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Prof. SRC & Dr. KB Innovations in Measuring the Impact and Action Recourse for Changes in Costs Prices Product Mix and Volume on Profits, Developed as an Effective Mathematical Tool for Reporting and Decision Making by Interlinking the Economic Analysis and Financial Analysis through Breakeven Analysis

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Abstract:

The innovative applications of BEA for the study and measurement of effect of changes in any one or some or all the variables under consideration in BEA on the rate of profit with simple mathematical calculations is developed for single product firm in the research paper published in IJBM in June 2016. This is the model developed as a useful tool for measuring the impact of changes in volume along with changes in proportions of output and sales of a multiproduct firm apart from changes in price & costs (both fixed & variable) on profits and profitability. This model further pay the way for measurement of impacts of changes in the economic/market/demand like external environment factors and or the impact of changes in internal factors like marketing efficiency (buying/selling) operational efficiency/ (material/Labour)/promotional efficiency (advertisements/campaigning) on profits through a given change in price/costs/volume/volume proportions directly on profits and profitability. Further the very basis forms as the basis for effective and timely decision on recourse in consideration of the changes in costs and cost-drivers. Further it is hoped that it become a useful tool for decision making under strategic considerations for attaining competitive edge under the situations of multidimensional dynamic changes in costs and prices. This is the tool/system that works as a monitoring/observatory and controlling of profits. Further is plays a pivotal role in framing/development and implementation of competitive strategy.

1. Introduction

The breakeven analysis is confines to determination of Breakeven Point and mostly for studying the effects of changes in volume/value of sales on costs and profits. Till date the concept is ringing around the Break Even Point. The breakeven point is a referring variable more for risk verification and little for the profit planning implications. It had not involved on profitability analysis. This is the innovative analysis considers the actual market trend effects on variables viz. the price, cost, volume and in turn measures the effect of the on the aggregate profits and profitability. In tandem it helps to measure the effect and effectiveness of the remedial action/measures on the aggregate profitability that to what extent it is possible to redeem the negative impact of the environmental effects on the profitability. This further helps to measure the net impacts at each variable and in aggregate in a sequence.

This innovation is projected for determining exact level of impact of changes in external (market) forces and internal (efficiency) on profits and profitability of a multi-product firm on one hand and the same process ensures exact measurement of effectiveness of corrective measures in narrow down negative impact of the external/internal forces. Further at present the purpose of strategic pricing and price changes are made mostly under the economic analysis which is in different dimension in assessment of costs and profits when compared to cost and management accounting systems. The BEA is the tool which has bearing/roots in both the systems and has the ability to interlink these two systems. The strategic implications of cost and pricing invariably need interlinking of both the systems in analysis. Several economists and financial analysts have theoretically explained in their respective way in experimenting under the BEA but no major breakthroughs have evolved. Further my research paper published in IJBM in June 2016 is meant for the single product organization. This is the tool that works in the same way for a multi-product manufacturing organization/ firm.

In continuation/expansion of the applicability of the formulations from a single product firm (elaborated in my research paper published in IJBM in June 2016), here the thought is extended and explained how the innovations are applicable for a multi-product firm i.e. the firm uses the same plant for producing more than one product or a firm producing joint products and by products. Simply

to say the application of the innovations for a firm that has a mix of products in its production and sales and that followed a most effective product mix.

2. Objectives

1. Application of BEA as a strategic profit monitoring tool through measuring the impact of changes in costs, price and promotion even for a multi-product firm.
2. Prescription of common formulae for the above that can be used to ensure the scope of applicability of assumptions of BEA to a negligible level.
3. Ensuring the BEA as a deterministic analytical model for determination of strategic cost/price changes for multi-product business.
4. Ensuring the study of effects of changes in VC/FC/SP/mix proportions and sales volume individually and in combination on rate of profit with respect to initial planned levels with simple calculations makes the planning of profits as dynamic concept and it is any more a static concept.
5. Interlinking of economic analysis and financial analysis in solving the problems of effective and timely decision making on ensuring the best way to realize the profits as planned through effective monitoring and controlling of effect on profits and profitability that affected by changes in determinants i.e. costs price volume mix proportions.

3. Methodology

1. Innovative formulations with existing concepts for extended applications of BEA for a multi-product firm.
2. Innovative approach in application of basic fundamental theme and thoughts of BEA in solving the managerial decision problems in monitoring and controlling the negative impacts of environmental forces on profits and profitability.

4. Limitation

1. Here only the hypothetical example is used and no live example is used.
2. It considers and works on the theme of usual inconsistent economic/demand/marketing environment effects.
3. Though it serves for all favorable, normal and difficult constraint conditions, it is to explain the normal conditions in explaining the process or the way it ensures the possibility to measure the impact and how does it works for control.

5. Literature Review

As the concept of the paper is to formulate the calculations innovatively, the common existing formulae were collected from the review of literature.

1. The concepts used in BEA:
2. Sales(S): sales or selling price.
3. Variable costs (V): unit cost / proportional variable total cost.
4. Fixed costs (F): total fixed cost irrespective of level of output.
5. Contribution margin: it is the amount calculated with the following: $C = S - V$
6. P/V Ratio (Profit Volume ratio) it is the ratio of between the contribution and sales.
7. P/V Ratio: $C/S * 100$
8. All formulas of BEA ring around the following equation: $S - V = C = F + P$
9. $\frac{S-V}{S} = \frac{C}{S} = \frac{F+P}{S}$

5.1. Existing Other Formulas in Breakeven Analysis for Profit Planning

Calculation of Breakeven Point (BEP) I units: F/C_{pu}

In sales value/revenue: $F/p/v$ Ratio.

Determination n of sales required to get a profit of Rs. P

Required sales {in units}: $F + \text{desired } P$

C_{pu}

Required sales {in units}: $F + \text{desired } P$

P/V Ratio

Amount of profit (P) when sales are S units: $P = (S \times C_{pu}) - F$

Amount of profit (P) when target sales are 'S' rupees: $P = (S \times P/V \text{ Ratio}) - F$

Calculation of safety margin sales SM/MS/SMS:

$SMS = TS - BEP$ (in units or value)

SMS in units: P / C_{pu}

SMS in value: $P / (P/V \text{ Ratio})$

The newly invented formulae with the existing concepts are

% of $P = P/V \text{ Ratio} (1 - BEP \text{ Ratio})$ or $P/V \text{ Ratio} - (P/V \text{ Ratio} * BEP \text{ Ratio})$

Generally accessible from any text book of cost and management accounting and drawn from the references

Apart from the above some of the additional concepts/proportions are innovatively applied in deriving the desired results in BEA as given hereunder. Further though there are different mathematical models the end result of them are projected only to derive the above simple formulae and they have unable to provide a needed new dimension for application.

- Important terms: 1selling price, mix selling price/weighted average selling price, variable cost, mix / Weighted average variable cost/, product proportion, breakeven point (BEP), breakeven point ratio (BEPR), Weighted average variable cost ratio/ weighted average P/V Ratio.

6. The Terms and Acronyms Used in Formulation and Calculation

concept	acronym
selling price per unit	SP
variable cost per unit	VC
total fixed cost	F
product mix/ mix	($\sum abc$)
proportion of products in total output and sales	mix proportion
product proportion weighted selling price	WSP
product proportion weighted variable cost	WVC
product proportion weighted contribution	WC
mix P/V Ratio or multi-product combined P/V Ratio	mix P/V Ratio
mix variable cost ratio or multi-product combined variable cost Ratio	WVCR
multi-product combined BEP	mix BEP
product wise BEP on the basis product proportion	product wise BEP
multi-product combined BEP as percentage on mix sales	BEP ratio
percentage of mix profit on mix sales	%profit at present
revised variable cost	RVC
amount of change in variable cost	Δvc
weighted change in variable cost	Δwvc
percentage change in weighted variable cost on mix WVC	%of Δwvc mix
percentage change in VC effect on weighted variable cost ratio	or Δwvc mix
effect of change in VC on profit percentage	% ΔPvc
percentage of profit on sales after the effect of change in VC	revised profit rate
new selling price	NSP
change in SP	Δsp
weighted change in SP	Δwsp
percentage of weighted change in WSP	% of Δwsp mix
effect of change in SP on profit percentage	ΔPsp
percentage of profit on sales after the effect of change in SP	revised profit rate
old or initial planned proportion of products in total quantity of mix sales	omix
revised proportion of products in total quantity of mix sales	nmix
change in proportion of products in total quantity of mix sales	Δmix
change in mix SP with respect of change in mix proportion in sales	$\Delta mix.wsp$
change in mix VC with respect of change in mix proportion in sales	$\Delta mix.wvc$
change in mix C with respect of change in mix proportion in sales	$\Delta mix.wC$
change in mix P/V ratio with respect of change in mix proportion in sales	$\Delta p/v$ Ratio
effect of change in mix proportion on profit percentage	$\Delta pmix$
percentage change in mix sp on mix SP with respect of change in mix proportion in sales	% of $\Delta mix.wsp$
percentage of profit on planned sales revenue after the effect of change in mix	revised profit rate
percentage of profit on revised mix sales revenue	% of P at newmix
effect of change in vc on mix vc	$\Delta vc.\Delta mix$
effect in percentage of change in vc on changed mix vc	% of $\Delta mix.\Delta vc$ in wvc
effect of change in mixvc on WVCR	$\Delta mix.\Delta vc$ in WVCR
	Δsp
	Δmix
effect of changes in SP & mix on mixsp	$\Delta mix.\Delta wsp$
effect of changes in sp on mixsp / mixp p/v Ratio	$\Delta spmix$ (% of $\Delta mix \Delta wsp$ in wsp)
change in volume	Δvol
change in volume as percentage in revised new volume	% of Δvol on nvol
change in BEP ratio with respect of change in volume	$\Delta bepr.vol$
new BEP Ratio after a change in volume	NBEPR
change in profit ratio with respect to change in volume	$\Delta P.vol.$
change in fixed cost	Δfc
change in fixed cost as a percentage on base planned fixed cost	% Δf
change in BEPR/NBEPR vol. with respect of change in Fixed cost	$\Delta BEPRfc$
effect of change in fixed cost on profit ratio	$\Delta P.\Delta fc.$ or $\Delta P.\Delta fc.\Delta vol$

Table 1

7. Analysis

1. The following Innovative application of breakeven concept: for measurement of effect of changes in costs, price, volume and mix proportions of multiproduct firm are developed from the theme of my paper published in June 2016 in IJBM where the same concept is published for a single product firm.

Page no 235 of Vol 4 Issue 6 June 2016 (ISSN 2321-8916) **SRCSPPS Karivena Effects...** point 6.2. The Innovations Enable the Breakeven Analysis as an Analytical Tool for Strategic Cost and Pricing Model

Following is the example helps to understand the way that the innovative formulations works on measuring the impact of changes in costs and prices of products in total and in isolation of the variables (mix, costs price & volume), effected by changes in forces of economic environment, on profits and profitability of the mix of products in aggregate for the firms under the multi-product operations. The effects are possible view variable wise independently and in combination with other others for all products individually or in combinations with simple calculation. Further using an excel work sheet it is possible to know within no time the effects of changes in factors on profit/profitability.

particulars	total	a	b	c
Total fixed cost	50000	-	-	-
planned volume of output and sales	10000	2000	3000	5000
Proportions in product mix		0.2	0.3	0.5
sp		200	100	50
vc		100	75	25

Table 2: hypothetical example problem

- A. Calculate the rate of profit expected form the above.
- B. As the time progresses, if the situation leads to any one case or all of the following at once, calculate the effect of change in variables (cost and prices and volume/mix) on aggregate profits separately of each case and variable and in aggregate considering each case as distinct.

In the light of trends in demand, market, economic conditions for short or long run forced to the following:

- a. Rise in Variable cost of products: product A to Rs. 110/- product C to Rs 27.5 and a fall of VC to Rs. 73.5
- b. A reduction in selling price of products: product A to Rs. 190/- B to Rs. 98/- and C to 47.5/-
- c. Change in only mix proportion to .4, .2, .4 respectively of products a, b, c. (irrespective of change in mix volume) and together with (i) changes in VC and (ii) changes in SP. (iii) changes in VC & SP.
- d. The actual trends in quantities of sale of the products would likely a 20% increase with revised proportions said in c above as: A 4800 units B: 2400 units and C 4800 units.
- e. The fixed costs would likely increase by 20%. To Rs 60000/- and sales volume would decrease by 20% to 8000 units

You are requested to provide the information of:

- I. The effect of change in variable costs, prices, mix, volume and fixed costs individually as B. a,b,c,d,e, above and in combination of changes in all on the rate of profit in aggregate with effect to the effects of all.

The economic reports of the firm reveal the following. In the light of the economic reports suggest the most profitable action recourse to the likely fall of sales by 10% as given in point no1 of the following. The combined promotion costs cover 60% of total fixed costs at present.

	Particulars	Product a	Product b	Product c
1	market/systematic effects observed as 10% fall in demand of all products equally	-0.1	-0.1	-0.1
2	price elasticity in %	-0.7	-1	-0.5
2a	As a measure the possible % change in price	-5	-5	-5
3	The possible % change in advt. exp.	40	40	40
3a	Advt. elasticity%	0.6	0.8	0.7

Table 3: applicable economic factors with hypothetical values

Note the common advt. cost cover 60% of fixed cost. The plant has just sufficient plant capacity to the effect of the above. Use information of the base planned data for showing the impact of the above. Determine the rate of profit on sales to the effect of the above.

- a. With a restructure of plant the variable costs of products will reduce by 5% each but it increases the fixed cost by 40%
- b. What would be the volume of sales required to maintain the same rate of profit on present/planned sales revenue/ on ROI as planned?
- c. You are required to calculate the % of profit on total sales and on Investment where the investment is Rs. 25, 00,000/-

Solution: part A of the hypothetical problem						
acronym	formula	products				
		a	b	c	mix($\sum abc$)	
planned volume of sales	given or base plan volume of sales	2000	3000	5000	10000	
SP	base plan selling price	200	100	50		
VC	base plan variable cost	100	75	25		
F	base plan Fixed cost					50000
mix proportion	initial planned	0.2	0.3	0.5		1
WSP	mix proportion*SP	40	30	25		95
WVC	mix proportion*VC	20	22.5	12.5		55
WC	WSP-WVC	20	7.5	12.5		40
mix P/V Ratio	WC/WSP*100 of mix					42.11
WVCR	WVC/WSP*100					57.89
mix BEP	F/ WC					1250
product wise BEP	F/wC mix and BEP * product mix proportion for each product	250	375	625		1250
BEP ratio	BEP/Sales*100					12.5
%profit at present	P/V Ratio (1-BEP Ratio)	(42.11*87.5/100)				36.84

Table 4: solution to the problem No A of the table 2

verification:	a		b		c		total
	PER UNIT	TOTAL	PER UNIT	TOTAL	PER UNIT	TOTAL	mix
UNITS OF SALE		2000		3000		5000	10000
sales	200	400000	100	300000	50	250000	950000
variable cost	100	200000	75	225000	25	125000	550000
contribution		200000		75000		125000	400000
total fixed cost							50000
net profit							350000
% profit on sales							36.84

Table 5: verification of the results of table 4

point No7 B a Determination/measurement of effects of changes in VC on Profits (When the change is only in VC)

particulars	FORMULA	a	b	c	Mix ($\sum \Delta abc$)	
VC	as given	100	75	25		
RVC	**as given	110	73.5	27.5		
Δvc	(vc-rvc)	-10	1.5	-2.5		
Δwvc	$\Delta vc*w$	-2	0.45	-1.25	-2.8	
%of Δwvc mix	$(\sum \Delta wvc \text{ mix} / \sum WVC \text{ mix} * 100) =$	(-2.8/55*100)				-5.09
or Δwvc mix	$(\%of \Delta WVC \text{ mix} * 100 / WVCR \text{ mix}) =$	(-5.09*57.89/100)				-2.95

Table 6: solution to the point No7 B a

The net effect on rate of profit with respect to change in VC is a fall of 2.95%. Therefore, the rate of profit after the change in VC is: 36.84-2.95 = 33.89%

Verification of the effect of the above

particulars	a		b		c		total
	PER UNIT	TOTAL	PER UNIT	TOTAL	PER UNIT	TOTAL	
UNITS OF SALE		2000		3000		5000	10000
sales	200	400000	100	300000	50	250000	950000
variable cost	110	220000	73.5	220500	27.5	137500	578000
contribution		180000		79500		112500	372000
total fixed cost							50000
net profit							322000
% profit on sales	(322000/950000*100)						33.89

Table 7: verification of results of table 6

point No7 B b Determination/measurement of effects of changes in SP on Profits (When the change is only in SP)

particulars	FORMULA	a	b	c	mix
SP	as given	200	100	50	mix($\sum \Delta abc$)
NSP	**as given	190	98	47.5	
Δsp	as given	-10	-2	-2.5	
Δwsp	w Δ sp	-2	-0.6	-1.25	-3.85
% of $\Delta wspmix$	$\Delta wspmix/wspmix*100$	(-3.85/95*100)			-4.05

Table 8: solution to the point No7 B b

The net effect on rate of profit with respect to change in SP is a fall of 4.05%. Therefore the rate of profit after the change in SP at the base/initial planned revenue is: 36.84-4.05 = 32.79% and

The profit rate on the revenue at revised SP is (32.79*100/100+-4.05)=34.17%

Verification							
	a		b		c		total
UNITS OF SALE	2000		3000		5000		10000
sp/sales	190	380000	98	294000	47.5	237500	911500
variable cost	100	200000	75	225000	25	125000	550000
contribution	90	180000	23	69000	22.5	112500	361500
total fixed cost							50000
net profit							311500
% profit on sales at the revised sp rates	(311500/911500*100)						34.17
% profit on sales at the base sp rates	(311500/950000*100)						32.79

Table 9: verification of results of table 8

point No7 B c: Determination/measurement of effects of changes in product mix proportion on Profits (When the change is only in mix)

particulars	FORMULA	a	b	c	mix($\sum \Delta abc$)
omix	as given	0.2	0.3	0.5	1
nmix	**as given/calculated	0.40	0.20	0.40	1
Δmix	(NEWmix-Old mix)	0.20	-0.10	-0.10	0
$\Delta mix.wsp$	($\Delta mix/mix1 *wsp$)	40.00	-10.00	-5.00	25.00
$\Delta mix.wvc$	($\Delta mix/mix1 *wvc$)	20.00	-7.50	-2.50	10.00
$\Delta mix.wC$	$\Delta mix.wsp - \Delta mix.wvc$				15.00
$\Delta p/v$ Ratio	($\Delta mix.C/mixwsp$)*100	(15/95)*100			15.79
% of $\Delta mix.wsp$	($\Delta wsp.mix/wsp.mix$)*100	(25/95*100)			26.32

Table 10: solution to the point No7 B c

The net effect on rate of profit with respect to change in mix is a rise of 15.79%. Therefore the rate of profit after the change in mix at the base/initial planned revenue is: 36.84+15.79 = 52.63% and

The profit rate on the revenue at revised SP is (52.63*100/100+-26.32)=41.67%

Verification							
	a		b		c		total
UNITS OF SALE	4000		2000		4000		10000
sp/sales	200	800000	100	200000	50	200000	1200000
variable cost	100	400000	75	150000	25	100000	650000
contribution	100	400000	25	50000	25	100000	550000
total fixed cost							50000
net profit							500000
% profit on sales at the revised sp rates	(500000/1200000*100)						41.67
% profit on sales at the base sp rates	(500000/950000*100)						52.63

Table 11: verification of results of table 10

The additional calculations to determine /measure the impact/effect of change in mix together with changes in VC in this regard apart from the above the following are need to be calculated(B.c.i)

Point No7 B c(i): Determination/measurement of effect of change in VC & mix on profit with respect to change in mixVC (ΔVC sub effect to Δmix)

particulars	FORMULA	a	b	c	mix($\sum \Delta abc$)
Δvc	as calculated in VC change effect	-10	1.5	-2.5	
Δmix	as calculated in mix change effect	0.2	-0.1	-0.1	
$\Delta vc.\Delta mix$	$\Delta mix*\Delta wvc$	-2	-0.15	0.25	-1.9
% of $\Delta mix.\Delta VC$ in wvc	$(\Delta mix*\Delta wvc*wvc/100)$	$(-1.9/55*100)$			-3.45
$\Delta mix.\Delta VC$ in WVCR	% of $\Delta mix.\Delta VC$ in wvc*vcr/100	$(-3.45*57.89/100)$			-2

Table 12: solution to the point No7 B c(i)

The net effect on rate of profit with respect to change in VC & mix (VC effect + mix effect +mix VC effect) is a rise of 10. 84 %. (- 2.95+15.79+-2) Therefore the rate of profit after the change in VC & mix at the base/initial planned revenue is: $36.84+10.84 = 47.68\%$ and the rate of profit on the revenue at revised mix revenue $(47.68*100/100+26.32)=37.75\%$

Verification of results of the above							
verification:	a		b		c		total
UNITS OF SALE	4000		2000		4000		10000
sp/sales	200	800000	100	200000	50	200000	1200000
variable cost	110	440000	73.5	147000	27.5	110000	697000
contribution	90	360000	26.5	53000	22.5	90000	503000
total fixed cost							50000
net profit							453000
% profit on sales at the revised sp rates	$(453000/1200000*100)$						37.75
% profit on sales at the base sp rates	$(453000/950000*100)$						47.68

Table 13: verification of results of table 12

The additional calculations to determine /measure the impact/effect of change in mix together with changes in SP. in this regard apart from the above the following are need to be calculated (B.c.ii)

point No7 B c(ii): Determination/measurement of effect of change in SP & mix on profit with respect to change in mixSP (ΔSP sub effect to Δmix)

particulars	FORMULA	a	b	c	mix($\sum \Delta abc$)	
ΔSP	as calculated in SP change effect	-10	-2	-2.5		
Δmix	as calculated in mix change effect	0.2	-0.1	-0.1		
$\Delta mix\Delta wsp$	$\Delta mix*\Delta wsp$	-2	0.2	0.25	-1.55	
% of $\Delta mix\Delta wsp$ in wsp	$\Delta mix*\Delta wsp/wsp*100$	$(-1.55*100/95)$				-1.63
$\Delta mix\Delta wsp$ mixsp on P	As the above					-1.63

Table 14: solution to the point No7 B c(ii)

The net effect on rate of profit with respect to change in SP & mix (SP effect + mix effect +mix SP effect) is a rise of 10. 11 % (15.79 -4.05-1.63) further the rate of profit after the change in SP & mix at the base/initial planned revenue is: $36.84+10.11 = 46.95\%$ and the rate of profit on the revenue at revised SP & mix is $(46.95*100/100+26.32+-1.63+-4.05)=38.92\%$

Verification of results of the above							
verification:	a		b		c		total
UNITS OF SALE	4000		2000		4000		10000
sp/sales	190	760000	98	196000	47.5	190000	1146000
variable cost	100	400000	75	150000	25	100000	650000
contribution	90	360000	23	46000	22.5	90000	496000
total fixed cost							50000
net profit							446000
% profit on sales at the revised sp rates	$(446000/1146000*100)$						38.92
% profit on sales at the base sp rates	$(446000/950000*100)$						46.95

Table 15: verification of results of table 14

(B. c. iii) or otherwise (B. a, b& c) When changes are together in SP, VC and mix and their combined effect on rate of profit is:
 Effect of change in SP + effect of change in VC+ effect of change SP effect of change in mix + effect of change in mixVC+ effect of change in mixSP

$$= -2.95+4.05+ 15.79 + -2+ -1.63 = 5.16\%$$

The net profit rate after the changes in SP, VC and mix on base planned revenue is: $36.84+5.16 = 42\%$

The net profit rate after the changes in SP, VC and mix on revised revenue to all the effect of changes in sp, vc& mix): is $42*100/(100+15.79-4.05-1.63) = 34.82\%$

Verification of results of the above							
	a		b		c		total
UNITS OF SALE	4000		2000		4000		10000
sp/sales	190	760000	98	196000	47.5	190000	1146000
variable cost	110	440000	73.5	147000	27.5	110000	697000
contribution	80	320000	24.5	49000	20	80000	449000
total fixed cost							50000
net profit							399000
% profit on sales at the revised sp rates	(399000/1146000*100)						34.82
% profit on sales at the base sp rates	(399000/950000*100)						42.00

Table 16: verification of results B. a, b& c.

Note: as the measurement of changes in volume and fixed costs are calculated through the changes in BEP, the effects though measured separately but be considered together as follows:

Solution to: B.d. Effect on profit when change in volume with or without changes in SP/VC/ mix/proportions irrespective of change in fixed costs (even when there is a change in PS, VC, mix they will be calculated as usual as said above)

particulars	FORMULA		mix($\sum \Delta abc$)
Revised volume			12000
ΔVol	(n vol -o vol)	(12000-10000)	2000
% of Δvol on nvol	($\Delta vol/nvol*100$)	(2000/12000*100)	16.67
$\Delta bepr.vol$	(base bep ratio*%change in voume)	(12.5*16.67/100)	2.08
NBEPR	base BEPR -change in BEPR	(12.5-2.08) or (base BEPR(1- $\Delta BEPR$)	10.42
$\Delta P.vol.$	(PV Ratio* $\Delta BEPR vol./100$)	42.11*2.08/100	0.88

Table 17: solution to the point No7 B d.

Net impact of change in total mix volume is: .88% and the rate of profit on revenue at the changed new volume of sales is: base profit ratio + change impact = $36.84+.88=37.72$. Further the % of profit after the change in volume on base revenue = %p at new revenue*new vol/old vol.= $37.72*12000/10000=45.26$

Verification							
	a		b		c		total
UNITS OF SALE	2400		3600		6000		12000
sp/sales	200	480000	100	360000	50	300000	1140000
variable cost	100	240000	75	270000	25	150000	660000
contribution	100	240000	25	90000	25	150000	480000
total fixed cost							50000
net profit							430000
% profit on sales revised volume	(430000/1140000*100)						37.72
% profit on sales at the base revenue	(430000/950000*100)						45.26
							45.26

Table 18: verification of results given in table 17

Point No B. e measurement of effect of change in fixed cost on profit rate

acronym	FORMULA		mix($\sum \Delta abc$)
NFC		new fixed cost is	60000
% ΔF	FCo-FCn	(50000-60000)	-10000.00
% $\Delta FC.$	($\Delta FC/FC1*100$)	(-10000/50000*100)	-20.00
$\Delta BEPRfc$	BEPR*% ΔF	(12.5*-20/100)	-2.50
$\Delta P.\Delta fc$	$\Delta BEPRfc/BEPR*P/V$ Ratio	(-2.08/12.5*P/V Ratio)	-1.05

Table 19: solution to the point No7 B e.(i)

Net impact of change in total FC is: -1.05% and the rate of profit on base plan revenue are: base profit ratio + change impact =36.84+-1.05=35.79.

Verification of results of effect of change in FC on profits								
	a		b		c		total	
UNITS OF SALE	2000		3000		5000		10000	
sp/sales	200	400000	100	300000	50	250000	950000	
variable cost	100	200000	75	225000	25	125000	550000	
contribution	100	200000	25	75000	25	125000	400000	
total fixed cost							60000	
net profit							340000	
% profit on sales revised volume	(420000/1140000*100)							35.79

Table 20: verification of results given in table 19

Net impact of change in total FC is: -1.05% and the rate of profit on base plan revenue are: base profit ratio + change impact =36.84+-1.05=35.79. Further the % of profit after the change in volume to be affect to BEPR and to the effect the FC impact needs to calculate the correlative factor impact of change in FC & volume apart from the above (volume effect and FC effect) to determine the rate of profit to the effect of total of both as:

Correlative factor of impact of changes volume and fixed cost (this is deduction to Volume & FC impact)

$\Delta bepr.vol$	$BEPR*(\Delta vol/nvol*100)$		2.08
% ΔF	$(\Delta FC/FC1*100)$	$(-10000/50000*100)$	-20.00
$.\% \Delta vol \Delta F$ in $\Delta bepr$	$\Delta bepr vol * \Delta F / 100$	$(2.08 * -20 / 100)$	-0.42
$\Delta vol \Delta F$ sub effect on	$.\% \Delta vol \Delta F$ in $\Delta bepr * P/V$ Ratio/100	$(-.42 * 42.11 / 100)$	-0.18
$\Delta p vol.fc$			-0.18

Table 21: solution to the point No7 B e.(ii)

Or (alternatively)

Table 7-: solution to the point No7 B e.(i & ii)

Point No B. e: Effect on profit when change is in fixed costs (it will be measure after the measurement of change impact of volume on BEP (i.e. on NBEPR) if there is no change in volume consider the initial BEPR

particulars	FORMULA		mix($\sum \Delta abc$)
ΔFC	$FC_o - FC_n$	$(50000 - 60000)$	-10000.00
% ΔF	$(\Delta FC / FC1 * 100)$	$(-10000 / 50000 * 100)$	-20.00
$\Delta BEPR_{fc}$	$NBEPR_{vol} * \% \Delta F$	$(10.42 * -20 / 100)$	-2.08
$\Delta P.\Delta FC.$ or $\Delta P.\Delta FC.\Delta vol$	$\Delta BEPR_{fc} / NBEPR * P/V$ Ratio	$(-2.08 / 10.42 * P/V$ Ratio)	-0.88

Table 22: solution to the point No7 B e.

Note: The impact of change in volume can be calculated independently but impact of change in fixed costs need to be measured on the BEP after the change if any there in volume. When there is change in total mix volume the net impact of change in FC has to be measured together as: .88+- .88=0. If there is no change in mix volume the effect of change in FC will be determined on base BEP ratio independently.

Or

When consider and calculated independently the impacts of changes in volume and fixed costs, the change in total mix volume the net impact of change in FC has to be measured together as: (.88+-1.05--.18) =0 + base P 36.84

Therefore, the new profit ratio on the revenues after the effect of changes in fixed costs with new BEPR is 36.84+0=36.84 The profit ratio at the base planned revenues (base Profit ratio*new vol/old vol) is =36.84*12000/10000 = 44.21%

Verification results of (table 17, 19, 21 or 8-22)

particulars	a	b		c		total	
UNITS OF SALE	2400	3600		6000		12000	
sp/sales	200	480000	100	360000	50	1140000	
variable cost	100	240000	75	270000	25	660000	
contribution	100	240000	25	90000	25	480000	
total fixed cost						60000	
net profit						420000	
% profit on sales revised volume	(420000/1140000*100)						36.84
% profit on sales at the base revenue	(420000/950000*100)						44.21

Table 23: verification of results given in table 19

Table showing the effect of changes in all the variables independently and in combination of all				
Extent of Impact to be	End result after the effect	Determinant Variable	extent of impact in % P	
add to base profit rate	gives the revised % P on base revenue	effect of change in VC		-2.95
add to base profit rate	gives the revised % P on base revenue	effect of change in SP		-4.05
add to base profit rate	gives the revised % P on base revenue	effect of change in mix proportion	15.79	
add	gives the revised % P on base revenue	ΔVC sub effect to Δmix	-2	
add	gives the revised % P on base revenue	ΔSP sub effect to Δmix	-1.63	12.16
add to base profit rate	gives the revised % P on new revenue	effect of change in volume		0.88
add to base profit rate	gives the revised % P on base revenue	effect of change in FC	-1.05	
Less	gives the % P on new revenue	$\Delta Vol.$ sub effect to $\Delta volume$	-0.18	-.88
		total effect		5.16
	add	initial planned profit		36.84
%of profit at initial price with new volume(initial P + total effect)(5.16+36.84)				42.00
%of profit on the revenue after all the changes incl. volume(42*100/(100+26.32+-4.05+-1.63)				34.82
%of profit on the base plan revenue after all the changes incl. volume(42*new vol/old vol)				50.40

Table 24: solution to the point No7 B II

Verification of results of the above:							
verification:	a		b		c		total
UNITS OF SALE	4800		2400		4800		
sp/sales	190	912000	98	235200	47.5	228000	1375200
variable cost	110	528000	73.5	176400	27.5	132000	836400
contribution	80	384000	24.5	58800	20	96000	538800
total fixed cost							60000
net profit							478800
% profit on sales at all the revised values	478800/1375200*100						34.82
% profit on sales at the base sp rates	478800*100/(12000*95)						42.00
% profit on initial sales revenue	478800/950000*100						50.40

Table 25: verification of results given in table 24

The above table clearly shows that the extent of impact with nature i.e. negative or positive of change in every variable independently and in combination of any few or all on rate of profit on the revenues initially planned and at the amount of revenue after the changes in price costs and volume separately if necessary with simple formula. Having an excel work sheet that I have prepared with the calculations is more than sufficient to calculate the results just by putting the real time values of any business firm can get the results instantaneously.

With the help of the above it is clear that the exact extent of effect/impact of a given change in volume, SP, VC, FC, mix proportions etc. is possible to determine on profits either in total of all at a time or in any combination of few of them or in each of them independently. This paves the way for integration of economic and financial analysis. The integrated analytical result certainly forms as an effective basis for decision making and reporting to the management apart from working as vigilant analytical to determine the possible market forces forced negative deviations in profits on one hand and the proposed best possible alternative measures of recourse on the other. Further this forms as the only analytical tool that ensures integrative analysis of economic theory of firm and financial analysis of a firm for managerial decision making and reporting.

Further as this helps to measure the extent of impact of changes in the determinants viz. the volume, SP, VC, FC, mix proportions on ensure to keep the business to maintain static future plan for profits on one hand and ensure as a dynamic alert system on the other, being measures everything in terms of the basic plan and provides the exact deviation from the planned. This helps to take the corrective action whose impact also measured on the same terms and the basis alike of the measured effects of resultant changes occurred/presumed with effect from changes in the market system.

Further the measurement of extent of effect that the measure/instrument selected or to be selected as recourse to overcome the negative impact, helps to measure its capabilities to alleviate the negative impact measured/identified of the market system. This further helps to decide the number of possible alternative means available and the extent of impact that each of them can show in alleviation and provide/possible to provide a cushion for reaching the goal of attainment of planned rate of profit at any change environments of market system. As everything is measurable on the same base values, it simplifies the efforts in identifying measuring and impacts accurately, legibly with clarity and simplicity. This ensures no scope for any error in results arrived in application of the tool. Any error if would like to predict is only in respect of the errors in measurement of changes in market system. Once if it is measured accurately the accuracy in attaining/controlling the deviations in the rate of profit measured and determined on basics i.e. interims of planned revenues, this avoids the revision of estimates time and again, that are commonly undertaken by every business.

8. Evaluation of the mathematical tool:

Following is the solution for the data given in example problem in table 3 for the integrated analysis of economic and financial analysis that helps how the system ensures the objectives aforesaid.

Table showing the effect of changes in market conditions on volume of sales				
Particulars	Product a	Product b	Product c	total
market/systematic effects of trend observed as 10% fall in demand	-0.1	-0.1	-0.1	10%
effect of change above on volume	-200	-300	-500	-1000

Table 26: measurement of effect on volume table 7-2.1

Measuring the effect of change (trend projected fall of 10%) in volume due to change in market system on profits

variable acronym	FORMULA			mix($\sum \Delta$ abc)
ΔVol	(n vol -o vol)	(9000-10000)		-1000
% of Δvol on nvol	($\Delta vol/nvol*100$)	(-1000/9000*100)		-11.11
$\Delta bepr.vol$	(base bep ratio*%change in voume)	(12.5*11.11/100)		-1.39
NBEPR	base BEPR -change in BEP	(12.5-1.39) or (base BEP(1- Δ BEPR)		13.89
$\Delta P.vol.$	(PV Ratio* Δ BEPRvol./100)	42.11*1.39/100		-0.58
change in profit ratio with respect to change in volume				-0.58
revised profit on the revenue at new volume:		(base profit -change effect (36.84 -0.58)		36.26
Impact on base profit =((basep+ impact)*(new vol/old vol)-base profit)		((36.84+-.58)*9000/10000)-36.84		-4.21
revised % of profit on the base revenue(Rs. 950000):		(36.84-4.21)		32.63

Table 27: measurement of market effect on profits solution to 7.2.1

Action recourse impact on profits to overcome the negative effect of change in volume to 9000 units from 10000 units as above
Effect by reduction of price by 5% on volume

possible % change in price		-5	-5	-5
experienced price elasticity in %		-0.7	-1	-0.5
effect of price elasticity		3.5	5	2.5
change in volume:		70	150	125

Table 28: effect of 7-2.2&2a on volume

Option of increase in promotion costs (fixed cost) by 40% Effect of increase in promotion cost on volume

% change in advt exp		40	40	40
experienced advt. elasticity%		0.6	0.8	0.7
effect of advt. elasticity		24	32	28
change in volume:		480	960	1400
Increase in volume to the effect of both the above		550	1110	1525
Less market effect		-200	-300	-500
		350	810	1025

Table 29: effect of 7-2.3&3a on volume

Effect of reduction of price by 5% on profits

SP	as given	200	100	50	mix($\sum \Delta$ abc)	
NSP	**as given	190	95	47.5		
Δsp	as given	-10	-5	-2.5		
Δwsp	w* Δsp	-2	-1.5	-1.25	-4.75	
% of $\Delta wspmix$	$\Delta wspmix/wspmix*100$	(-3.85/95*100)			-5.00	-5.00%

Table 30: solution to effect of table 7-2.2

Effect of reduction of price and increase in promotion costs on mix

as given	0.2	0.3	0.5	1	
**as given/calculated	0.193	0.313	0.494	1	
(NEWmix-Old mix)	-0.01	0.01	-0.01	0	
(Δ mix/mix1 *wsp)	-1.43	1.27	-0.28	-0.44	
(Δ mix/mix1 *wvc)	-0.71	0.95	-0.14	0.10	
Δ mix.wsp- Δ mix.wvc				-0.54	
(Δ mix.C/mixwsp)*100		(-0.54/95)*100		-0.56	
Effect on P					-0.56
(Δ wsp.mix/wsp.mix)*100		(-0.44/95)*100		-0.46	

Table 31: partial solution (part-a) to effect of table 7-2.2a.3a

Sub price effect or mix SP effect on profits

		sp			mix($\sum\Delta$ abc)
Δ SP	as calculated in SP change effect	-10	-5	-2.5	
Δ mix	as calculated in mix change effect	-0.007	0.013	-0.006	
Δ mix Δ wsp	Δ mix* Δ wsp	0.071	-0.063	0.014	0.022
Δ spmix(% of Δ mix Δ wsp in wsp)	Δ mix* Δ wsp/wsp*100		(0.02*100/95)		0.02
effect of changes in mixsp on P					0.02

Table 32: partial solution (part-b) to effect of 7-2a.3a

Effect of change in volume to the effect of counter measure of change in sp and promotion costs new volume: 12185 units

variable acronym	FORMULA		mix($\sum\Delta$ abc)
Δ Vol	(n vol -o vol)	(12185-10000)	2185.00
% of Δ vol on nvol	(Δ vol/nvol*100)	(2185/12185*100)	17.93
Δ bepr.vol	(base bep ratio*%change in volume)	(12.5*17.93/100)	2.24
NBEPR	base BEPR -change in BEP	(12.5-2.24) or (base BEP(1- Δ BEPR)	10.26
Δ P.vol.	(PV Ratio* Δ BEPRvol./100)	42.11*2.24/100	0.94
	change in profit ratio with respect to change in volume		0.94

Table 33: partial solution (part-c) to effect of 7-2a.3a

Effect of change in FC to the effect of counter measure of change in promotion costs

	FORMULA		mix($\sum\Delta$ abc)
	FCo-FCn	(50000-60000)	-12000.00
	(Δ FC/FC1*100)	(-10000/50000*100)	-24.00
	BEPR/NBEPRvol*% Δ F	(10.26*-24/100)	-2.46
	Δ pFc*BEPR/NBEPR	Δ p.fc-(-2.46*10.26/100)	-1.04
			-1.04

Table 34: partial solution (part-b) to effect of 7-3

Total impact and the net profit after the change impacts

Add		effect of change in VC		0.00
Add		effect of change in SP		-5.00
Add		effect of change in mix proportion	-0.56	
	Add	effect of change in mix.vc	0.000	
	Add	effect of change in mix. sp	0.02	-0.54
Add		volume		0.94
Add		effect of change in FC		-1.04
		total effect		-5.63
		initial planned profit		36.84
		%of profit at initial price/mix with new volume (36.84-5.63)		31.21
		%of profit on the revenue after all the changes incl. volume(31*21*100/(100+-5+-46+.02)		33.00
		%of profit on the base plan revenue after all the changes incl. volume (31.21*12185/10000)		38.03

Table 35: final solution w.r.t to all change implications

verification:	a		b		c		total
UNITS OF SALE	2350		3810		6025		12185
sp/sales	190	446500	95	361950	47.5	286187.5	1094638
variable cost	100	235000	75	285750	25	150625	671375
contribution	90	211500	20	76200	22.5	135562.5	423263
total fixed cost							62000
net profit							361263
% profit on sales at the revenues at revised mix and volume		$361263/1094638*100$					33.0
% profit on sales at the base level revenues		$361263/950000*100$					38.03
% profit on revised volume at the base price/mix revenues		$361263/(12185*95)*100$					31.21

Table 36: verification of final solution w.r.t to all change implications

Therefore, the net profit after the changes made in the price and fixed cost towards sales promotion and with forecasted economic analytical effects on volume and in turn on the rate of profit would likely be increase from 36.84 to 38.03 instead of fell down to 32.63 if not taken the steps to augment the sales through the reduction of price and increased promotion costs.

This is a useful tool that helps to show the impact on profits with an addition or deletion of a product line. It also helps to measure the impact on profits with effect from using the spare plant capacity for export of an existing product or by hire to others at a fixed or variable consideration. Using the tool in an excel work sheet enable to give automated result in measurement of impact of any kind of variation from the budgeted or base plans with final results after the effects.

8. Conclusion

With the help of the above I hope that all the objectives related to measurement of impacts and the results after the impact can be realized with the help of the proposed analytical tool developed on the basis of breakeven analysis. Further with an excel work sheet calculation helps and works as a dynamic vigilant monitoring system for measurement and reporting to the management on the effect of changes in market conditions on profits and performances of the organization.

9. References

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