Sector; I.E. Amrutanjan Ltd, Where Growth Rate Was Found To Be Negative I.E. (-) 45 Percent Per Annum.

The Year-Wise Analysis Of Sample Companies Reveals That In 2007, The Ranbaxy Ltd Has Invested Highest Amount, I.E. Rs 4605.1 Crores In R&D, Followed By Dr Reddy's Labs With Rs. 2918 Crores. Again In 2008, 2009 And 2010 Ranbaxy Also Topped The List As Regards To The Investment In R&D Is Concerned, Where As Dr Reddy's Labs Replaced The Ranbaxy Ltd In This Respect In The Last Two Years Of Study. Contrary To This, Celestial Biolab Have Invested Least In R&D Activities (Rs. 8.6 Crores Only) In 2007, Followed By Amruntanjan Health With Rs.12.3 Crores And Merck With Rs.14.8 Crores. Similarly, Lowest Investment Was Found For Marksans Pharma With Rs 2.4 Crores, Rs. 0.6 Crores And Rs. 5 Crores For Three Next Consecutive Years. However, Amruntanjan Health Found With Least Investment In Last Two Years Of Study With An Investment (Rs. 6.4 In 2011 And 0.6 In 2012). However, The Average Of Indian Pharma Sector Investment In R&D Is Found To Be Rs. 796.67 Crores During The Entire Period Of Study.

Correlation Between R&D Cost And Profitability In Indian Pharmaceutical Industry

The Correlation Between R&D Cost And Profitability Has Been Assessed Through Karl Pearson's Coefficient Of Correlation And Computed Values Are Presented In Table-2.

Table:2
Correlation Between R&D Cost And Profitability
Correlations Between R&D Cost And Profitability In Indian Pharma Sector

		R&D Cost	Profitability
R&D Cost	Pearson Correlation	1	.714**
	Sig. (2-Tailed)		.000
	N	39	39
Profitability	Pearson Correlation	.714**	1
	Sig. (2-Tailed)	.000	
	N	39	39

Source:*Computed By The Researcher From Collected Data*

The Coefficient Of Correlation Between R&D Cost And Profitability In Pharma Sector Of India Is Calculated To Be 0.714. The Value Of Coefficient Of Correlation Shows That R&D Cost Significantly And Positively Affects The Profitability Firms In Pharmaceutical Industry.

- **Impact Of R&D Cost On Profitability In Indian Pharmaceutical Industry**

After Assessing The Degree Of Correlation, Effort Has Been Made To Analyze The Magnitude Of Influence Of R&D Cost Over The Profitability In Pharmaceutical Companies Of India By Applying The Linear Regression Analysis. The Basic Model Of Which Is:

Profitability = F (R&D Cost)

$P = A + B_1x_1 + E$

P= Profitability Of Pharmaceutical Companies

X_1= R&D Cost

The "A" Is Constant And "B" Is Coefficient To Estimate And "E" Is The Error Term. Profitability Is Taken As The Dependent Variable And R&D Cost As Independent Variable.

The Statistical Hypotheses For The Significance Of The Regression Model Are As Follows:

H_0: The Relationship Between R&D Cost And Profitability In Indian Pharmaceutical Industry Is Dependent Of Each Other.

H_1: The Relationship Between R&D Cost And Profitability In Indian Pharmaceutical Industry Is Independent Of Each Other.

If The Significant Value (Sig. Value) Is Less Than 5% (0.05), The Linearity Of The Relation Between The Two Variables Is Approved Otherwise Rejected.

Table-3 Represents The Impact Of R&D Cost Over Profitability On Total Sample Companies Through Regression Analysis.

Table- 3

Impact Of R&D Cost On Profitability In Indian Pharmaceutical Industry

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.124	0.606		4.275	.000
	R&D Cost	.830	.851	.889	11.788	.000
Adjusted R Square : 0.784						
A. Dependent Variable: Profitability						
Source: *Computed By The Researcher From Collected Data*						

The Adjusted R Square Value (0.784) Indicates That The R&D Cost Is About 78.4 Percent Responsible For Change In Profitability In Indian Pharmaceutical Sector. Coefficient Analysis Shows The Relationship Between Profitability (Dependent Variable) And R&D Cost (Independent Variable) In The Form Of Sig. Value. According To Sig. Value, R&D Cost Has Significant Correlation With Profitability Of The Sample Companies As Table Sig. Value Of 0.05 Is Found To Be Higher Than Calculated Sig. Value Of 0.000. Again The Value Of The Coefficient Is Computed As 0.830 Which Represents That 100 Percent Change In R&D Cost Leads To 83 Percent Change In Profitability Of The Sample Companies. The Regression Equation To Estimate The Relationship Is Follows:

Profitability = 4.124 + 0.830 × R&D Cost+ 0.606

From The Above Statistical Analysis It Is Observed That There Is Significant Relationship Between R&D Cost And Profitability In Indian Pharmaceutical Industry As The Calculated Sig Value Of 0.000 Is Less Than 0.05.

Hence The Null Hypothesis Is Accepted By Rejecting The Alternative Hypothesis.

The Above Result Suggests That The Greater Intensity On Research And Development Increases A Firm's Innovation Capabilities And Therefore Increase The Firm's Profitability.

VI. Conclusion:

The Main Objective Of This Paper Was To Analyse The Trend Of R&D Cost In The Indian Pharmaceutical Sector During The Period 2007 To 2012 Followed By Testing The Fundamental Relationship Between The R&D Cost With Profitability.

It Is Inferred From The Analysis That The Investment On R&D Activities Followed A Rising Trend During The Period Of Study. The Karl Pearson's Correlation Analysis Proves That There Is A Significant Relationship Between R&D Cost With Profitability Of The Sample Companies. Finally Through Regression Analysis The Impact Of R&D Cost Overprofitability Was Ascertained. This Analysis Revealed That A 100 Percent Change In R&D Cost Leads To 83 Percent Change In Profitability In Pharmaceutical Sector Of India.

Though Investment In R&D By Pharma Industry As A Whole In India Has Fairly Improved; Still It Has Been Low Over The Period Of Our Study. The Low Investment In R&D Is Due To The Low Levels Of Profitability, Lower Market Capitalization, And Comparatively Small Size Of The Companies. Not Much R&D Is Being Pursued In Traditional Systems Of Medicine. Even The Limited R&D Is Concentrated On Standardisation Of Raw Materials And Final Products. A Few Companies Are Now Using Modern Scientific Methods And Limited Biological Screening As Well As Toxicity Studies For Validation Of Formulations. However, The Scenario Is Now Changing. Some Pharma Companies Now Spend Nearly 5 Percent Of Their Turnover On R&D.

VII. Limitations:

This Study Is Based Upon The Secondary Data. So All The Limitations Inherent To The Secondary Data Are Applicable Here In This Study In Addition To The Followings:

- Efforts Were Made To Secure As Much Information As Possible From Various Sources. Since The Companies Follow Different Approaches In Computing The Data And Defining The Concepts, There May Be Certain Discrepancies In The Interpretation Of Data
- The Study Extends Over A Period Of Seven Years Only From 2006-2012 During Which Inflation Has Obviously Taken A Heavy Toll Of The 'Real Value Of The Rupee'.
- This Study Includes The Data Related To Only 39 Pharmaceutical Companies Operating In India.
- Lastly, The Study Focused Only To Establish A Causal Relationship Of R&D Cost With Profitability In Pharmaceutical Industry, But Has Not Included The Influence Of Patent Life, Advertising Cost, Policy Reforms Etc. Over Profitability.

References:

[1] Grabowski, H. G., & Mueller, D.C. (1988). Industrial Research And Development, Intangible Capital, And Firm Profit Rates. Bell Journal Of Economics, 328-343.
[2] Branch, B. (September. 1974). Research And Development Activity And Profitability: A Distributed Lag Analysis. Journal Of Political Economy, 999-1011.
[3] Edge, A. G., Keys, B., & Remus, W. E. (1985). The Multinational Management Game. Dallas: Business Publications, Inc.
[4] Hatten, K. J., & Schendel, D. E. (1977, December). Heterogeneity Within An Industry: Firm Conduct In The U. S. Brewing Industry. The Journal Of Industrial Economics, Vol 27(4), 97-1 13.
[5] Hirschey, M. (1982, June). Intangible Capital Assets Of Advertising And R&D Expenditure. Journal Of Industrial Economy, 375-390.
[6] W. C., & Fries, Clarence. (1992). Critical Success Ratios: A Comparison Of Two Technology-Intensive Industries. Southwest Business Symposium.
[7] Morbey, G. K. (1989, May-June). R&D Expenditures And Profit Growth. Research Technology Management, Pp. 8-15.
[8] Moreby, G. K. & Reither, R. M. How R&D Affects Sales Growth, Productivity, And Profitability. Research Technology Management, Pp. 11-14.

[9] Peters, T. J., & Waterman, R. H. Jr. (1982). In Search Of Excellence. New York: Harper & Row. Roberts, E. G. & Hauptman, O. (1987, March).
[10] The Financing Threshold Effect On Success And Failure Of Biomedical And Pharmaceutical Startups. Management Science, Vol. 33(3), 38 1-394.
[11] Wesley. Schoeffler, 5. (1977) Good Productivity Versus Bad Productivity. P/Ms Newsletter, Vol 77, Cambridge: Strategic Planning Institute.
[12] Thompson Arthur A., Jr. & Stappenbeck, Gregory J. (1992) The Business Strategy Game. (2nd Ed.) Homewood: Irwin. Walsh, F. J. (1987) Measuring Business Unit Performance. National Industrial Conference Board Research Bulletin, No. 208.

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