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Net Present Index Rate The Dcf-Method For Product Lifecycle Cost Based Capital Budgeting-An Innovative Application Of Profitability Index

Dr. Sreedhara Ramesh Chandra[1], Dr. Dhadurya Naik M[2]

[1]Associate Professor, Department of MBA, Atria Institute of Technology, Anandnagar, Hebbal Bangalore 560024.
ORCID ID: 0000-0002-0014-6240

[2]Assistant Professor, Department of Business Administration, Prasad V Potluri Siddhartha Institute of Technology, Kanuru, Andhra Pradesh.
ORCID ID: 0000-0002-3625-2125

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KEYWORDS
Capital budgeting, certainty, uncertainty conditions, project lifecycle costing, ROS, ETROS, CEROS, CEACIFR. PVCEACIFR, CENPIR, PVACIFR CENPIR NPIR, NPIIR, NPIIRTV, NPV IRR, PI:

ABSTRACT
The development of a new integrated method of DCF technique the Net Precast Index Rate (NPIR) for project life cycle costing based effective investment decision "An efficient application for the PI with the innovated new IPPPA tools. The new formulae of IPPPA are instrumental for the innovative design of integrated sensitivity, scenario, break-even, and certainty equivalent cash flow techniques of investment analysis as the unique technique that ensures to overcome their limitations mutually and combines their advantages with the use of the modified version of the Profitability index as net present index rate (NPIR). It is able to provide a more effective application of the profitability index which is free from the limitations of NPV and assumptions of IRR. The most advantage of this method is that it provides the scope of using the ideal/standard/targeted level of performance as the basis for the entire lifecycle of the project in the analysis on one hand and the effects of the changes in operating variables on ROS as the extent of effect and the returns on investment in terms of indexed rate of return at present value on the other. The Profitability Index (PI) provides parity in weightage for the risk and returns with no ambiguity or assumptions. The NPIR or NPIIR are similar in characteristics of PI except the adoption of one assumption that the "accounts finalization is deemed to be done at the end of n^{th} year, for NPIIR". These are enabled to apply the prediction/forecasted extent of deviations/change is the uniqueness of NPIR or NPIIR. The NPIR and NPIIR curves represent respectively the marginal and average index rate at present value of economic analysis to identify the peak rate of returns and overall maximum rate of index returns at present value. It forms as the standard base for continuous evaluation and feed back in progression all through life of the project with provision for f impact analysis in financial perspectives point by point in the course of implementing the performance improvement strategies like BSC, back flush Costing, Target costing etc.

Full form of key acronyms: ROS(return on sales), ETROS (elasticity of target return on sales of target revenues), CEROS (certainty equivalent return on target sales), CEACIFR (certainty equivalent annual cash inflow rate on initial investment), PVCEACIFR (present values of certainty equivalent annual cash inflow rate), CENPIR (certainty equivalent net present index rate), PVACIFR (present value of annual cash inflow rate on initial investment), CENPIR (certainty equivalent net present index rate on initial investment), NPIR (net present index rate on initial investment), NPIIR(net present internal index rate on initial investment), NPIIRTV (NPIIR at terminal value), sensitivity, scenario, sensitivity to the scenario.

1. INTRODUCTION

The full costing techniques, such as absorption costing (UBC) and activity-based costing (ABC), allocate semi-fixed and

fixed costs to product units but are limited to short-run applications. Conversely, marginal costing (MC) and the Theory of Constraints (TOC) often disregard semi-fixed and fixed costs, either partially or entirely, making them unsuitable for long-term applications. The Integrated Product Profitability and Performance Assessment (IPPPA) process overcomes these limitations by balancing both approaches. It limits the allocation of semi-fixed and fixed overheads as product costs under ABC, while simultaneously treating them as constant within volume limits, similar to TOC. This ensures compatibility between ABC and TOC, leading to a more comprehensive total cost determination.

For simplicity, TOC and methods like MC/CVP/BEA typically ignore fixed costs in product cost calculations, while UBC and ABC apply overhead absorption rates. Although this provides reasonable cost assessment accuracy, it remains constrained in short-term applications due to the lack of a direct proportional relationship between fixed costs and volume. The IPPPA process optimally integrates ABC and TOC for mid-term applications by maintaining this proportionality while implicitly excluding overhead as a unit cost. Since UBC and ABC do not inherently recognize fixed costs, they lack the scope for variance analysis in cost control. Similarly, TOC's simplified approach limits its applicability to variance analysis. IPPPA ensures factual consistency in total cost compilation, combining simplicity with accurate marginal and total cost assessment. It facilitates profit planning and cost control across short-, mid-, and long-term horizons with a structured variance analysis framework. In the context of product lifecycle cost-based project investment decisions, IPPPA demonstrates a skillful integration of ABC and TOC with discounted cash flow (DCF) techniques for capital budgeting. This approach enhances planning, control, and appraisal of project proposals using present value considerations for more effective investment evaluation.

Investment proposal evaluation methods fall into two main categories: traditional techniques and Discounted Cash Flow (DCF) techniques, each used under certainty and uncertainty conditions. Traditional methods, such as the Payback Period (PBP) and Accounting Rate of Return (ARR), focus solely on either pure risk or pure returns, without accounting for the time value of money. In contrast, DCF-based methods are considered more effective as they incorporate the time value of money while also addressing both risk and return factors in the evaluation process. Among DCF techniques, investment proposals are primarily assessed using either Net Present Value (NPV) or Internal Rate of Return (IRR). While NPV focuses more on risk by discounting future cash flows, IRR prioritizes returns by identifying the discount rate at which NPV becomes zero. The Profitability Index (PI), often seen as an extension of NPV, provides a more balanced approach by giving equal weightage to both risk and return, unlike NPV's emphasis on risk or IRR's focus on returns. Its simplicity and relevance make PI an effective tool for investment decision-making.

The methods of evaluation in the context of uncertainty conditions of Cash Inflows viz. the sensitivity, scenario, present value break-even and certainty equivalent cash inflows etc. Though they are effective, they are suffering from certain limitations [19,20,22]. Such as the sensitivity analysis able to provide the change effects of not more than one element/variable at once[22]; the scenario though considers the change effects of all thevariables but no provision for independently identifiable effect of any one variable alike of sensitivity[22]. Further, though the certainty equivalents are able to apply the cash-flows under different scenarios with probability of occurrence of distinct conditions/scenario, it is unable to implicate the effects of change in the operating aspects alike of sensitivity/scenario directly. Further more importantly, though the uncertainty is confined to operating aspects and affects the returns more than the cash inflows, for which there is no provision in the certainty equivalents. Finally, the evaluation criterion has noparity on the risk return weight-age being measures in-terms either NPV or IRR[20].

The proposed technique integrates all the previously discussed methods, ensuring a balanced approach without overemphasizing either risk or return while giving due consideration to the time value of money. It effectively overcomes the limitations of these methods while incorporating the measuring implications of NPV and IRR through the Net Present Index Rate (NPIR) / Net Present Internal Index Rate (NPIIR). Additionally, the graphical representation of the Index Rate in progression enhances clarity in risk mitigation and return projection under varying conditions of certainty and uncertainty, ensuring a more comprehensive evaluation after validating acceptability through the certainty equivalent Net Present Index Rate. More importantly, this technique is highly suited for strategic cost management, particularly in the context of project and product lifecycle costing, profitability assessment, and evaluating the efficiency and effectiveness of products or projects throughout their lifecycle. By integrating a flexible budgeting approach within capital budgeting analysis, it provides a dynamic and adaptable framework for informed decision-making.

2. LITERATURE REVIEW

The contemporary multi-product operations, automation and computerization of information and accounting systems the CMA practices of the 1950s and 1980s become irrelevant [Johnson, H. T. and R. S. Kaplan 1987][1]. The management accounting research of the late 20th century and early 21st century has concentrated on both financial and non-financial information-analytical systems for the regaining of relevancy of CMA [Johnson, H. T. 1992.][2]. The Management research in this era has concentrated on three distinct dimensions. One is the disclosure of ABC in place of the traditional total cost-based Absorption Costing/Unit based Costing (UBC) system. The second is the TOC [Goldratt, E. M. 1992][5] as a solution to overcome the complexities in the treatment of semi-costs of Direct/Marginal costing based Cost Volume Profit Analysis/Break-even Analysis (CVP/BEA). And thirdly the non-financial systems like Balanced Score Cards (BSC), Just In

Time Processing (JIT), and Total Quality Management (TQM) [Albright, T. L. and H. Roth. 1993][6]. The third category is concerned mostly with deriving of the norms/standard measures for non-financial to impact/improve and work with the strategic management issues. Theory of Constraints Through-put Costing (TOC) for the short term. Further, the research studies on the systems and environments like JIT [Deluzio, M. C. 1993][4], BSC [Kaplan, R. S. and D. P. Norton. 1996][3], [Lipe, M. and S. Salterio. 2000][8] , TQM [Albright, T. L, and H. Roth. 1993][6], ABM etc. have concentrated on the improvement of physical efficiencies and management and control of physical operations' costs at the micro/functional level, being implicated in the nonfinancial information.

Research Gap

The aspect of long terms investment and project life cycle costing and profitability analysis under certainty and uncertainty conditions is not properly aligned with these contemporary methods and techniques identified as the basic need as the gap for the present research disclosure.

Objectives of the study

To provide the optimum method and process for the effective report on product life-cycle costing with graphical presentation on the risk return tread-off with projection of profitability, efficiency and effectiveness.

The development and elaboration of the design and application process of progressive net present indexrate (PNPIR)/net present internal index rate (NPIR).

To clarify on the matters how the integrated technique relieves limitation effects of the existing NPV and the assumptions of IRR with the net present index rate (NPIR).

3. RESEARCH METHODOLOGY

Innovative research to develop the method and process for application of new IPPPA tools to fill the analytical gaps in the ascertainment of project/product life-cycle costing and analysis of profitability, efficiency and effectiveness of them with total cost effects under the direct costing & Cost Volume Profit (CVP)/break-even analysis (BEA) concepts and with the DCF implications. The Design process has used the following basic theme, concepts & variables applied in the method and process for the application IPPPA tools:

The theme of research: The innovated method and process is designed on the following theme that once the projects under consideration are determined and the details of variables and the values of them at each of the initial introduction-growth-maturity-decline stages were evolved in consideration of the environmental changes in due course in progression of the project all though the life period with probability of occurrence on one hand on the value of variables targeted as ideal on the target performance levels. The primary plan has to be chalked out either on the target performance level or at the initial level. The assessment of the costs revenues performance and results (returns) in progression are measured on the basis of primary plans. This process provides with crystal clarity that at each stage of the life cycle what are the effects of changes predicted have been presented as extent of effect on ROS for the predicted change in each of the variable individually and in net total of all the changes in variables as of elasticity of ROS is the unique in nature for the evaluation process enabled by the IPPPA tools. It allows the analyst to used the initial plan as the standard norm/bar for the assessment of efficiency of operations in progression. This relieves the burden of finding a right norm for measuring the performance being the original plan forms as the basis i.e. on the own norms/standards resemble the standard costing variances.

Concepts under consideration:

Determination of the Individual effect of changes in each one of the accounting variables on Return On Sales (ROS):

- The Elasticity of ROS with respect to each of the variables.
- Differential Selling Price (ΔSP) -The difference in Selling Price ($\Delta SP = SP_2 - SP_1$)
- Differential Variable Cost (ΔVC) - The difference in VC ($\Delta VC = VC_2 - VC_1$)
- Differential Fixed Cost (ΔFC) - The difference in FC ($\Delta FC = FC_2 - FC_1$)
- Differential Volume (ΔVol.) - The difference in Vol. ($\Delta Vol. = Vol_2 - Vol_1$)

Variables under consideration:

- Differential Price = (ΔSP),
- Differential Selling Price (ΔSP),
- Differential Variable Cost (ΔVC),
- Differential Fixed Cost (ΔFC),
- Differential Volume (ΔVol.)
- The planned level of selling price (SP_1)

- The changed limit of selling price (SP_2)
- The planned level of Variable Cost (VC_1)
- The changed limit of Variable Cost (VC_2)
- The planned level of Fixed Cost (FC_1)
- The changed limit of Fixed Cost (FC_2)
- he planned level of Vol (Vol_1)
- The changed limit of Vol. (Vol_2)

The formulae of IPPPA tool-2:

- The Elasticity of ROS on planned/target Revenues (ETROS) with respect to a given change in price (SP) of the product/product mix
- a= $ETROS_{Sp}$= $\Delta SPR*(1+\Delta VolR_1)$
- The Elasticity of ROS on planned/target Revenues (ETROS) with respect to a given change in volume of the product/product mix
- b= $ETROS_{vol}$=$\{[(\Delta VolR_2)*(BER*CMR)]*(1+\Delta VolR_1)\}+ (TROS*\Delta VolR_1)$
- The Elasticity of ROS on planned/target Revenues (ETROS) with respect to a given change in Variable Cost of the product/product mix
- c= $ETROS_{vc}$= $\Delta VCR*(1+\Delta VolR_1)$
- The Elasticity of ROS on planned/target Revenues (ETROS) with respect to a given change only in Fixed Cost of the product/product mix
- d= $ETROS_{Fc}$= $\{[(\Delta FCR)*(1-\Delta VolR_2)]*BER*CMR\}*(1+\Delta VolR_1)$
- The extent of net Sum of effect on TROS:e=$ETROS_{all}$ = (a+b) - (c+d)

Particulars of variables affected by the scenarios for measuring their scenario change effects on the ideal/Normal ROS	variable short name	
Volume of output & Sales	Volume	(CMR*BER)
Selling Price/Sales revenue	SP	SP/SP
through put cost or Variable Cost	VC	VC_{pu}/SP
batch level costs	SFCa	(SFCa/TFC)*(CMR*BER)
(allocated to products and not absorbed to units) product level costs	SFCb	(SFCb/TFC)*(CMR*BER)
(allocated to products and not absorbed to units) firm/Facility level	SFCc	(SFCc/TFC)*(CMR*BER)
(allocated to products and not absorbed to units) customer level	SFCd	(SFCd/TFC)*(CMR*BER)
Project Book Costs (depreciation)	FC	(FC/TFC)*(CMR*BER)
	TFC:	(sum of SFC &FC)

Application of IPPPA tool to substantiate the objectives using Hypothetical case analysis of the integrated technique under uncertainty:

Case analysis-I: XYZ company is considering a project for investment with the credential as: life of the project =5 years, cost of the project Rs.100000/- scrap value =10000 and cost of capital 12% and applicable tax rate is 40%. The capacity of plant is 20000 units. The forecasted Operating details at the predetermined Ideal/normal operating capacity and the forecasts likely extent of changes in variables under different economic scenario conditions are given below: (determine the Net

present index rate when the uncertainty is confined only to operating results and when it is up to the cash inflows).

Table. I-1. The detailed forecasts of changes in the variables to different economic the scenario conditions.

Cost and Prices	predetermined Ideal/normal conditions & at 90% capacity utilization: 18000 units		forecasted scenario effects on costs, price asa proportionate change and volume in proportion of capacity utilization (- indicates reduction & +indicatesincrease of price and costs)		
(Allocated to products and absorbed to units as per ABC) the costs other than the throughput and depreciation are of semi Fixed (SFC) and the changes forecasted of SFC are from the total cost of the respective variable and depreciation is fixed and the price and throughput are Directly proportional to Volume.	Rs. perunit (as per the ABC costing)	total Rs. /Ratio	slump scenario	recessionscenario	boom scenario
Volume / Level of Activity	90% capacity	18000	0.5	0.6	1
Selling Price/Sales revenue	10	180000	-0.10	0.20	0.300
Through-Put Cost or Variable Cost-(VC)	4	72000	-0.25	-0.10	0.125
Batch Level Costs(SFC)	0.7	12600	-0.40	-0.30	0.150
Product Level Costs-(SFC)	0.6	10800	-0.45	-0.12	0.120
Firm/Facility Level-(SFC)	0.5	9000	-0.33	-0.20	0.180
(allocated to products and notabsorbed to units) customer Level-(SFC)	0.8	14400	-0.10	0.12	0.150
Project Book Costs(depreciation)-(FC)	1	18000	0	0	0.000
TFC(SFC+FC)	3.6	64800			
TC	7.6	136800			
Profit	2.4	43200			
ROS on Ideal/Normal Revenues		0.240			

Further, the occurrence of number of times of the scenarios during the life in random as: normal -1, the slump -1, recession-2 and boom-1 in its life. Inconsideration of the risks ofscenarios you are requested to find out the certainty equivalent returns and net Present Index Rate (NPR) with details of sensitivity of operating returns to each variable to the above said scenarios effects on the net returns using suitable technique.

Solution: on application of integrated technique (IPPPA):

Step-1:

Table-I-2 Determination of ROS with IPPPA technique at the given scenario of predetermined Ideal/ normal conditions:

particulars	formula	result
Investment/cost of the project	as given	100000
Contribution Margin(CM) Rs. Per unit	sp-vc	6
CM Ratio	CM/SP	0.6
Break Even Point (BEP) Rupees	TFC/CMR	108000
Break Even Ratio (BER)	BEP/S	0.600
Return on Sales (ROS / ΔROS)	ROS=(CMR*(1-BER))	0.24

Source table:I.1.

Step-2:

Table-I.3 the sensitivity constants (SC) are determined relating to each variable based on the predetermined Ideal/normal values as: volume= PVR*BER; SP=1, VC= VCR i.e. VC/SP; each component of SFC or FC: PVR*BER*(each component of SFC or FC /TFC) determined as follows.

Particulars of variables affected by the scenarios for measuring their scenario change effects on theideal/Normal ROS	variable short name	Formula for determining sensitivityconstant on the given normal/Ideal basis	sensitivity constant (SC)
Volume of output & Sales	Volume	(CMR*BER)	0.36
Selling Price/Sales revenue	SP	SP/SP	1.00
through put cost or Variable Cost	VC	VC_{pu}/SP	0.40
batch level costs	SFCa	(SFCa/TFC)*(CMR*BER)	0.07
(allocated to products and not absorbed to units) product level costs	SFCb	(SFCb/TFC)*(CMR*BER)	0.06
(allocated to products and not absorbed to units) firm/Facility level	SFCc	(SFCc/TFC)*(CMR*BER)	0.05
(allocated to products and not absorbed to units) customer level	SFCd	(SFCd/TFC)*(CMR*BER)	0.08
Project Book Costs (depreciation)	FC	(FC/TFC)*(CMR*BER)	0.10
	TFC:	(sum of SFC &FC)	0.36

Source table:I.1,2.

Formulae for determination of impacts of variables individually on ideal/normal ROS as extent of effect orsensitivity using the sensitivity constants (SC) are:

- Volume effect: ((SC* $\Delta VolR_2$) *(1+ $\Delta VolR_1$))+(ROS Idl.* $\Delta VolR_1$)
- Price (SP) effect: ((SC* ΔSPR_1) *(1+ $\Delta VolR_1$))
- Variable Cost (VC) effect: ((SC* ΔVCR_1) *(1+ $\Delta VolR_1$))
- Concerned Individual SFC/FC effect: ((SC* $\Delta SFCR_1$ or ΔFCR_1)*(1- $\Delta VolR_2$))+(1+ $\Delta VolR_1$)
- To determine the sum extent or net extent of sensitivity from the ideal ROS:(Sum of effects of Price and Volume) – (sum of the cost effects)
- To determine the new ROS at the Ideal revenues after the net extent of sensitivity from the idealROS: (Ideal ROS + net extent of effects)

- To determine the new ROS at the respective scenario revenues after the net extent of sensitivityfrom the ideal ROS: (scenario ROS at Ideal revenues(as determined f point 6 above)/ ((1+ $\Delta VolR_1$)*((1+ ΔSPR_1))
- The formula to convert the ROIAT on initial investment to PV of total investment = concernedyear/scenario ROIAT* initial investment/PV of total Investment.

Interpretation of impacts of variables on ROS: a negative (-) value of price and volume and positive (+)value of costs indicates adverse and vice versa. The net impact is calculated as deducting the sum of costs effects from the sum of Price and Volume effects. The net negative indicate adverse and net positive indicates favorable. Finally, the net positive impact will be added to (net negative deducted from) the initial/Target ROS of target/ideal/normal revenues to determine the ROS on the target revenues after the impacts of all the concerned variables. The ROS on the each scenario revenues individually be calculated by dividing the respective scenario net ROS on ideal revenues after the effects with the product of (1+ΔSPR1) and (1+ ΔVolR1) of the respective scenario. In the calculation of Δ Ratios 1 represents the limit-1 as the basis and 2 refers to limit-2 as the basis for calculating the ratio. Further the limit-1 is always the ideal/normal/base value and limit-2 is the respective scenario value concerned.

A: when the uncertainty is confined to operating activities/results:

Step-3a:

Table-I.4. shows the assessment of elasticity or extent of effect/responsiveness of ROS at the predetermined Ideal/normal to a given change in the variables individually and in total.

forecasted scenario effects on costs, price as a proportionate change and volume in proportion ofcapacity utilization as given					sensitivity of ROS to the scenario changes in the variables (the extent of effect for a given change in each variable to each of the distinct scenarios as theindividual and net total effect on the ROS of normal/ideal Revenues)				
differential ratios ofvariable		slump scenario	recession scenario	boom scenario	sensitivity constant	acronym of variable to represent the variablefor their effect	slump scenario	Recession scenario	boom scenario
volumeof sales	Ideal/normal	18000	18000	18000					
	scenario volume	10000	12000	20000					
Vol	ΔVolR1	-0.444	-0.333	0.111					
Vol	ΔVolR2	-0.800	-0.500	0.10	0.36	ΔVol	-0.267	-0.200	0.067
SP	ΔSPR1	-0.10	0.20	0.30	1.00	ΔSPR	-0.056	0.133	0.333
VC	ΔVCR1	-0.25	-0.10	0.125	0.40	ΔVCR	-0.056	-0.027	0.056
SFCa	ΔSFCRa1	-0.40	-0.30	0.15	0.07	ΔSFCRa	-0.028	-0.021	0.011
SFCb	ΔSFCRb1	-0.45	-0.12	0.12	0.06	ΔSFCRb	-0.027	-0.007	0.007
SFCc	ΔSFCRc1	-0.33	-0.20	0.18	0.05	ΔSFCRc	-0.017	-0.0100	0.009
SFCd	ΔSFCRd1	-0.10	0.12	0.15	0.08	ΔSFCRd	-0.008	0.0096	0.012
FC	ΔFCR1	0.00	0.00	0.00	0.10	ΔFCRe	0	0	0
	ΔTFCR1∑ΔSFCR+ΔFCR	-1.280	-0.500	0.600	0.36	ΔTFCR	-0.0795	-0.0286	0.0387
net impact on ROS at the planned revenues							-0.187	-0.011	0.306
new ROS after the scenario effects on planned revenues							0.053	0.229	0.546
new ROS after the scenario effects on the respective scenario revenues							0.106	0.286	0.378

Source table:I.1,2,3.

Step-4a: expected returns on Ideal sales revenues: based on the information of random occurrences of thescenarios the

Probability (P) is determined and the CEROS at 3σ as:

Table-I.5. shows the details of average ROS after probability weights and the standard deviation of suchand the certainty equivalent ROS

scenario	ROS	P(probability)	P*ROS
Ideal/planned/normal	0.240	0.2	0.0480
slump	0.053	0.2	0.0106
recession	0.229	0.4	0.0914
boom	0.546	0.2	0.1091
mean		(sum of p*ROS)	0.2591
Stn.Dev. σ	Stndv of (p*ROS)		0.04431
certainty equiv valet returns (CEROS)	(Mean ROs) – (3*σ =3*0.04431 =0.1329) =(0.2591-0.1329)	(CEROS)	0.1262

Source table:I.3.

Step-5a: The determination of net Present Rate (NPR) as follows:

Table-I.6. shows the certainty equivalent Net Present Index Rate under the uncertainty confined to onlyoperating returns.

CEVROS	determined above	0.1262
tax at 40%	as given	0.0505
ROSAT	(CEVROS-T)	0.0757
ITR	(IDEAL-S/I)	1.8
ROIAT	(ROSAT*ITR)	0.1363
add depreciation rate	% of Depreciation	0.18
CIFR	ROIAT+CIFR	0.3162
PV annuity at KI 12%	as per the table	3.605
PVCIFR	(PVA*CIFR)	1.1403
PV factor yr5 at 12%	as per the table	0.567
scrap rate	as given	0.10
PVCIF of scrap	scrap*PV'5	0.057
Total CEPVCIFR	(PVIFR+PVIF Scrap)	1.1973
CENPIR	(1-PVIFR)	0.1973

Source table:I. 1,4,5.

: When the uncertainty is extended to operating cash inflows: step 1b&2b same as above 1a&2a.

Step-3b & 4b:

Table-I.7. shows determination of elasticity of ROS/ROI/Cash flows after taxes at the Ideal conditions asan extent of variation to the changes in each variable individually to the distinct scenario.

forecasted scenario effects on costs, price as a proportionate change and volume in proportion ofcapacity utilization as given					sensitivity of ROS to the scenario changes in the variables(the extent of effect for a given change in each variable toeach of the distinct scenarios as the individual and net totaleffect on the ROS of normal/ideal Revenues)				
differential ratios ofvariable		slump scenario	recession scenario	boom scenario	sensitivity constant	acronym of variableto represent the variable for their effect	slump scenario	recession scenario	boom scenario
volumeof sales	Ideal/normal	18000	18000	18000					
	scenario volume	10000	12000	20000					
Vol	ΔVolR1	-0.444	-0.333	0.111					
Vol	ΔVolR2	-0.800	-0.500	0.100	0.36	ΔVol	-0.267	-0.200	0.067
SP	ΔSPR1	-0.10	0.20	0.30	1.00	ΔSPR	-0.056	0.133	0.333
VC	ΔVCR1	-0.25	-0.10	0.125	0.40	ΔVCR	-0.056	-0.027	0.056
SFCa	ΔSFCRa1	-0.40	-0.30	0.15	0.07	ΔSFCRa	-0.028	-0.021	0.011
SFCb	ΔSFCRb1	-0.45	-0.12	0.12	0.06	ΔSFCRb	-0.027	-0.007	0.007
SFCc	ΔSFCRc1	-0.33	-0.20	0.18	0.05	ΔSFCRc	-0.017	-0.0100	0.009
SFCd	ΔSFCRd1	-0.10	0.12	0.15	0.08	ΔSFCRd	-0.008	0.0096	0.012
FC	ΔFCR1	0.00	0.00	0.00	0.10	ΔFCRe	0	0	0
	ΔTFCR1∑ΔSF CR+ΔFCR	-1.280	-0.500	0.600	0.36	ΔTFCR	-0.0795	-0.0286	0.0387
net impact on ROS on the ideal/normal revenues						Ideal/normal	-0.187	-0.011	0.306
Scenario ROS after the scenario effects on the ideal/normal revenues						0.24	0.053	0.229	0.546
Tax @ 40%						0.096	0.0212	0.0916	0.2184
Scenario ROSAT after the scenario effects on the ideal/normal revenues						0.144	0.0318	0.1374	0.3276
ITR (IDEAL-S/I)						1.8	1.8	1.8	1.8
ROIAT						0.2592	0.05724	0.24732	0.58968
add depreciation Rate						0.18	0.18	0.18	0.18
CIFR						0.4392	0.23724	0.42732	0.76968
Probability						0.2	0.2	0.4	0.2
P weighted CFR						0.08784	0.047448	0.170928	0.153936
Mean of CIFR						0.08784+0.047448+0.170928+0.153936=0.4602			

Source table: I.1,2.

Step-5b: expected returns on Ideal sales revenues: based on the information of random occurrences of thescenarios the

Probability (P) is determined and the CECIFR at 3σ as:

Table-I.8. shows the steps in the determination Certainty equivalent cash inflows rate and the net presentvalue index Rate under the situation of the uncertainty is extended to the cash inflows after taxes.

Mean of CIFR	0.4602
Stn.Dev. σ of scenario CIFR	0.0576
CECIFR: (CIFR) – (3*σ =3*0.0576 =0.1727) =(0.4602-0.1727)	0.2874
as per the PVA table @12% by the end of 5th year	3.605
CEPVCIFR: (PVA*CIFR)	1.0362
as per the PV table @12% 5th year	0.567
as given	0.1
scrap*PV'5	0.057
(CEPVCIFR+PVIF Scrap)	1.0932
CENPIR: (1-PVIFR)	0.0932

Source table:I.1,2,7.

Verification of the ROS results (if required):

Table-I.9. shows the verification of the ROS on the Ideal Revenues after the scenario effects.

PARTICULARS	ideal/normal conditions& at 90% capacity utilization: 18000 units		forecasted scenario effects on costs, price as a proportionate change and volume in proportion of capacity utilization			verification of results		
	Rs. per unit (as per the ABC costing)	total Rs. /Ratio	slump scenario (- indicates reduction & +indicates increaseof price and costs)	recession scenario(- indicates reduction & +indicates increaseof price and costs)	boom scenario(- indicates reduction & +indicates increase of price and costs)	slump scenario	recession scenario	boom scenario
Volume/ level of activity	90% capacity	18000	0.5	0.6	1	10000	12000	20000
Selling Price/Sales revenue	10	180000	-0.10	0.20	0.300	90000	144000	260000
through put cost orVariable Cost-(VC)	4	72000	-0.25	-0.10	0.125	30000	43200	90000
batch level costs		12600	-0.40	-0.30	0.150	7560	8820	14490
product level costs-(SFC)		10800	-0.45	-0.12	0.120	5940	9504	12096
firm/Facility level-(SFC)		9000	-0.33	-0.20	0.180	6030	7200	10620
(allocated to products and not absorbed to units) customer level-(SFC)		14400	-0.10	0.12	0.150	12960	16128	16560
Project Book Costs (depreciation)-(FC)		18000	0	0	0.000	18000	18000	18000

TFC(SFC+FC)		64800				50490	59652	71766
TC		136800				80490	102852	161766
Profit		43200				9510	41148	98234
ROS on ideal/normal revenues		0.240				0.053	0.229	0.546
ROS on respective scenario revenues			scenario revenue based ROS			0.106	0.286	0.378

Source table:I.1,2,7,8.

4. CONCLUSION:

The research study concludes that the IPPPA tool -2 is not only effective for decision-making on operating aspects in progression but also provide the platform for capital budgeting decisions of long-term as a system of operating integrated investment decision analysis, being meaningfully unifying uncertainty based advanced capital budgeting techniques of sensitivity, scenario, break-even and integrated with the certainty equivalent technique used for uncertainty conditions. Therefore it is a compact technique applicable for both certainty and certainty conditions analysis. It is measuring the sensitivity/elasticity of returns with reference to the ideal/standard/normal/budgeted sales revenues on one hand and the initial/ PV of totalinvestments of phase-out investments, enable to standardize the analysis to assess the effects/impacts of changes in any one or more variables at predicted different scenario conditions directly as the extent of effect on the results more importantly in terms of proportions rather than the absolute amounts. Further, itis enabled to assess the effectiveness of the capital budgeting decision being assessed the cash flows directly as a proportion to investments. It is able to relieve the misinterpretation of NPV and ambiguous assumption of possibility of reinvestment of earlier period cash inflows at the IRR of the IRR.

Further the IPPPA Tool-1 is able to provide the important data of operating and investment risk premium analysis for operating and capital budgeting decisions under uncertainty conditions. The application of proportion measurement is able to integrate the investment analysis with the operating market risk analysis viz. the demand, supply, competition analysis of managerial economic theory for strategic product life cycle analysis. Following cognizant hypothetical firm data enable to provide the insights for application of both the IPPPA tools for capital budgeting decision analysis for product life cycle.

Note: if the uncertainty is applicable to cash-inflows then the probability will be applied at the cashinflows after taxes i.e. at the point of ROIAT+ depreciation rate on investment/project cost as implied in case b..

Analysis of Product lifecycle under uncertainty and expected certainty conditions:

Case analysis-II

PQR Company is planning to introduce the newly developed product ‘T’. The forecasts of potential market are 50000 units pa. The company is aiming to attain 40% of it as its share in the market at the target maturity level. The forecasted data for the product's life cycle are as given below. Initial cost of the project Rs.100000/- and cost of capital at risk free rare as 8% and expected risk premium is 2% and the additional investment by the end of development stage is Rs. 20000 and Rs. 20000 during the growth stage and the capacity of plant is 20000 units. The expected life of the project of the product is 10 years. and the likely life span spread cycle is as: entry level 1.year, development 1 years, growth 2 years, maturity 2 years initial fall for 2 years, declining 1 year about to die/exit/withdrawal 1 year.

the forecasted Operating details at entry level of operating capacity and the forecasts of likely extent of changes in operating variables under different economic/market conditions during the life cycleof the proposed product of the project from the initial entry level are:

Table-II.1. shows the forecasts of expected changes in the operating variables and activity levels during thelifecycle of a product from its introductory conditions.

cost and prices	ideal/normal conditions & at 90% capacity utilization: 18000 units		Forecasted effects from the entry level to each stage of product life cycle. The effects measured as proportionatechanges. The price and variable costs at per unit and the Semi fixed and fixed costs in total and the changes in volume as a proportion of capacity utilization.					
(allocated to products and absorbed tounits as per ABC) the costs other than the throughput and depreciation are of semi Fixed (SFC) and the	Rs. per unit (as per the ABC	entry level						dying/exit/

changes forecasted of SFC as deemed not absorbed and the calculated are from the total of the respective variable anddepreciation is as fixed and the price and throughput are directly proportional to Volume.	costing) market potential projected 50000 units	at40% capacity	developme nt level	growth level	maturityy	falling level	further falling	withdraw
Volume/ level of activity	target market share 40% at the maturity	8000	0.6	0.8	1	0.9	0.7	0.55
Selling Price/Sales revenue	11.25	90000	0.15	0.20	0.25	0.20	0.12	-0.06
through put cost or Variable Cost-(VC)	6	48000	0.12	0.15	0.18	0.20	0.10	0.08
(allocated to products and deemed not absorbed to units) batch level costs (SFC)	1.5	12000	0.10	0.15	0.18	0.16	0.12	0.10
(allocated to products and deemed not absorbed to units) product level costs-(SFC)	1	8000	0.10	0.12	0.15	0.13	0.10	0.12
(allocated to products and deemed not absorbed to units) firm/Facility level-(SFC)	0.75	6000	0.05	0.90	0.12	0.10	0.08	0.07
(allocated to products and deemed not absorbed to units) customer level-(SFC)	1.5	12000	0.15	0.18	0.20	0.20	0.12	0.10
TSFC		38000						
Project Book Costs (depreciation)-(FC)		10000	0.2222	0.4722	0.4722	0.4722	0.4722	0.4722
TFC(SFC+FC)		48000						
TC		96000						
Profit		-6000						
ROS on ideal/normal revenues		-0.067						
initial and additional investments in progression		100000	20000	20000	0	0	0	0

Note: The depreciation is calculated on the basis of life time spread of the total project cost from therespective point of initial and additional investments.

Further, in consideration of the risks of scenarios, you are requested to verify the certainty equivalent returnswith details of sensitivity of operating returns to each variable at each stage of the life cycle of the above proposal foracceptance being considering likely uncertain conditions and the detailed spread of returns as of likely certainty of theforecasts in its life cycle in the report using suitable technique.

Checking the feasibility of the proposal when the forecast imply uncertainty:

Solution:

Table-II.2. shows the determination of ROS at the introductory level using the direct costing/TOC Throughput/CVP/BEA called IPPPA developed by the author.

Determination of ROS with IPPPA technique at the given entry level:

particulars	Formula	result
Investment/cost of the project	as given	100000
Contribution Margin(CM) Rs. Per unit	sp-vc	5.25
CM Ratio	CM/SP	0.467
Break Even Point (BEP) Rupees	TFC/CMR	102857
Break Even Ratio (BER)	BEP/S	1.143
Return on Sales	ROS=(CMR*(1- BER)	-0.067

Source table:II.1.

Step-2:

The sensitivity constants(SC) are determined relating to each variable based on the present/initial/planned values as: volume= PVR*BER; SP=1, VC= VCR i.e. VC/SP; each component of SFC or FC: PVR*BER*(each component of SFC or FC /TFC) determined as follows.

Table-II.3. shows determination of sensitivity constants for the product life cycle

Particulars of variables affected by the scenarios for measuring their scenario change effects on theideal/Normal ROS	variable short name	Formula for determining sensitivity constant as the given normal/Ideal/entry level as the Basis	sensitivity constant (SC)
Volume of output & Sales	Volume	(CMR*BER)	0.53
Selling Price/Sales revenue	SP	SP/SP	1.00
through put cost or Variable Cost	VC	VC_{pu}/SP	0.53
batch level costs	SFCa	(SFCa/TFC)*(CMR*BER)	0.13
(allocated to products and deemed notabsorbed to units) product level costs	SFCb	(SFCb/TFC)*(CMR*BER)	0.09
(allocated to products and deemed notabsorbed to units) firm/Facility level	SFCc	(SFCc/TFC)*(CMR*BER)	0.07
(allocated to products and deemed notabsorbed to units) customer level	SFCd	(SFCd/TFC)*(CMR*BER)	0.13
Project Book Costs (depreciation deemed not absorbed to units)	FC	(FC/TFC)*(CMR*BER)	0.11
	TFC:	(sum of SFC &FC)	0.53

Source table:II.1,2.

- Formulae for determination of impacts of variables individually on ideal/normal ROS as extent of effect orsensitivity using the sensitivity constants (SC) are:
- Volume effect: ((SC* $\Delta VolR_2$) *(1+ $\Delta VolR_1$))+(ROS Idl.* $\Delta VolR_1$)
- Price (SP) effect: ((SC* ΔSPR_1) *(1+ $\Delta VolR_1$))
- Variable Cost (VC) effect: ((SC* ΔVCR_1) *(1+ $\Delta VolR_1$))
- Concerned Individual SFC/FC effect: ((SC* $\Delta SFCR_1$ or ΔFCR_1)*(1- $\Delta VolR_2$))+(1+ $\Delta VolR_1$)

- To determine the sum extent or net extent of sensitivity from the ideal ROS:(Sum of effects of Price and Volume) – (sum of the cost effects)
- To determine the new ROS at the Ideal revenues after the net extent of sensitivity from the ideal ROS:(Ideal ROS + net extent of effects)
- To determine the new ROS at the respective scenario revenues after the net extent of sensitivity fromthe ideal ROS: (scenario ROS at Ideal revenues(as determined f point 6 above)/ $((1+ \Delta VolR_1)*(1+ \Delta SPR_1))$
- The formula to convert the ROIAT on initial investment to PV of total investment = concernedyear/scenario ROIAT* initial investment/PV of total Investment.

Interpretation of impacts of variables on ROS: a negative (-) value of price and volume and positive (+)value of costs indicates adverse and vice versa. The net impact is calculated as deducting the sum of costs effects from the sum of Price and Volume effects. The net negative net positive indicates favorable and vice versa. Finally, the net positive impact will be added to (net negative deducted from) the entry level ROS to determine the ROS at each stage of the product life concerned of all the variables on the entry levelrevenues. The ROS at each stage of the life cycle on revenues of the stage concerned can be calculated by dividing the net ROS of the respective stage on entry level revenues with the product of (1+ΔSPR1) and (1+ ΔVolR1) of the respective stage. In the calculation of Δ Ratios '1' represents the limit-1 as the basis and 2 refer to limit-2 as the basis for calculating the ratio. Further the limit-1 is always the initial/entry level/ideal/normal and limit-2 is the respective scenario value concerned.

Table-II.4. shows the process of determination of the elasticity of Entry level ROS to the product lifecycle changes of the product.

	variable short name	The measurements for assessment of effects as an extent of from the entry level ROS of the forecasted changes in costs & price as given as a proportionate change from the entry level. And the changes in volume in proportion to initial entry level (ΔVolR1) & at the Respective stage in the life cycle (ΔVolR2) of the product.								Sensitivity or the extent effect on the entry level ROS for the changes in all the variables individually with respect to each of the stages of life cycle of the product and in total ofsuch effects at each stage of the life cycle.						
		sensitivity constant	differential ratiosof variable	Development Stage	growth Stage	Maturity Stage	falling Stage	Stage of further falling	Stage of dying/ withdraw		Development Stage	growth Stage	Maturity Stage	falling Stage	Stage of further falling	Stage of dying/ withdraw
			Entry level volume	8000	8000	8000	8000	8000	8000							
			volume scenario	12000	16000	20000	18000	14000	11000							
	Vol_1		ΔVolR1	0.5	1	1.5	1.25	0.75	0.375		12000	16000	20000	18000	14000	10000
Volume	Vol_2	0.53	ΔVolR2	0.333	0.500	0.600	0.556	0.429	0.273	ΔVol	**0.233**	**0.467**	**0.700**	**0.583**	**0.350**	**0.175**
SellingPrice/Sales revenue	SP/S	1.00	ΔSPR1	0.15	0.20	0.25	0.20	0.12	-0.06	ΔSPR	**0.225**	**0.400**	**0.625**	**0.450**	**0.210**	**-0.083**
through put cost or Variable Cost	VC	0.53	ΔVCR1	0.12	0.15	0.18	0.20	0.10	0.08	ΔVCR	**0.096**	**0.160**	**0.240**	**0.240**	**0.093**	**0.059**
batch level costs	SFCa	0.13	ΔSFCRa1	0.10	0.15	0.18	0.16	0.12	0.10	ΔFCRa	0.013	0.020	0.024	0.021	0.016	0.013
(allocated to products and not absorbed to units) product level costs	SFCb	0.09	ΔSFCRb1	0.10	0.12	0.15	0.13	0.10	0.12	ΔFCRb	0.009	0.011	0.013	0.012	0.009	0.011
(allocated to products and not absorbed to units) firm/Facility level	SFCc	0.07	ΔSFCRc1	0.05	0.90	0.12	0.10	0.08	0.07	ΔFCRc	0.003	0.060	0.008	0.007	0.005	0.005
(allocated toproducts and not absorbed to units) customer level	SFCd	0.13	ΔSFCRd1	0.15	0.18	0.20	0.20	0.12	0.10	ΔFCRd	0.020	0.024	0.027	0.027	0.016	0.013
											0.046	0.115	0.072	0.066	0.046	0.042
Project Book Costs (depreciation)	FC	0.11	ΔFCR1	0.22	0.47	0.47	0.47	0.47	0.47	ΔFCRe	0.025	0.052	0.052	0.052	0.052	0.052
		0.53	ΔTFCR1∑ΔSFCR+ΔFCR							ΔTFCR	**0.070**	**0.167**	**0.124**	**0.119**	**0.099**	**0.094**
		The net impact on ROS at entry-level revenues								-	0.292	0.540	0.961	0.675	0.368	-0.061

Source table:II.1,2,3.

Table-II.5. shows the process of determining the Probability weighted Cash Inflow Rates on the PV of total investments in different stages of product life-cycle.

Particulars	entry levelat 40% capacity	Developm ent Stage	growth Stage	Maturity Stage	falling Stage	Stage of further falling	Stage of dying/ withdraw
life cycle ROS on entry-level revenues before Tax	-0.067	0.225	0.473	0.894	0.6080	0.301	-0.127
Tax: (ROSIS*TR at .4)	0	0.090	0.189	0.358	0.243	0.121	0.000
ROSAT=(ROSIS -Tax)	-0.067	0.135	0.284	0.536	0.365	0.181	-0.127
cost of the project at present value terms	100000	100000	100000	100000	100000	100000	100000
ITR=(IS/I)	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
ROIAT=(ROSAT*ITR)	-0.060	0.122	0.255	0.483	0.328	0.163	-0.115
depreciation rate on the initial investment (100000)	0.1000	0.1222	0.1472	0.1472	0.1472	0.1472	0.1472
CIFR at initial investment=(ROIAT+DR)	0.0400	0.2439	0.4026	0.6299	0.4755	0.3099	0.0327
Present value of total investment (@10%discount of addl. capital)	131555	131555	131555	131555	131555	131555	131555
CIFR on PV of total investment (TI): (@10%)	0.0304	0.1854	0.3060	0.4788	0.3615	0.2356	0.0248
life span probability	0.100	0.100	0.200	0.200	0.200	0.100	0.100
Probability weighted life span CIFR on PV of total investment (PWCIFR on TI)	0.0030	0.0185	0.0612	0.0958	0.0723	0.0236	0.0025

Source table:II.4.

Table-II.6. shows process of determining the certainty equivalent Net Present Index Rate on PV of total Investments.

particulars	Rate on TI
AACIFR: Mean (Sum of probability-weighted average CIFR) PWACIFR on PV of TI)	0.2769
Stndv. of PWCIFR on T	0.0368
3*Stndv.	0.1103
CEAAIFR (Certainty Equiv. AACIFR):	0.1666
PV annuity @ 10% for 10 years	6.145
PVAACIFR: PV of CEAACIFR	1.024
CENPIR: (-1+PV of CIFIR) i.e.(-1+1.024)	0.024

Source table:II.4,5.

Analysis of Product lifecycle expected certainty of forecasts:

Table-II.7. shows the determination of Net present Index Rate in progression under Normal annual returns and cash flow

particulars	entrylevel	Developme nt Stage	growthStage		Maturity Stage		fallingStage		Stage of further falling	Stage of ying/exit/ withdrawal
	1	2	3	4	5	6	7	8	9	10
Annual ROSBT(AROSBT)	-0.067	0.225	0.473	0.473	0.894	0.894	0.608	0.608	0.301	-0.127
tax	0.000	0.090	0.189	0.189	0.358	0.358	0.243	0.243	0.121	0.000
AROSAT	-0.067	0.135	0.284	0.284	0.536	0.536	0.365	0.365	0.181	-0.127
ITR=(IS/I) at initial Investment (100000)	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
AROIAT at initial investment	-0.060	0.122	0.255	0.255	0.483	0.483	0.328	0.328	0.163	-0.115
ADR(annual depreciation Rate on initial investment)	0.100	0.122	0.147	0.147	0.147	0.147	0.147	0.147	0.147	0.147
ACIFR(on initial investment)	0.040	0.244	0.403	0.403	0.630	0.630	0.476	0.476	0.310	0.033
PV of total investment	131555	131555	131555	131555	131555	131555	131555	131555	131555	131555
ACIFR (on PV of total Investment (0.40*100000/131555=0.030)	0.030	0.185	0.306	0.306	0.479	0.479	0.361	0.361	0.236	0.025
PV Factor at 10 % rate	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386
PV of ACIFR on total investment at PV	0.028	0.153	0.231	0.209	0.297	0.270	0.185	0.169	0.100	0.010
NPIRP: (net present index The rate in progression)	-0.972	-0.819	-0.588	-0.379	-0.082	0.188	0.373	0.542	0.642	0.652

Source table: II.4,5.

Table-II.8. shows the determination of Net present Index Rate under year to year progression (i.e. as cumulative progression) of operations.

Particulars	entrylevel	developing level	growth level		maturity		falling level		further falling	dying/ withdrawal
	1	2	3	4	5	6	7	8	9	10
The extent of change in the returns during the life cycle from entry level	0	0.292	0.540	0.540	0.961	0.961	0.675	0.675	0.368	-0.061
ROSBT on revenues at the entry-level	-0.067	0.225	0.473	0.473	0.894	0.894	0.608	0.608	0.301	-0.127
PROSBT (cumulative ROSBT of above)	-0.067	0.159	0.632	1.104	1.998	2.892	3.500	4.108	4.409	4.282
Progressive tax as per the financial accounting regulations (cumulative tax)	0.000	0.090	0.279	0.468	0.826	1.184	1.427	1.670	1.790	1.790
ROSAT=(ROSIS -Tax)	-0.067	0.069	0.352	0.636	1.172	1.709	2.073	2.438	2.619	2.492
ITR=(IS/I) at initial investment (100000)	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900
PROIAT(PROSAT*ITR)	-0.060	0.062	0.317	0.572	1.055	1.538	1.866	2.194	2.357	2.243
Add PDR (progressive depreciation Rate on initial investment)	0.100	0.222	0.369	0.517	0.664	0.811	0.958	1.106	1.253	1.400
PCIFR (on initial investment)	0.040	0.284	0.687	1.089	1.719	2.349	2.824	3.300	3.610	3.643
*less rate of total depreciation to initial inv	1.0	1.2	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
PROIAT	-0.960	-0.916	-0.713	-0.311	0.319	0.949	1.424	1.900	2.210	2.243
PV of total investment	131555	131555	131555	131555	131555	131555	131555	131555	131555	131555
PCIFR (on PV of total investment) (-0.96*100000/131555=-0.730)	-0.730	-0.696	-0.542	-0.236	0.242	0.721	1.083	1.444	1.680	1.705
PV Factor at 10 % rate	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386
NPIIR: (Progressive NPIR)	-0.663	-0.575	-0.407	-0.161	0.151	0.407	0.556	0.674	0.712	0.657

Source table: II.4,5,7.

Table-II.9. shows the determination of the Net present Index Rate under a year-to-year progression (i.e. as cumulative progression) of operations at the terminal value

Particulars	entrylevel	development level	growth level		maturity		falling level		further falling	dying/ withdrawal
	1	2	3	4	5	6	7	8	9	10
PROIAT=(PROSAT*ITR)	-0.730	-0.696	-0.542	-0.236	0.242	0.721	1.083	1.444	1.680	1.705
*Annual depreciation rate on PV of total investment	0.076	0.169	0.281	0.393	0.505	0.617	0.728	0.840	0.952	1.064
** terminal value Rate on PV of total Investment (TV on PV TI) – annual depreciation rate (1-0.076----)	0.924	0.831	0.719	0.607	0.495	0.383	0.272	0.160	0.048	-0.064
CIFRAT at Terminal value on PV of total investment (PROIAT+ TV on PV TI)	0.194	0.135	0.177	0.371	0.738	1.105	1.354	1.604	1.728	1.640
PV Factor at 10 % rate	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386
NPIIRTV: (NPIIR at terminal value)	0.177	0.112	0.133	0.253	0.458	0.624	0.695	0.748	0.733	0.632

Source table:II.4,5,7,8.

Note:* the deduction of total depreciation rate at the initial stage is to implicate the concepts of, being deemed of the project cost as sunk cost of the projectand determination of results that enable to determine the net cash inflows in progression to assess the exact internal rate of index returns at present value. Itis enabled to assess the results on net cash flows by the end of the n^{th} year in progression in the condition of no recognition of results up to the n^{th} year under such sunk cost conditions.

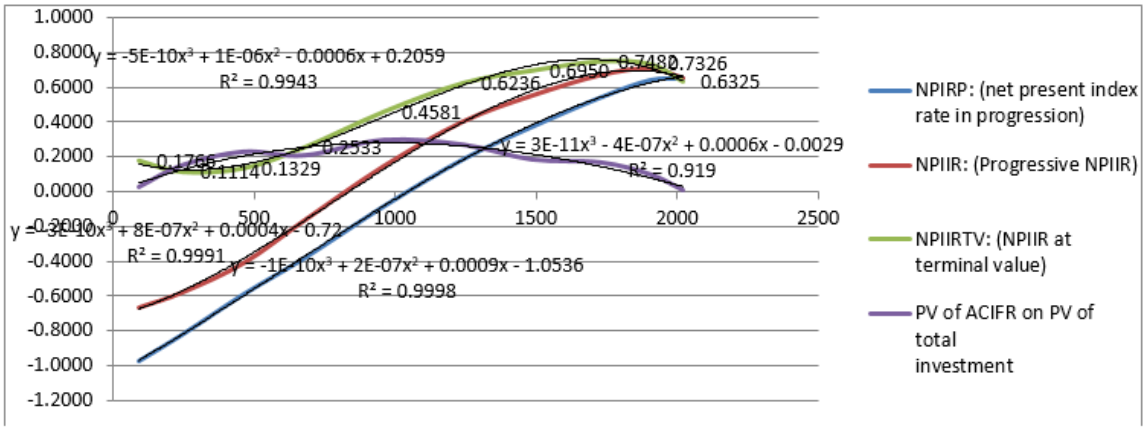
**And in the other context i.e. the recognition of residual value/terminal value in the next enable to provide the net cash inflow rate at the terminal condition in progression as the possible realization of such sunk cost with the addition of residual value/terminal value rate at the end of each stage of assessment of results as of net cash inflows in progression to determine the net cash inflow rate at the terminal value.

Table-II.10. is data of the above analysis collected for graphical presentation of Net present Index/internal Index rates for clarity of purpose anddistinctiveness of the rate of return in the progression of operations.

year	Progressive Sales by the end of the year Rs. In '000	PVACIFR	NPIRP	NPIIR	NPIIRTV
1	90	0.0276	-0.9724	-0.6634	0.1766
2	245.25	0.1533	-0.8191	-0.5755	0.1114
3	461.25	0.2299	-0.5892	-0.4075	0.1329
4	677.25	0.2090	-0.3802	-0.1614	0.2533
5	958.5	0.2973	-0.0829	0.1506	0.4581
6	1239.75	0.2703	0.1874	0.4072	0.6236
7	1482.75	0.1855	0.3729	0.5556	0.6950
8	1725.75	0.1686	0.5415	0.6737	0.7482
9	1902.15	0.0999	0.6414	0.7124	0.7326
10	2018.48	0.0096	0.6510	0.6572	0.6325

Source table: II.7,8,9.

Figure-II.1 provides the picture of cash inflow rates under different criteria with respective breakeven points of sales revenue



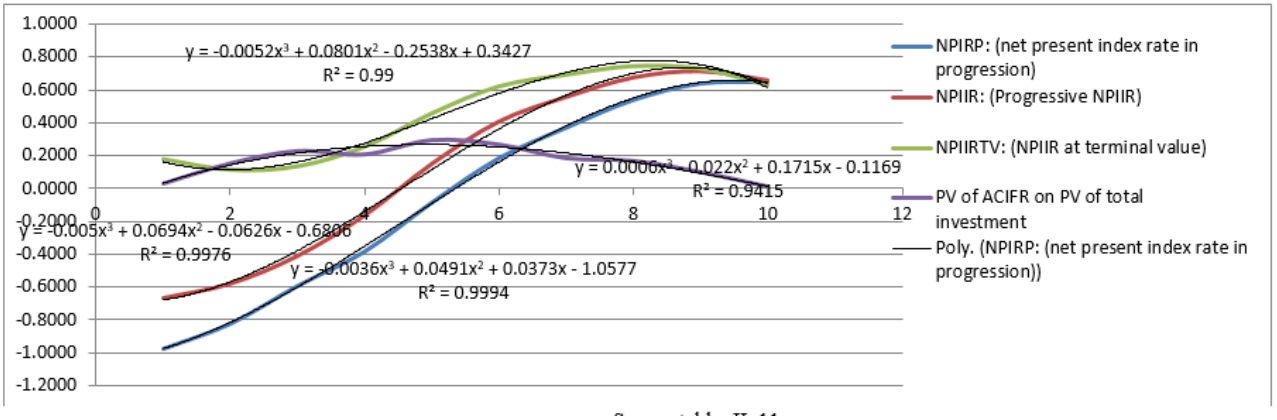
Source table:II.10

Table-II.11. is data of the above analysis collected for graphical presentation of Net present Index/internal Index rates to depict the pay bach periods with clear purpose anddistinctiveness of the rate of return in the progression of periods.

YEAR	NPIRP: (net present index rate in progression)	NPIIR: (Progressive NPIIR)	NPIIRTV: (NPIIR at terminal value)	PV of ACIFR on PV of total investment
1	-0.9724	-0.6634	0.1766	0.0276
2	-0.8191	-0.5755	0.1114	0.1533
3	-0.5892	-0.4075	0.1329	0.2299
4	-0.3802	-0.1614	0.2533	0.2090
5	-0.0829	0.1506	0.4581	0.2973
6	0.1874	0.4072	0.6236	0.2703
7	0.3729	0.5556	0.6950	0.1855
8	0.5415	0.6737	0.7482	0.1686
9	0.6414	0.7124	0.7326	0.0999
10	0.6510	0.6572	0.6325	0.0096

Source table: II.7,8,9

Figure-II.2 provides the picture of cash inflow rates under different criteria with distinct present value pay back periods.



Source table: II. 11

The above graphical presentation enables us to provide the much-needed pay-back period in (accounting if needed), the present value of normal annual cash inflow conditions as well as under-deemed reinvestment within the project of earlier period cash inflows through the progressive accumulation concept. The points of intersection of the X axis by the NPIRP, NPIIR, and (as if NPIIRTV) reveals that a) The point of intersection by the NPIRP represents the normal discounted PBP, similarly the NPIIR represents the Discounted PBP under deemed internal reinvestment. Finally, the NPIIRTV, if intersected, it indicates the discounted PBP under terminal value conditions. And the state of the curves beyond the intersection point represents the post-pay-back period cash inflow index rate in the progression of their respective condition. It can be observed immediately in Figure II.1. Further, the Figure II.2 the intersection points indicate the required sales for discounted Break-even under such distinct conditions. Further, the R^2 of the polynomial regression calculated indicates that a non linear breakeven application is more reliable than linear breakeven application.

 R-squared (R^2) This is a statistical measure that explains the proportion of variance for the dependent variable that's explained by the independent variable(s) in a regression model.

 High R-squared Value (e.g., 0.90+): When R^2 is close to 1, it indicates that the model (in this case, a polynomial function) has a very high explanatory power, meaning the model closely fits the data points.

 Polynomial Function: Using polynomial regression can sometimes result in higher R^2 values compared to linear models, especially if the data has a non-linear pattern.

5. CONCLUSION:

This concept or technique that integrates the sensitivity with the scenario through breakeven (non-linear) enables to provide the entire spectrum of parameters from period to period (year to year) in progression providing the reports in terms of the normal present value of annual cash inflow rate on the initial or present value of total investments and provides the profitability index rate directly. This integrated technique is enabled to provide the NPIR & NPIIR in terms of two conditions i.e. under deemed sunken and terminal investment value. And finally, the graphical presentation of results enables to provide of the Present value Pay-back period under different conditions viz. under terminal value condition, under internal reinvestment of earlier cash inflows condition, and as per the present value of annual cash inflow conditions of a project(s) under consideration. Further, the graphical presentation of the net present rate ofindex returns is very much helpful to determine the present value breakeven point of sales. The point of intersection of the X axis by the respective curves in the year/period-based curve indicates the present value pay-back period and the revenue-based graph indicates the present value break-even sales for recovery of total investment.

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