PAPER – 5: STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

××× CASE STUDY ×××

Porter's Five Forces Model

1. **Safe and Wise Advisory Limited (SWAL)** is well established financial planning & risk advisory firm of the country with nation-wide presence. SWAL is engaged in selling third party products be it financial products or insurance products (life assurance only). Financial advisory business of SWAL is doing well and contributing to the half of gross revenue of group and two-third of overall group's bottom line, but insurance brokerage business is not performing as per expectation. 'Independent and impartial advice' to client is unique selling point of SWAL.

   SWAL was established by Mr. Kaushal Jaiswal around two decade ago (when life-assurance business goes private), at then it was one division business i.e. assurance brokerage business. Mr. Kaushal Jaiswal is dynamic leader and presently leading the company as CEO, apart from being major shareholder of the company.

   SWAL is widely acknowledged in market for two distinct features, first being presence wide across the nation, in form of 'sub-agency offices' equipped with professionally trained sale staff headed by financial planner or advisor, where customer can take advise and discuss opinion prior to investing/ buying any insurance or financial product. SWAL has 'sub-agency offices' in 580 cities, towns and blocks. Locations are semi-commercial in nature but prominent. SWAL has practice to sign 30-year lease, when so ever taking and 'sub-agency office' on lease in order to reduce the lease cost and bring stability.

   Secondly, SWAL sold product of all third parties, hence provide a range of products to its client to choose from. In 2010, SWAL signed a 15 year's agency agreement with all 23 life insurance companies recognised then. SWAL's tagline is also depicting the same 'we are ethically committed to understand and deliver your needs'. SWAL believes in organic growth and listed on stock market 3 years back to float additional capital to fund more 'sub-agency offices'.

22 out of these 23 life assurance companies are private and registered themselves with regulatory between the year 2000-2009 for a period of 25 years. Considering the default by few insurance firms and increasing customer complaints, regulator of insurance business in country tighten the registration criteria and harden the norms.

Typically each of 'sub-agency office' comprises three regular and one contractual employee. One being financial planner/ advisor, 2 sales and relationship officer and contractual worker in role of support staff and vested with miscellaneous clerical responsibilities. The on-roll number of employees engaged in assurance brokerage business has been increased to 1,564 from 720 five year ago (up-till 3 year ago number was 845 but since expansion of 'sub-agency' office division it is around 1,500).

Market trend is changing, since the SWAL commence the business. Each of such insurance company, now has their own network of branch offices to sale their insurance product directly; that too at more prominent locations. SWAL counter this step by highlighting its 'independence and impartial advice' practice, although SWAL managed to retain the revenue at same level, but this result in low profitability of 'sub-agency office' business. Now these insurance companies are not authorising any new agent.

Being in service industry and further in order to ensure wider market reach to compensate the loss of profitability in 'sub-agency office' business, SWAL has established own 'E-platform'- 'Policy at you click' to sell the insurance product with total staff of 50 professionals; as a separate division under insurance brokerage business from 'sub-agency office' division. 'E-platform' division is prospering but 'sub-agency office' business is certainly in trouble.

Supported by revenue figures given below (in '000 Crores), analysts reach to conclusion that growth in the assurance brokerage business is slowing down both for SWAL and industry overall–

Market Size/Year	2019-20	2018-19	2017-18	2016-17	2015-16
SWAL's assurance brokerage business	326	320	312	298	280
Total market size of life assurance	2,240	2,198	2,122	2,004	1,960

Revenue earned by each division of assurance brokerage business (in term of age of the client), is shown in table below for year 2019-20–

Division/Age	20-30	30-40	40-50	50-60	60+	Total
'Sub-agency office' division	2	25	38	164	51	280
'E-platform' division	8	28	8	2	0	46
					Total Business of SWAL	326

Since the profitability of 'sub-agency office' division is declining, hence the strategic review committee of board of directors are concerned about the company's declining profitability due to poor performance of 'sub-agency office' division and suggest that the 'sub-agency office' division should be sold off and that SWAL shall re-position its assurance business as an online solution.

Extract from financial statement for agency office division only (figures in '000 Crores) –

Particulars/Year	2019-20	2018-19	2017-18
Revenue	280	272	250
Profit before interest and tax	18	16	31
Shareholder's' Equity	156	150	150
8% Long term debt	78	64	50
Current Liabilities	455	437	395
Current Assets	605	565	540

Applicable tax rate is 22%. The nature of cost incurred by 'sub-agency office' division is more or less balanced between the variable and fixed. Fixed costs are largely committed in nature.

But the CEO is not agreed to the suggestion made by strategic planning committee, because CEO is of belief that SWAL's USP or original business model is 'sub-agency offices' through which they ensure 'independence and impartial advice' to their clients.

In next board meeting, board is expected to pass resolution on this agenda item in order to decide either to continue or sale the 'sub-agency office' division.

Required

(i) ASSESS the competitive environment of life-assurance business of SWAL (including 'sub-agency office' division). ***[present only two appropriate points for each phase of assessing the environment]***

(ii) EVALUATE the case for holding the 'sub-agency office' division, backed by financial viability among other criteria. ***[present only two appropriate points for each monetary and the non-monetary issue]***

×××QUESTIONS×××

Overall Equipment Effectiveness (OEE)

2. **Sheetal Bearing Balls Limited (SBBL)** is the famous name for bearing balls of different sizes. Mr. Syal recently joined as Manager Production and Operations at Unit 3 of Ludhiana (in Punjab) plant of the SBBL, wherein 10mm diameter steel ball bearings for bicycles are manufactured. The plant is largely automated and lashed with the latest technology machines.

From Mr. Singh, Plant Accountant Mr. Syal come to know that since machines are of the latest technology and workers are motivated due to the liberal workman policy of SBBL, hence productivity and quality is and was never an issue, but availability is. Over lunch, when Mr. Syal greets Mr. Kumar, Plant Head, he also expresses his worry over excessive downtime and optimal use of limiting factors.

Mr. Syal, while navigating the ERP and reviewing the files & other documents handed over to him, which was prepared and maintained by his predecessor; come across the OEE rate of 93.555% measured during last week for machine '107-10M-Bearing' (which is limiting factor – caused bottleneck activity) during a normal shift. Since the said machine has a high-performance rate of 105%; hence Mr. Syal decided to dig deep into the composite OEE.

In the normal shift of 9 hours workers are allowed to take 2 short breaks of 15 minutes each and a lunch break of 30 minutes. During such a normal shift, out of the total manufactured 27,216 bearing balls by said machine, only 272 balls are found defective.

Required

(i) DETERMINE the unplanned downtime witnessed by machine 107-10M-Bearing and advise Mr. Syal, the best way-out to reduce the same (in brief).

(ii) MEASURE the Ideal Cycle Time to manufacture a single bearing ball.

(iii) APPLY, Goldratt's five steps that can be applied to remove the bottleneck at the Ludhiana plant of SBBL.

Environmental Management Accounting

3. **Sheetal Paper Mart (SPM)** is in process of getting ISO 14001:2004 Environmental Management Systems (revised ISO 14001:2015) certification. SPM is selling eco-friendly and wheat straw-based paper of different sizes (A3, A4, and A5) and GSM under the brand 'Prime'. Prime is a famous name among both commercial and household consumers.

For purpose of getting certified, a cross-functional team is constituted, which is responsible ***'to improve the environmental impact & image of SPM as eco-friendly enterprise and control environmental cost'***, which collects the following particulars relating to the H1 and H2 (first and second half of the relevant fiscal year respectively)

Disposing of the toxic material costs ₹1.2 crores to SPM in H2 which is 20% lesser than what was spent during H1. Committee responsible for formulating policy matters on environment-related aspects in SPM has departmental budget of ₹6 lakhs p.a., in H1 the utilisation rate was 80% and in H2 it was 110%.

Environmental audits earlier used to conduct on a half-yearly basis, but management decided to reduce the frequency to quarter each, in the mid of such year. Each such audit

cost ₹8 lakhs to SPM. In the H2 SPM extends the production capacity and installed the new plant & machinery which has put to use cost of ₹77.25 crores, this is the premium version of the plant and machine due to its capability to reduce the generation of waste. Erection and other installation costs including dry-run were ₹65 lakhs and the same for all versions. The standard version has on-board cost of ₹76.20 crores.

SPM is practicing the recycling policy, which was formulated around three years ago; for the scrap, it generates in its plant. The review of the recycling policy is pending for the last 12 months. The cost incurred during the fiscal year was ₹2.75 crores, spent in alignment to scrap generated during the year. The policy document also states– *'zero discharge of waste/scrap into the environment, in order to be true-sense eco-friendly enterprise'*.

In H2 contamination test was performed which cost ₹4 lakhs to SPM. The monitoring cost incurred during the year was ₹78 lakhs; in H2 this was double then H1.

Required

(i) PREPARE the environmental cost statement as per the classification suggested by 'Hanson and Mendoza'.

(ii) ANALYSE the elements of environmental cost at SPM.

(iii) EVALUATE whether the cross-functional team is successful in serving their 'terms of reference'.

Note- Clearly State the assumptions (if any).

Annexure

Scrap Generated (during the year)

Quarter	First	Second	Third	Fourth
Scrap generated and recycled	1,572 MT	1,428 MT	1,114 MT	886 MT

Cellular Manufacturing

4. It has been resolved that cellular manufacturing shall be adopted in order to improve productivity, in the recent board meeting of **Raptor Bearing and Shaft Limited**. In favour of the resolution, Mr. Nayak (the executive director) who is responsible for production and operation function gave a briefing over different layouts of cells. The Managing Director, Mr. Syal believes that each possible cell formation and layout need to be studied in advance by a cross functional team.

Chief HR officer Mr. Mishra shown his concern over the utility of cellular manufacturing to enhance productivity. In response to him, Mr. Nayak mentioned *'Although scientific management is quite an old theory of management pronounced by Frederick Winslow Taylor, which analyses and synthesizes workflows with the objective of improving*

economic efficiency, especially labour productivity; but still has relevance. This relevance multi-folds when Time and Motion studies are considered in nexus with cellular manufacturing'.

Mr. Nayak constituted a cross-functional team with the term of reference stated in said board resolution. You are also part of teams as a representative of Management Accounting Division. The team started with the study of different possible layouts and machine cell designs. While analysing the production flow it is observed that 5 different parts/ components (P101, P104, P105, P107, and P108) are complexly involved in processing at 5 different machines (M2, M7, M13, M13A, and M15).

Part-Machine Incident Matrix for Production Flow Analysis for the said product is given below–

	P101	P104	P105	P107	P108
M2	1*				
M7		1#			1
M13	1*			1	
M13A		1#	1		
M15				1	

Interpretation

(*) P101 requires processing at M2 and M13, whereas (#) P104 requires processing at M7 and M13A.

Required

(i) DISCUSS the concern expressed by Mr. Mishra over the utility of cellular manufacturing.

(ii) EXPLAIN on utility of at-least three machine cell designs, which can be used.

(iii) FIND logical part families and machine groups based upon Part-Machine Incident Matrix to showcase Machine-Part grouping using Rank Order Clustering Algorithm.

5. You are newly appointed management consultant with experience in Lean System. During discussion at meeting, managing partner (Mr. Gupta) explain the assembly line workflow process at **RIO** along with the machine part incident matrix. You quoted about your past experience of implementing Cellular Manufacturing system. Mr. Gupta asks you to:

(i) FIND appropriate cells using suitable method.

(ii) COMMENT on the results, if any.

Note- Use "Rank Order Clustering method".

Machine Shop RIO-042

Machine Part Incident Matrix

Part / Machine	P_1	P_2	P_3	P_4	P_5	P_6
M_b			1		1	
M_c				1	1	1
M_d	1	1				
M_e			1		1	1
M_f	1	1		1		

Manufacturing Cycle Efficiency

6. **Glen Electronics** manufactures a wide range of electronic heaters and geysers. Glen was a popular name among retailers and customers, but it keeps on losing the market share; the major reason is emerging competitors are offering economical product customers with similar features and quality. The market where-in Glen operating is price sensitive, hence adding more features and establish itself as a premium brand is not the option. The only possible choice left with glen is to reduce prices for that it needs to reduce the cost to maintain the profit margin.

A cost management committee was constituted to study the scenario and recommend the solution to the board of directors. The committee based upon their study suggests a 3-phase solution, out of which phase one is 'stress on enhancing manufacturing cycle efficiency from its current level of 62.50%'. The committee collects the following data with help from the office of the Chief Management Accountant–

- Current batch wait time before the order getting process is 4 days.
- The time spent working on the products (batch processing time) is currently 20 days.
- Total time spent by the products waiting –to be processed, moved, inspected, and delivered (batch queue time) is currently 6 days.
- Currently, the time spent on making sure that the products are not defective (batch inspection time) is double that time spent in transferring products between workstations (batch move time).

The Board of directors based upon the committee's report decided to apply cellular manufacturing to reduce unnecessary move time. Based upon decision tasks are allocated to concerned functional managers.

Managers and workers showed their resistance by stating – "*we are not convinced that cellular manufacturing reduces motions on the production floor*". Some workers even mentioned they are not aware of what is current batch inspection time and batch move time.

Required

You are deputy to management accountant and was part of the committee, hence board approached you to convince the managers and workers as part for change management.

(i) CALCULATE current batch inspection time and batch move time.

(ii) CALCULATE manufacturing cycle time, and how much is non-value-added time? (in term of days)

(iii) CALCULATE revised manufacturing cycle efficiency if both batch inspection time and batch move time cut down to half of the current level and other elements remain constant.

(iv) What makes cellular manufacturing capable to reduce motions on the production floor and how benefit the workers? EXPLAIN.

Decision Making

7. Micro-Guard Industries Limited (MGIL) is a renowned company for a unique range of thoughtfully-engineered products, designed to provide simplified solutions and upscale your home interiors. MGIL engaged in the manufacturing of Power Systems, Batteries, Wires & Cables, Switch Gears & Modular Switches etc. But MGIL is largely famous for its wide range of Voltage Stabilizers. Each product is manufactured in a separate division.

While planning regarding voltage stabilizers division (VSD) for the first half of the fiscal year 20-21 amid the outbreak of COVID-19, the board get through a report from internal expert committee pertaining to crystal series of voltage stabilizers which says– *'due to restricted availability of the input factors (on account of lock-down by the government), only 40,000 crystal voltage stabilizers (CVS) is expected to manufactured and sold during the first half of fiscal, against the normal capacity of 75,000 per quarter; that too at ₹ 1,600/- per CVS'*. At normal capacity level it incurs the following cost to manufacture and sell single unit of CVS–

Particulars	Amount (₹)
Direct material	575
Direct labour	215
Variable overhead	310
Fixed overhead	300
Cost per unit	**1,400**

One of the directors suggested– '*since migrant workers moved to their home states and expected to come back in 3-5 months' time hence it is better to temporary discontinue (lock-out) the production for the first half of fiscal'*. Another director support him by stating– *'it will give the opportunity to our suppliers (or retailers) to clear the old stock available with them'*. On the reference by the board, you (chief management accountant

at MGIL) provide an estimate to management that 1/3rd fixed overhead at a normal capacity level is unavoidable and additional cost due to discontinue (lock-out) of plant for 6 months and resumption thereafter is ₹ 35 lacs.

Required

You are required to ADVISE the management–

(i) Shall they continue the production of CVS or temporary discontinue (lock-out) for the first half of the fiscal year? (consider monetary aspects)

(ii) The qualitative factors which need to consider, while deciding either discontinue (lock-out) or continue.

(iii) What are the minimum number of CVS that VSD needs to manufacture and sell; in order to economically justify the continuation of the production?

Note– *In a legal sense, Lock-out means the temporary closing of a place of employment or the suspension of work, or the refusal by an employer to continue to employ any number of persons employed by him; which is way different from shut-down. But in management accounting lock-out and shutdown both carry the same meaning.*

Pricing Strategy

8. **Zutus Ltd.** is a leading Indian Pharmaceutical company which is a fully integrated, global healthcare provider. With in-depth domain expertise in the field of healthcare, it has strong capabilities across the spectrum of the pharmaceutical value chain. Zutus has earned reputation worldwide amongst pharmaceutical companies for providing comprehensive and complete healthcare solutions.

One of the drugs, Rifmn is an antibiotic used to treat contagious disease "Tbis". Rifmn is a patented medicine. The patent for which is now going to expire, and several other competitors are expected to enter in the market for selling the medicine using the same components of chemicals, under different other name. In order to reposition itself in the market, the company is reviewing its pricing policy considering the market change and other threat.

The market research for Rifmn indicates that for every ₹4 decrease in price, demand would be expected to increase by 8,000 batches, with maximum demand for Rifmn being one million batches.

Each batch of Rifmn is currently made of using chemical salts:

Salt X: 367.50 gm at ₹0.08 per gm

Salt Y: 301.50 gm at ₹0.40 per gm

Each batch of Rifmn requires 30 minutes of machine time to make and the variable running costs for machine time are ₹40 per hour. The fixed production overhead cost is expected to be ₹35 per batch for the period, based on a budgeted production level of 3,00,000 batches.

The skilled workforce who has been working on Rifmn until now are being shifted onto the production of Zutus company's new antiviral drug (injection) for Viral Disease-19 which costs millions of ₹ to develop. Zutus has obtained patent for this revolutionary drug and it is expected to save millions of lives all across the world. The launch of this drug is excitedly anticipated all over the world, while its demand in unknown and no other similar specific drug exists. The average labor cost (outsourcing) of each batch of Rifmn is ₹38.60.

The management of Zutus considers that pricing decision of Rifmn should be based on each batch.

Required

(i) CALCULATE the optimum (profit-maximizing) selling price for Rifmn and the resulting annual profit which Zutus will make from charging this price.

(ii) RECOMMEND the pricing strategy for launching of new antiviral drug.

[Note– If P = a - bQ, then MR = a - 2bQ]

Just in Time

9. X sells 'mu-50' to its customers. It purchases mu-50 from Y @ ₹ 140 per unit. Y pays all freight to X. No incoming inspection is necessary because Y has a superb reputation for delivery of quality merchandise. Annual demand of X is 13,000 units. X requires 15% annual ROI. The purchase order lead time is 2 weeks. The purchase order is passed through EDI and it costs ₹ 2 per order. The relevant insurance, material handling etc. ₹ 3.10 per unit per year. X has to decide whether or not to shift to JIT purchasing. Y agrees to deliver 100 units of mu-50→ 130 times per year (5 times every two weeks) instead of existing delivery system of 1,000 units→ 13 times a year with additional amount of ₹ 0.02 per unit. X incurs no stock out under its current purchasing policy. It is estimated X incurs stock out cost on 50 units under a JIT purchasing policy. In the event of a stock out, X has to rush order which costs ₹ 4 per unit.

Required

Briefly COMMENT whether X should implement JIT purchasing system.

10. IPL is a leading manufacturing company. Under increasing pressure to reduce costs, to control inventory level and to improve services, IPL's Costing Department has recently undertaken a decision to implement a JIT System.

The management of IPL is convinced of the benefits of their changes. But Supplies Manager "W" fears with the Costing Department's decision. He said:

"We've been driven by suppliers for years ... they would insist that we could only purchase in thousands, that we would have to wait weeks, or that they would only deliver on Mondays!"

Required

COMMENT on Mr. W's viewpoint.

Budgetary Control

11. The following are 2 types of monthly control report of a CA firm showing gross collection (in ₹'000). The budgeted collection for the year ending on 31 March are ₹4,14,00,000 in total.

Type-X

'Gross Collection' Report for July

Activity	Budget	Most Recent Forecast for the year	Expected Variance
Accounting	16,560	17,250	690 (F)
Auditing	10,350	8,280	2,070 (A)
Taxation	14,490	13,386	1,104 (A)

Type-Y

'Gross Collection' Report for July

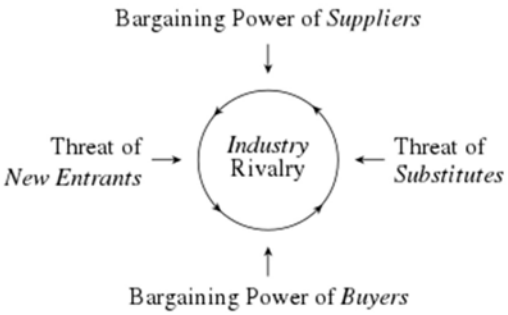
Activity	Monthly			Cumulative		
	Budget	Actual	Variance	Budget	Actual	Variance
Accounting	2,415	2,622	207 (F)	6,210	6,486	276 (F)
Auditing	1,380	966	414 (A)	3,450	2,691	759 (A)
Taxation	1,725	1,587	138 (A)	3,450	3,105	345 (A)

Required

IDENTIFY the type of *control system* for both types of report.

SUGGESTED ANSWERS/HINTS

1. **(i)** Michael E Porter, in 1980 in his book "Competitive strategy: Techniques' for analysing industries and competitors" suggested **five force model** to assess the *competitive environment* of an industry. The five forces which are enumerated by this model are the bargaining power of suppliers; the bargaining power of customers (buyers); the threat of new entrants; threat of substitute products; and the level of rivalry among current competitors in the industry.



This model is also named as porter's five force analysis. Since each of these five forces *affect the competitiveness of business,* hence can be used to assess the potential of any organisation or entity; life-assurance business of SWAL (including 'sub-agency office' division) is not an exception to this.

The bargaining power of suppliers

Number of suppliers will decide the dominance they possess in term of bargaining power regarding the price of good and service they supply to business. In case of 'sub-agency office' division following factors will affect the suppliers' power–

Control over Value Chain – By adopting the strategy of forward integration the insurance companies them-selves getting into the direct sale through own network of branch offices in order to enhance their margin or reducing the margin earned by SWAL's 'sub-agency office' division. Since number of insurance companies are neither too less nor too much, hence bargaining power of insurance companies; in terms of percentage brokerage they offered to SWAL is *moderate*.

Importance of product – SWAL is also dealing in financial product's marketing and advisory, which contribute 50% of group sales and around 67% of group's profit; thus assurance business which is no doubt significant but *only choice (business) available* to SWAL. Hence, bargaining power of supplier is *moderate*.

Substitution among the brand – Life assurance product offers similar utility to client; hence easily substitutes among the brands, means if insurance company 1 charge lesser premium then insurance company 2, client will buy assurance of company 1. No doubt switching is less viable once policy subscribed. Since SWAL's 'sub-agency' division is offering the product from all 23 insurance companies, hence bargaining power of suppliers become *low*.

Supply of other factors – Other factor such 'sub-agency offices', which are largely on lease, has 30-year lease, this will reduce the lease cost as well as bargaining power of land-lord apart from bringing stability.

(Any Two Points)

The bargaining power of customers

Whether seller is price taker or makes, this is outcome of bargaining power of customers (true sense competition). If the bargaining power is high seller will become price taker, else he is price maker. Following factors affect the bargaining power of customers of SWAL's 'sub-agency' division–

Number of buyers – In assurance industry the buyers are large (in comparison to few number of suppliers) and diversified, hence their bargaining power is *low***.**

Standardised products – Since the life assurance is the product, which is standard from prospective of core functionality, hence buyers can easily substitute brands and can negotiate to reasonable extent.

Switching – Once policy subscribed can't be easily switched with another, hence due to high switching cost bargaining power reduced to some extent at-least.

(Any Two Points)

The threat of new entrants

Although entry of a new firm to the industry/ market depends upon the level of entry barriers, but if new entity enters into the industry; it will surely bring additional capacity which enhance the stiffness of competition; hence become a kind of threat. In case of 'sub-agency office' division, there are some major barriers to entry–

Less number of new life-assurance licenses by regulator due to tough regulations – As mentioned in the case that after considering the default by few insurance firms and increasing customer complaints, regulator of insurance business in country has tighten the registration criteria and harden the norms; hence this may act as entry barrier and reduce the threat of new entrants.

Less number of new insurance agent due to no new authorisation by insurance companies – As market is revamping, the agents is becoming competitor to the insurance companies and as mentioned insurance companies stopped authorising new insurance agents, hence this will act an entry barrier for new insurance agents, which is a great positive for SWAL's 'sub-agency office' division and intact the competitive advantage.

Learning curve and economies of scale – Since all the 23 insurance companies dealing in life assurance and SWAL are 10 to 20 years old organisations; hence learning curve and economies of scale (shared services for the 580 offices - presence in 580 cities) which they are enjoying may become entry barriers for new firm. Since new firms require huge capital to be at par to such learning curve and economies of scale.

(Any Two Points)

Threat of substitution

Substitution means the product from some other industry which can render the same function which life assurance is rending. The threat of substitute product is *quiet low*.

Competitive rivalry

The level of competition among the players to acquire or retain the market share directly affects the profitability in an industry. Following factor is affecting the competitive rivalry–

Number of competitors and respective market size – Since there are good number of competitors, hence competition will be intense; may cut throat rivalry. Presently SWAL's insurance business represent 14.55% of market share (in 2019-20) in comparison to 14.29% of market share five year ago, without any major variation, hence possibility of gaining new market share is limited that too at high cost (in form of advertisement and more after sale services).

Lack of differentiation – Standardise product results in high rivalry, since the life assurance is standard product hence rivalry may be high on account of easy substitution effect among the different brands.

Slow market growth – If market is growing at high rate, rivalry may be stiffer or may be moderate; because everyone has reasonable opportunity to grow. The moment growth stagnated rivalry become stiffer because no one wish to lose market share. The industry life cycle curve is flatter here, because during last four years overall industry wide CAGR (compounded annual growth rate) of life assurance business is 3.39%, whereas year-on-year growth from 2018-19 to 2019-20 is 1.91%. Although potential is limited, but competition is still high.

Exit barriers – If the exit cost for player to move out of industry is high, it will have to be in industry and fight for survival, which may make competition tougher. Since agency agreement and lease agreement is already signed by SWAL hence, it becomes difficult to exit from the business, hence need to participate in competition to retain the share.

(Any Two Points)

(ii) Case for holding the 'sub-agency office' division

The strategic review committee suggests that the SWAL's 'sub-agency office' division should be sold off and that SWAL shall re-position its assurance business as an online solution, but the same suggestion firstly needs to be evaluated in terms of *financial perspective* among the other criteria.

The growth in life assurance business is stagnated and industry is in maturity stage of industry life cycle. This is evident from industry size and growth in the same. During last four years overall industry wide CAGR (compound annual growth rate)

of life assurance business is 3.39%, whereas year-on-year growth from 2018-19 to 2019-20 is 1.91%. The moment growth stagnated rivalry become stiffer because no one wish to lose market share. Hence, there is intense competition in market. In cases where market witnesses intense competition, operating efficiently is essential and reduction in cost become *key success factor*; in order to offer competitive deals to clients and retain market share.

Hence it becomes need of hour, that we review the operating processes followed at 'sub-agency offices' to check whether they are efficient or not, in order to ensure greater profitability rather thinking to sale off the entire 'sub-agency office' division.

Now, move to *financial analysis*, which suggests it is beneficial to hold back 'sub-agency' division.

Contribution to the group – Insurance business is contributing 50% of top-line of overall group revenue (and 1/3rd of bottom line), and around 86% (280/ 326) of this comes from 'sub-agency office' division and 'E-platform' division contribute only remaining 14%.

Profitability – Margins are positive. There are two major parameters to evaluate profitability further on–

- Operating profit *(EBIT/ Revenue)* – No doubt, operating profit shrink from 12.4% to 6.43% in three years' time frame. But as earlier quoted, margin is positive and secondly, there is sign of recovery as well. EBIT increased in absolute terms (from 16 to 18).
- Return on capital employed *(ROCE) [EBIT / (Equity + Long Term Debt)]* – No doubt, ROCE shrink from 15.5% to 7.69% in three years' time frame. But reduction in EBIT is not only a reason, another major reason for decline is also change in capital structure. Long term debt is increased in absolute terms (from 50 to 78).

Liquidity – Current ratio *(Current Assets / Current Liabilities)* being reasonable measure of liquidity indicates enough liquidity in 'sub-agency office' division to meets it obligation. There is minor decline from 1.367 times to 1.33 times. Component analysis of working capital can be performed for greater insight.

Gearing (Debt / Equity) – Gearing ratio depicts the financial leverage**,** a measure of risk**.** Gearing ratio no doubt increased as result of introduction of debt, from 1/3 to 1/2, but under control.

(Any Two Points)

Some *other quasi-finance* and *significant factors* relevant to the decision of sale of 'sub-agency office' division and full focus on 'E-platform' division–

Client's demography – Clients from all age groups from 20 to 60+ are clients of SWAL's assurance brokerage business. 66.56% (217/326) of revenue coming from

clients with 50+ years of age, and 99% (215/217) out of them are associated through 'sub-agency offices', hence holding of 'sub-agency' division become essential. Secondly, clients from all age group may not find it convenient to shift to 'E-platform' 'Policy at you click' and their resistance may result in losing business. Thirdly, they have easily available substitute, because competitors also have branch offices which will give them same feel.

Resistance from employees – Out of 1,564 on-roll employees of assurance brokerage business, only 50 are associated in 'E-platform' division- 'Policy at you click', rest all in 'sub-agency office' division. If SWAL re-structure itself fully as online solution for life assurance then also can't absorb all the employees, many of them need to be retrenched. Resistance will be there in both the cases, because transferred employee may not have requisite skill set, result in poor quality of service and no job satisfaction to employee. Whereas in case of retrenched workers redundancy cost will become additional financial burden. This can be seen as exit barrier.

Legal aspect in term of pre-closure of lease - SWAL has practice to sign 30-year lease, when so ever taking and 'sub-agency office' on lease in order to reduce the lease cost and bring stability. It started the business 2 decades ago and expanded it 3 years ago and many of leases are active right now, in case of pre-closure, it may be possible to bear additional financial burden as per terms of lease agreement.

Loosing USP – **'**Independence and impartial advice' with presence wide across the nation, in form of 'sub-agency offices' equipped with professionally trained sale staff headed by financial planner or advisor, where customer can take advise and discuss opinion prior to investing/ buying any insurance or financial product is USP for SWAL's assurance brokerage business. By disposing the 'sub-agency office' division this central idea, with which SWAL was established may be washed out.

(Any Two Points)

In nutshell, the life assurance market has matured in recent years, and result in low growth potential and lower profitability but still yielding positive numbers. Hence, sale of 'sub-agency' division will adversely hit the revenue as well as profitability.

IMPORTANT NOTE

- **This is a comprehensive "Case Study" covering various aspects of 'Porter's Five Forces' model. Students are required to present only two relevant points for each force properly linked with the Case. More points have been given than asked for in the requirement to "assist" students.**
- **Conceptually correct and brief explanation is sufficient for each step or point.**

2. (i) Unplanned downtime of machine 107-10M-Bearing

Overall equipment effectiveness (OEE) is a quantitative metric for measuring the productivity of individual equipment in a manufacturing plant. According to Seiichi Nakajima who introduced OEE, it is capable to identify and measure the losses in a manufacturing process through availability rate, performance rate, and quality rate.

OEE = Availability Rate × Performance Rate × Quality Rate

Quality Rate

Particulars	Units
Output units – total count	27,216
Rejected units out of the above	272
Good units – good count (which met the quality criteria) (27,216 - 272)	26,944
Quality Rate (Good Counts / Total Counts) (26,944 units / 27,216 units) → 99.00%	

Since the quality rate is 99.00% and performance rate (105%), as well as overall equipment effectiveness (93.555%), is also given in the case; hence availability rate can be measure–

Availability Rate × 105.00% × 99.00% = **93.555%**

The **Availability rate is 90%** i.e., run time [*or* net operating time (NOT)] / planned production time [*or* net available time (NAT)]

Planned Production Time

Particulars	Time in minutes
Total possible time (9 hours × 60 minutes) [scheduled time]	540
Less: Planned down time [scheduled loss]	
Short breaks (2 breaks × 15 minutes)	30
Meal break (30 minutes)	30
Planned production time	**480**

Since the Availability rate is 90% and planned production time is 480 minutes, hence **run time shall be 432 minutes** (run time / 480 minutes = 90.00%).

Since unplanned downtime is the difference between run time and planned production time, hence **unplanned downtime of machine 107-10M-Bearing is 48 minutes.**

Particulars	Time in minutes
Planned production time	480
Less: Run time (actual time taken)	432
Unplanned Downtime	**48**

Note

Alternate Working
Unplanned downtime = Planned production time (1 – availability rate)
480 minutes (1 - 90%) = 48 minutes

Advise–

In order to reduce the unplanned downtime, preventive maintenance shall be practiced either before or after each shift; and the **shine (out of 5S)** principle shall be adopted by the workman as part of the TPM initiative. It is expected that the time spends on preventive maintenance will be less than the current unplanned downtime of 48 minutes.

☞

Alternate advices are also possible, provided shall be valid and reasonably relevant.

(ii) Ideal Cycle Time to manufacture a single bearing ball

Performance rate can be computed by dividing standard time required [*or* ideal operating time] with run time. Since performance rate (105%) is given in the case and run time (432 minutes) computed above; hence the standard time required to manufacture 27,216 bearing balls is 453.6 minutes (standard time required / 432 minutes = 105.00%)

So, standard time required to manufacture a single bearing ball (i.e., ideal cycle time) is **1 (one) second** (453.6 minutes × 60 / 27,216 balls) i.e., 60 bearing balls per minute.

Note

Alternate Working
OEE = (Good count × Ideal cycle time) / Planned production time
93.555% = (26,944 × Ideal cycle time) / 480 minutes
Ideal cycle time = 1 second per bearing ball

(iii) Goldratt's five steps to remove the bottleneck at Ludhiana plant of SBBL

Goldratt's theory of constraints describes the following mentioned five steps process of identifying and taking steps to remove the bottlenecks that restrict output.

1. **Identifying the System Bottlenecks,** likewise, at unit 3 of Ludhiana plant of SBBL, 107-10M-Bearing is limiting factor hence activity performed through/using this equipment is bottleneck activity.
2. **Exploit the Bottlenecks –** Limiting factor **(**Bottleneck's activity capacity) must be fully utilised and that too optimally. Currently the overall equipment effectiveness is already 93.555%, attention on the possibility to enhance the same is needful. (Like preventive maintenance shall be practiced to avoid unplanned downtime. Similarly for each production units, way-out depends upon the limiting factor of that unit.)
3. **Non-bottleneck activities are subordinate –** Bottleneck activity should set up the pace for non-bottleneck activities. Production units shall plan their production keeping respective limiting factors at the centre point, because even if the efficiency of non-bottleneck enhanced; same may be worthless due to scarcity of limiting factor (bottleneck activity).
4. **Elevate the bottleneck –** Eliminate the bottleneck by enhancing the capacity and efficiency. Major change (business reengineering) or continuous minor change (kaizen) may do.

   Note – There will always be one bottleneck in the system, if such bottleneck is eliminated then a new constraint emerges as a bottleneck. Hence this process continuous. Ultimately improvement is a never-ending continues process.
5. **Repeat the process –** Apply step 1 to new bottleneck activity which emerges at different production units of Ludhiana plant of SBBL and repeat the process.

For Your Understanding

Seiichi Nakajima led the introduction of TPM, OEE and the Six Big Losses in the early 1970s while at the Japanese Institute of Plant Maintenance. OEE is a quantitative metric for measuring productivity of individual equipment in a manufacturing plant. OEE identifies and measures losses of crucial parts in a manufacturing process namely availability rate, performance rate and quality rate.

OEE = Availability × Performance × Quality

OEE Factors are calculated as follows–

1. Availability: NOT / NAT = (432 / 480) × 100 = 90.00%
2. Performance: IOT / NOT = (453.60 / 432) × 100 = 105.00%
3. Quality: (IOT – LOT) / IOT = (453.60 – 4.533….) / 453.60 × 100 = 99.00…%

Or

$$\left\{\frac{\text{27,216 units - 272 units}}{\text{27,216 units}}\right\}\times 100$$

OEE = A × P × Q = 90.00% × 105.00% × 99.00…% = **93.555…%**

Alternative Presentation-I

Good Counts = 27,216-272 = 26,944 units

Planned Production Time= 540 mins. – 60 mins. = 480 mins. (or NAT)

OEE = (Good Counts × Ideal Cycle Time)/ Planned Production Time

{(26,944 / 60 units (per min.)} / 480) x 100 = **93.555…%**

Alternative Presentation-II

OEE = (Ideal operating time –loss operating time)/ Net Available Time

{(453.60 – 4.533….)/ 480} × 100 = **93.555…%**

Workings

1. Scheduled Time (total time) = 540 Minutes (9hrs. × 60 mins.)
2. Planned Down Time = 2 short breaks × 15 minutes +meal break 30 minutes = 60 minutes
3. Net Available Time (NAT) = 540 – 60 = 480 minutes
4. Unplanned Downtime = 48 minutes
5. Net Operating Time (NOT) = Net Available Time – Unplanned Downtime
   NOT = 480 – 48 = 432 minutes
6. Ideal Operating Time (IOT): 27,216 total units / 60 (units per min.) = 27,216 / 60 = 453.60 minutes
7. Lost Operating Time (LOT): 272 units / 60 (units per min.) = 272 / 60 = 4.533… minutes

3. (i) **Sheetal Paper Mart**

Environmental Cost Statement

Particulars	H1		H2	
	Amount (in lakhs)	% to total	Amount (in lakhs)	% to total
Environmental Prevention Costs				
Creating Environment policies [(6/2) × 0.8] [(6/2) × 1.1]	2.4	0.68	3.3	0.96
Investment in protective equipment [(7,725 – 65) – 7,620]	-	-	40#	11.58
Sub-Total (a)	**2.4**	**0.68**	**43.3**	**12.54**
Environmental Detection Costs				
Monitoring (78 in the ratio of 1:2)	26	7.40	52	15.06
Performing Contamination test	-	-	4	1.16

Environmental Audit [1 × 8] [2 × 8]	8	2.28	16	4.63
Sub-Total (b)	**34**	**9.68**	**72**	**20.85**
Environmental Internal Failure Costs				
Recycling Scrap (275 in the ratio of 3:2)	165	46.95	110	31.86
Disposing of Toxic Material	150	42.69	120	34.75
Sub-Total (c)	**315**	**89.64**	**230**	**66.61**
Grand Total (a + b + c)	**351.4**	**100**	**345.3**	**100**

 # Since the details regarding useful economic life of the newly erected plant and the machine is not given, hence the entire incremental cost recognised in H2 only (when put to use); despite the benefit will arise over the useful economic life in form of a reduction in generation of waste.

Concept Insight

Hansen and Mendoza in the year 1999 point out that environmental costs are incurred because of poor quality controls. They classify the environmental cost into the following four categories–

- **Environmental Prevention Costs–** Those costs associated with *preventing* adverse environmental impacts.
- **Environmental Appraisal Costs–** The cost of activities executed to determine whether products, process and activities are in *compliance* with environmental standards, policies and laws.
- **Environmental Internal Failure Costs–** Costs incurred from activities that have been produced but *not discharged* into the environment.
- **Environmental External Failure Costs–** Costs incurred on activities performed *after discharging* waste into the environment.

(ii) Analysis

The environmental cost incurred in H2 (₹345.3 lakhs) is comparatively less than what was incurred in H1 (₹351.4 lakhs). Environmental internal failure costs reduced in H2 (₹230 lakhs) in comparison to H1 (₹315 lakhs), but still a substantial component of total environmental costs (66.61% in H2 against 89.64% in H1). The reduction of environmental internal failure costs is the outcome of increased environmental prevention costs (12.54% in H2 against 0.68% in H1) and environmental detection costs (20.85% in H2 against 9.68% in H1).

Note** – Since the policy document also states 'zero discharge of waste/scrap into the environment, in order to be true-sense eco-friendly enterprise' hence there are no **environmental external failure costs.

(iii) Evaluation

Apart from getting the certificate, the cross-functional team has terms of reference *'**to improve the environmental impact** & **image of SPM as eco-friendly enterprise** and **control environmental cost'***

In the context of **controlling environmental cost**, the team attained a reasonable reduction in total environmental cost, impact in this environmental cost statement (over H1 and H2) seem low because the incremental cost due to purchase of premium version of plant and machine is charged in H2, which will benefit in form reduced waste over the useful economic life.

In the context of **improving the image of SPM as an eco-friendly enterprise**, the policy document which in practice also states– *'zero discharge of waste/scrap into the environment, in order to be true-sense eco-friendly enterprise'* and same is also visible through environmental cost statement as there are no environmental external failure costs

In the context of **improving the environmental impact**, SPM able to generate low waste in H2 (2,000 MT) in comparison of H1 (3,000 MT) just by installing new plant and machine which produce less waste, increased monitoring, and audits.

Hence it can be concluded that the team is successfully serving the terms of reference.

4. (i) Cellular manufacturing is a lean way to enhance productivity by improving (reducing) the performance in the context of *time* and *motion* involved in the production.

Cellular manufacturing is an application of **group technology** in the manufacturing in which all or a portion of a firm's manufacturing system has been converted into **manufacturing cells**.

Here is important to note that a manufacturing cell is a cluster of machines or processes located in close proximity and dedicated to the manufacturing of a family of parts.

Cellular Manufacturing results in following benefits to improve productivity–

(a) Reduce setup times by using part family tooling and sequencing.

(b) Reduce flow times by reducing material handling and transit time and using smaller batch sizes (even single piece flow – this also results in the requirement of less floor space).

(c) Reduce lead time.

(d) Reduced work-in-process inventory.

(e) Better use of human resources. Hence, reduced direct labour but heightened sense of employee participation.

(f) Better scheduling, easier to control, and automate.

(g) Increased use of equipment & machinery, hence reduced investment on machinery & equipment.

Hence, concern expressed by Mr. Mishra, regarding the utility of cellular manufacturing to enhance productivity is not material.

(ii) The Machine Cell Design can be classified based on the number of machines and the degree to which the material flow is mechanized between the machines. The most common designs are–

(a) **Single Machine Cell** consists of a machine plus supporting fixtures and tooling to make one or more part families. This can be applied **(useful)** to work parts that are made by one type of process such as turning or milling.

(b) **Group Machine Cell with manual handling** consists of more than one machine used collectively to one or more part families and no provision for mechanical part movement between machines. In this, human operators run the cell and perform material handling.

Note– *If the size of the part is huge or there is a large number of machines in the cell, then regular handling crew may be required.*

Preferable cell shape is ***U-shaped*** *(single/few workers). U shape is useful in the movement of multi-functional workers.*

Since the design simply includes certain machines in the group and restrict their use for specified part family hence often achieved without rearranging the process type layout; So, bring the cost-saving (on rearranging) but lock-in material handling benefits of group technology.

(c) **Group Machine Cell with semi-integrated handling** consists of more than one machine used collectively to one or more-part families and uses a mechanical handling system, such as conveyor, to move parts between machines in the cell.

Note– *There may be* ***in-line layout*** *(identical or similar routing - machines are laid along a conveyor to match the processing sequence) and* ***loop layout*** *(allows parts to circulate in the handling system and permits different processing steps in the different parts in the system).*

(d) **Flexible Manufacturing System** is a highly automated machine cell in group technology that combines automated processing stations with a fully integrated material handling system.

(iii) **Rank Order Clustering Algorithm** to form machine-part groups–

Assign **Binary Weight** ($BW_j = 2^{n-j}$) to each column *j* of the matrix, where $n = 5$ (the number/ types of components). Calculate the **Decimal Equivalent** (DE_i) of the binary values of each row *i* using the formula:

$$DE_i = \sum_{j=1}^{n} (BW_j)(a_{ij})$$

Rank the rows in decreasing order of their DE_i values i.e., the largest value is ranked as 1.

j / i	P101	P104	P105	P107	P108	DE_i	Rank
M2	1					16	2
M7		1			1	9	4
M13	1			1		18	1
M13A		1	1			12	3
M15				1		2	5
BW_j	2^{5-1} =	2^{5-2} =	2^{5-3} =	2^{5-4} =	2^{5-5} =		
	16	8	4	2	1		

Now, **Re-arrange** the rows in the running order of the rankings.

Since further rearrangement is necessary, assign **Binary Weight** ($BW_i = 2^{m-i}$) to each row *i* of the matrix, where m =5 (the number of machines). Calculate the **Decimal Equivalent** (DE_j) of the binary values of each column *j* using the formula:

$$DE_j = \sum_{i=1}^{m} (BW_i)(a_{ij})$$

Rank the columns in decreasing order of their DE_j values i.e., the largest value is ranked as 1.

j / i	P101	P104	P105	P107	P108	BW_i	
M13	1			1		2^{5-1}=	16
M2	1					2^{5-2}=	8
M13A		1	1			2^{5-3}=	4
M7		1			1	2^{5-4}=	2
M15				1		2^{5-5}=	1
DE_j	24	6	4	17	2		
Rank	1	3	4	2	5		

Now, **Re-arrange** the columns in the running order of the rankings.

Since further rearrangement is necessary, assign **Binary Weight** ($BW_j = 2^{n-j}$) to each column *j* of the matrix, where *n* =5. Calculate the **Decimal Equivalent** (DE_i) of the binary values of each row *i* using the formula:

$$DE_i = \sum_{j=1}^{n} (BW_j)(a_{ij})$$

Rank the rows in decreasing order of their DE_i values.

j / i	P101	P107	P104	P105	P108	DE_i	Rank
M13	1	1				24	1
M2	1					16	2
M13A			1	1		6	4
M7			1		1	5	5
M15		1				8	3
BW_j	2^{5-1} =	2^{5-2} =	2^{5-3} =	2^{5-4} =	2^{5-5} =		
	16	8	4	2	1		

Now, **Re-arrange** the rows in the running order of the rankings.

Since further rearrangement is necessary, assign **Binary Weight** ($BW_i = 2^{m-i}$) to each row *i* of the matrix, where m =5. Calculate the **Decimal Equivalent** (DE_j) of the binary values of each column *j* using the formula:

$$DE_j = \sum_{i=1}^{m} (BW_i)(a_{ij})$$

Rank the columns in decreasing order of their DE_j values.

j / i	P101	P107	P104	P105	P108	BW_i	
M13	1	1				2^{5-1}=	16
M2	1					2^{5-2}=	8
M15		1				2^{5-3}=	4
M13A			1	1		2^{5-4}=	2
M7			1		1	2^{5-5}=	1
DE_j	24	20	3	2	1		
Rank	1	2	3	4	5		

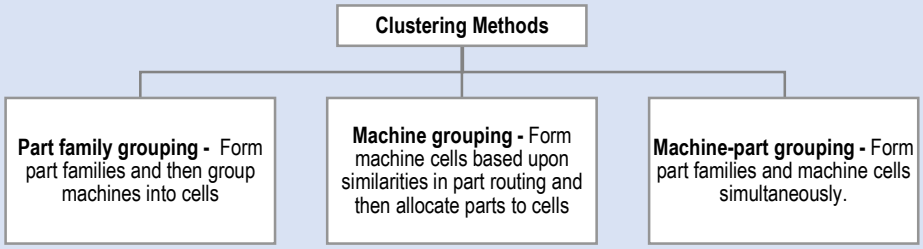
Since the ranking is now neatly arranged in order, stop the process. We can now identify the groupings.

Part Families and Machine Groups

Cluster/Cell	Part	Machine
I	P101 and P107	M13, M2, and M15
II	P104, P105, and P108	M13A and M7

Concept Insight

1. **Production Flow Analysis** rests on the basic idea to identify items that are made with the same processes / the same set of equipment. These parts are assembled into a part family and such the same equipment can be grouped (clustering) into a cell to minimize material handling requirements.



Note - The machine-part grouping is most significant.

2. Various **heuristic and exact methods** have been developed for grouping/clustering, but the simplest one is **binary ordering**, also known as **rank order clustering** or **King's algorithm.**
3. **Rank Order Clustering Algorithm** is a simple algorithm used to form machine-part groups.

Rank Order Clustering Algorithm

The steps in using the Rank Order Clustering Algorithm are as follows:

1. Assign **Binary Weight** ($BW_j = 2^{n-j}$) to each column *j* of the matrix, where *n is* the number/ types of components (parts).
2. Calculate the **Decimal Equivalent** (DE_i) of the binary values of each row *i* using the formula:

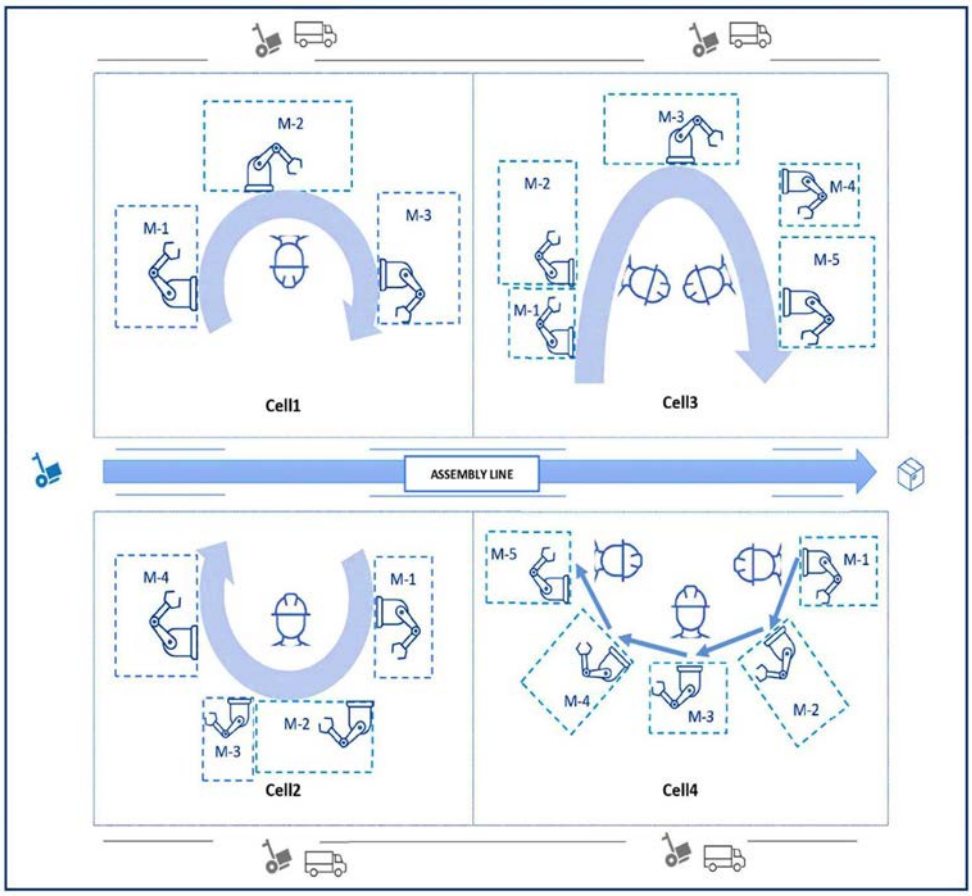
$$DE_i = \sum_{j=1}^{n} (BW_j)(a_{ij})$$

3. **Rank** the rows in decreasing order of their DE_i values i.e., the largest value is ranked as 1. Break ties (if any) arbitrarily.
4. **Re-arrange** the rows in the running order of the rankings.
5. If no further rearrangement is necessary, stop. Otherwise, go to next step i.e.,6.
6. Assign **Binary Weight** ($BW_i = 2^{m-i}$) to each rearranged row *i* of the matrix, where m is the number of machines.
7. Calculate the **Decimal Equivalent** (DE_j) of the binary values of each column *j* using the formula:

$$DE_j = \sum_{i=1}^{m} (BW_i)(a_{ij})$$

8. **Rank** the columns in decreasing order of their DE_j values i.e., the largest value is ranked as 1. Break ties (if any) arbitrarily.
9. **Re-arrange** the columns in the running order of the rankings.
10. If no rearrangement is necessary, stop. Otherwise, go to step 1.

Flow Shop or Assembly Line Workflow



Material flow; Machine utilization; Space utilization; Productivity (compared to process layout); Components standardization; Employee morale; Quality etc.

Planning effort; Paper work; Setup time; Down-time; Work movement; Work-in-process; Material handling cost; Direct/indirect labour cost etc.

Note- This illustrative layout has been given to assist students to comprehend the concept of **U-Shaped** Cells with single/ few workers.

5. Assign **Binary Weight** ($BW_j = 2^{n-j}$) to each column *j* of the matrix, where *n* =6 (the number/ types of parts). Calculate the **Decimal Equivalent** (DE_i) of the binary values of each row *i* using the formula:

$$DE_i = \sum_{j=1}^{n} (BW_j)(a_{ij})$$

Rank the rows in decreasing order of their DE_i values i.e., the largest value is ranked as 1.

i \ j	P_1	P_2	P_3	P_4	P_5	P_6	DE_i	Rank
M_b			1		1		10	4
M_c				1	1	1	7	5
M_d	1	1					48	2
M_e			1		1	1	11	3
M_f	1	1		1			52	1
BW_j	2^{6-1} =	2^{6-2} =	2^{6-3} =	2^{6-4} =	2^{6-5} =	2^{6-6} =		
	32	16	8	4	2	1		

Now, **Re-arrange** the rows in the running order of the rankings.

Since further rearrangement is necessary, assign **Binary Weight** ($BW_i = 2^{m-i}$) to each row *i* of the matrix, where m =5 (the number of machines). Calculate the **Decimal Equivalent** (DE_j) of the binary values of each column *j* using the formula:

$$DE_j = \sum_{i=1}^{m} (BW_i)(a_{ij})$$

Rank the columns in decreasing order of their DE_j values i.e., the largest value is ranked as 1. [Break ties arbitrarily]

i \ j	P_1	P_2	P_3	P_4	P_5	P_6	BW_i	
M_f	1	1		1			2^{5-1}=	16
M_d	1	1					2^{5-2}=	8
M_e			1		1	1	2^{5-3}=	4
M_b			1		1		2^{5-4}=	2
M_c				1	1	1	2^{5-5}=	1
DE_j	24	24	6	17	7	5		
Rank	1	2	5	3	4	6		

Now, **Re-arrange** the columns in the running order of the rankings.

Since further rearrangement is necessary, assign **Binary Weight** ($BW_j = 2^{n-j}$) to each column *j* of the matrix, where *n* =6. Calculate the **Decimal Equivalent** (DE_i) of the binary values of each row *i* using the formula:

$$DE_i = \sum_{j=1}^{n} (BW_j)(a_{ij})$$

Rank the rows in decreasing order of their DE_i values.

j / i	P_1	P_2	P_4	P_5	P_3	P_6	DE_i	Rank
M_f	1	1	1				56	1
M_d	1	1					48	2
M_e				1	1	1	7	4
M_b				1	1		6	5
M_c			1	1		1	13	3
BW_j	2^{6-1} =	2^{6-2} =	2^{6-3} =	2^{6-4} =	2^{6-5} =	2^{6-6} =		
	32	16	8	4	2	1		

Now, **Re-arrange** the rows in the running order of the rankings.

Since further rearrangement is necessary, assign **Binary Weight** ($BW_i = 2^{m-i}$) to each row *i* of the matrix, where m =5. Calculate the **Decimal Equivalent** (DE_j) of the binary values of each column *j* using the formula:

$$DE_j = \sum_{i=1}^{m} (BW_i)(a_{ij})$$

Rank the rows in decreasing order of their DE_j values. [Break ties arbitrarily]

j / i	P_1	P_2	P_4	P_5	P_3	P_6	BW_i	
M_f	1	1	1				2^{5-1}=	16
M_d	1	1					2^{5-2}=	8
M_c			1	1		1	2^{5-3}=	4
M_e				1	1	1	2^{5-4}=	2
M_b				1	1		2^{5-5}=	1
DE_j	24	24	20	7	3	6		
Rank	1	2	3	4	6	5		

Now, **Re-arrange** the columns in the running order of the rankings.

Since further rearrangement is necessary, assign **Binary Weight** ($BW_j = 2^{n-j}$) to each column *j* of the matrix, where *n* =6. Calculate the **Decimal Equivalent** (DE_i) of the binary values of each row *i* using the formula:

$$DE_i = \sum_{j=1}^{n} (BW_j)(a_{ij})$$

Rank the rows in decreasing order of their DE_i values.

j / i	P_1	P_2	P_4	P_5	P_6	P_3	DE_i	Rank
M_f	1	1	1				56	1
M_d	1	1					48	2
M_c			1	1	1		14	3
M_e				1	1	1	7	4
M_b				1		1	5	5
BW_j	2^{6-1} =	2^{6-2} =	2^{6-3} =	2^{6-4} =	2^{6-5} =	2^{6-6} =		
	32	16	8	4	2	1		

Since the ranking is now neatly arranged in order, stop the process. We can now identify the cells.

Cell1	P_1, P_2, P_4	M_f, M_d
Cell2	P_5, P_6, P_3	M_c, M_e, M_b

The following cells, as derived from the Rank Order Clustering Algorithm, shall be presented to Mr. Gupta for consideration along with the below comments.

Cell1		Cell 2	
Part Family 1	**Machine Group 1**	**Part Family 2**	**Machine Group 2**
P_1	M_f	P_5	M_c
P_2	M_d	P_6	M_e
P_4		P_3	M_b

Comments

It is essential to understand that the cells are ***not totally independent***. Since P_4, which is member of cell1, needs processing in M_c. But machine M_c belongs to cell 2. So, some amount of intercell movement/ change will take place in this situation. In general, these moves may become unavoidable in real life circumstances. There are various alternative ways of eliminating intercell moves in a cellular manufacturing system like– redesigning the part so that the machine belongs to other cell is no longer required for processing, subcontracting the part/ adding the necessary machines in the cell. The cell designer should evaluate the consequences of each of these ways and take suitable measures/ ways to minimise these moves.

6. (i) Batch Inspection Time and Batch Move Time

It is given in the question that currently–

MCE is 62.50%,

Batch process time is 20 days, and

Batch queue time is 6 days.

Let presume batch move time 'x' then batch inspection time will be '2x' because currently double then batch move time.

Hence,

$$62.50\% \; or \; 0.6250 = \frac{20 \text{ days}}{20 \text{ days} + x + 2x + 6 \text{ days}}$$

Solving linear equation

$$\Rightarrow 20 \text{ days} + x + 2x + 6 \text{ days} = \frac{20 \text{ days}}{.6250}$$

$$\Rightarrow 20 \text{ days} + x + 2x + 6 \text{ days} = 32 \text{ days}$$

$$\Rightarrow 3x + 26 \text{ days} = 32 \text{ days}$$

$$\Rightarrow 3x = 32 \text{ days} - 26 \text{ days}$$

$$\Rightarrow 3x = 6 \text{ days}$$

$$\Rightarrow x = 2 \text{ days}$$

So, **Batch move time** (x) is 2 days and **Batch inspection time** (2x) is 4 days

(ii) Manufacturing Cycle Time and Non-Value-Added Time (in days)

$$62.50\% \text{ or } .6250 = \frac{20 \text{ days}}{\text{Manufacturing cycle time}}$$

$$\Rightarrow \text{Manufacturing cycle time} = \frac{20 \text{ days}}{.6250}$$

$$\Rightarrow \text{Manufacturing cycle time} = 32 \text{ days}$$

Or

Manufacturing cycle time includes all form of time a product spends (in manufacturing department).

Hence, Manufacturing cycle time = 20 days + 2 days + 4 days + 6 days = 32 days

Non-Value Added Time is that component of manufacturing cycle time which does not lead to any value creation directly.

Hence, Non-value added time = 32 days – 20 days i.e., 12 days

Or

2 days + 4 days + 6 days = 12 days

Note – if the discussion is regarding **customer response time** then non-value added time also includes wait time before the order getting processed.

(iii) **Revised Manufacturing Cycle Efficiency** if both batch inspection time and batch move time cut down to half of the current level and other elements remains constant.

Hence,

Batch process time is 20 days,

Batch queue time is 6 days,

Revised batch move time is **1 day** (half of 2) and

Revised batch inspection time is **2 days** (half of 4).

$$\text{MCE}_{\text{Revised}} = \frac{20 \text{ days}}{20 \text{ days} + 1 \text{ day} + 2 \text{ days} + 6 \text{ days}}$$

$$\Rightarrow \text{MCE}_{\text{Revised}} = \frac{20 \text{ days}}{29 \text{ days}}$$

$$\Rightarrow \text{MCE}_{\text{Revised}} = .6897 \text{ or } 68.97\%$$

Improvement is recorded from 62.50% to 68.97%, on account of cut down of batch inspection time and batch move time to half of current level.

(iv) **Cellular manufacturing** capable to reduce motions on the production floor. Cellular manufacturing is a **lean way** to enhance productivity by improving the performance in the context of time and motion involved in the production.

Cellular manufacturing is an application of **group technology** in manufacturing in which all or a portion of a firm's manufacturing system has been converted into **manufacturing cells** (a cluster of machines or processes located in close proximity and dedicated to the manufacturing of a family of parts). In this manner cellular manufacturing results in the reduction of move time by reducing material handling (through integrated cell) and transit time and using smaller batch sizes (even single unit).

Hence motion (movement) of material (& product) and worker on production is reduced on the production floor. This may also result in reduced queue time because batch size is small even single piece flow in some cases. This is beneficial to the worker as well in two ways, apart from enhancing the productivity for organisation; first, due to **less motion, fatigue will also be less** to the worker after working in a shift of the same tenure (if he is a piece-rate worker get more wages) and second since he is working on more than one machine and part hence may feel **more empowered**. So cellular manufacturing leads to win-win situation wherein organisation benefits reduced direct labour cost and the worker has heightened sense of participation.

7. (i) Demand function

b = change in price/change in quantity b = ₹4/8,000 units = 0.0005

The maximum demand for Rifmn is 10,00,000 units, so where P = 0, Q = 10,00,000, so 'a' is established by substituting these values for P and Q into the demand function:

0 = a – (0.0005 × 10,00,000)

0 = a – 500

Therefore,

a = 500

Demand function is therefore: P = 500 – 0.0005Q

Marginal cost

		Total ₹
Salt X	367.50g × ₹0.08	29.40
Salt Y	301.50g × ₹0.40	120.60
Labour	Given in ques	38.60
Machine running cost	(30/60 × ₹40.00)	20
Total marginal cost per batch		208.60

Marginal revenue function: MR = a – 2bQ

Equate MC and MR and insert the values for 'a' and 'b' from the demand function in step 1

⇒ 208.60 = 500 – (2 × 0.0005 × Q)

Solve the MR function (to determine optimum quantity, Q)

⇒ 208.60 = 500 – 0.001Q

⇒ 0.001Q = 291.4

⇒ Q = 291,400 batches

Calculate the optimum price

⇒ P = 500 – (0.0005 × 291,400)

⇒ P = ₹354.30

Calculate Profit

	₹
Revenue (2,91,400 batches × ₹354.3)	10,32,43,020
Less: Variable costs (2,91,400 batches × ₹208.60)	6,07,86,040
Less: Fixed costs (3,00,000 batches × ₹35)	1,05,00,000
Profit	3,19,56,980

(ii) Firms often use different pricing strategies when their products are first launched into the market. The most two common approaches are price skimming and penetration pricing.

In ***penetration pricing***, low price is charged initially, thought behind this is that low price will make the product accessible to large number of buyers, so high sales will compensate the low price being charged getting the benefits of economy of scale. This approach works best when customers are *price sensitive*, R & D and marketing expenses are low, or when competitors will quickly enter the market.

In this case, medicines are *highly inelastic* in nature so any reduction in price will not increase the demand of the drug, which clearly indicates that market penetration pricing will not help.

Skimming Pricing refers to charging high price initially than lower the prices. High price in the early stage of the product's life cycle is expected to generate high initial cash flows, which will help the company to recover high development cost. This would enable the company to take advantage of unique nature of the product.

In present case, the unique nature of drug, entry barrier (since company has taken patent) requires huge initial investment and considering this market skimming pricing strategy would be more favorable pricing strategy. However, this strategy only works as long as drug is protected by patent.

In addition, a drug firm is required to consider the expected reactions from national price controllers who in turn may be influenced by political factors and public opinion.

Practical Insight

Most of the people in developing countries buy medicines through out-of-pocket payments, high prices of medicines might force people to forego treatment or go into debt. As a result, price of the medicines may be regulated by the health organisations/ agencies.

8. (i) The loss in case of temporary discontinue is ₹185 lakhs which is less than the loss in case of continuing the production of CVS (i.e., ₹250 lakhs), hence **considering monetary aspects** it is advised to discontinue (lock-out) the production of CSV for the first half of the fiscal year 2020-21.

Comparative Cost and Benefit for the first half of the fiscal year 2020-21

Continue – 40,000 units		Dis-continue (Lock-out)	
Particulars	**Amount in ₹**	**Particulars**	**Amount in ₹**
Contribution (₹500×40,000units)	200 Lakhs	Additional Cost (resumption)	35 Lakhs
Fixed Cost	450 Lakhs	Fixed Cost (unavoidable)	150 Lakhs
Loss	**250 Lakhs**	**Cost**	**185 lakhs**

Working note 1 – Contribution *per unit*

Particulars	Amount in ₹
Sale Price	1,600
Variable Cost (575+215+310)	1,100
Contribution	500

Working note 2 – Fixed Cost & Avoidable Component

Particulars	Amount in ₹
Total Fixed Cost for the first half [(75,000×2) units ×300]	450 Lakhs
Unavoidable (1/3rd)	150 Lakhs
Balance - Avoidable (2/3rd)	300 Lakhs

(ii) **Qualitative factors**, while deciding either discontinue (lock-out) or continue.

(a) **Government advisory regarding lock-down and lock-in** – MGIL is legally bound to observe and comply with government advisories regarding lock-down and lock-in.

(b) **Customer relations** – Discontinuing the production, even temporary may cause adverse reactions from customers, they may move to another product or brand which capable to substitute CVS. Further as per the director's opinion old stock will be cleared during such period, this may cause a *loss of reputation*.

(c) **Supplier relations** – The trade relation with suppliers of VSD/MGIL may turn bitter if supply halted. May also cause a loss of goodwill. Although the director argued that supplier can sell the old stock available with them, but it is nowhere mentioned that whether all the supplier or retailer have a *requisite amount of stock* in order to cater the need of their customers.

(d) Employee/Worker relations – One of the directors mentioned that migrant workers moved to their home states and expected to come back in 3-5 months. It is important to identify– *how much of the workforce* at VSD is migrant and *what is the duration of lock-down* announced by the government, is there any relaxation in the same (for example working with 1/3 or 1/2 capacity)? VSD also need to consider *guideline and term of the agreement with workers*, in regard to the compensation they will get, if it is decided to lock-out (temporarily discontinue the production). Apart from this, staff (or workers) morale is also an important factor to consider.

(e) Timing of shutdown – Timing (when to lock and unlock) and duration of lock-out, both are important form preview of VSD, because the kind of product in which MGIL deals either in demand during the *relevant season* or *near festival season* (during sales and bonanzas).

(f) Whether discontinuing a segment have adverse effects on the sale of other products – CVS is a *complementary product* to other models sold by VDS and product sold by MGIL. Hence, impact of discontinuing the production of CVS on sale of these relate products need to be considered.

(iii) In order to economically justify the decision of continuing the production, VSD need to manufacture and sell such number of CVS; so that loss (if continued) shall be less than or equal to the loss/ cost of ₹185 lakhs (which is due to discontinue (lock-out) of plant for the first half of fiscal 2020-21).

So, let presume 'x' is such number of CSV

450 Lakhs – (₹ 500 × 'x') ≤ 185 Lakhs

⇒ 500x ≥ 265 Lakhs

x ≥ 53,000 Units

Hence, VSD need to manufacture and sell at least 53,000 units of CVS; in order to economically justify the continuation of the production.

9. Comparative 'Statement of Cost' *for* Purchasing from Y under 'Current Policy' & 'JIT'

Particulars	Current Policy (₹)	JIT (₹)
Purchasing Cost	18,20,000 (13,000 units × ₹140)	18,20,260 (13,000 units × ₹140.02)
Ordering Cost	26.00 (₹2 × 13 Orders)	260.00 (₹2 ×130 Orders)

Particulars	Current Policy (₹)	JIT (₹)
Opportunity / Carrying Cost	10,500.00 (1/2 × 1,000 units × ₹140 × 15%)	1,050 (1/2 × 100 units × ₹ 140.02 × 15%)
Other Carrying Cost (Insurance, Material Handling etc)	1,550.00 (1/2 × 1,000 units × ₹3.10)	155.00 (1/2 × 100 units × ₹3.10)
Stock Out Cost	---	200 (50 units × ₹4.00)
Total Relevant Cost	**18,32,076**	**18,21,925**

Comments

As may be seen from above, the relevant cost under the JIT purchasing policy is lower than the cost incurred under the existing system. Hence, a JIT purchasing policy should be adopted by the company.

10. *"For successful operation of JIT inventory system, the suppliers chosen must be willing to make frequent deliveries in small lots. Rather than deliver a week's or a month's material at one time, suppliers must be willing to make deliveries several times a day and in the exact quantities specified by the buyer."*

It is described in the problem that suppliers are not willing to

- make frequent deliveries and
- make supplies in the exact quantities as required.

Accordingly Mr. W's doubt is correct on successful implementation of JIT System.

11. Type-X indicates to a feedforward control system. A feedforward control system operates by comparing budgeted results against a forecast. So that, corrective action can be taken to avoid expected adverse variances.

Type-X

'Gross Collection' Report for July

Activity	Budget	Most Recent Forecast for the year	Expected Variance
Accounting	16,560	17,250	690 (F)
Auditing	10,350	8,280	2,070 (A)
Taxation	14,490	13,386	1,104 (A)
Total	**41,400**	38,916	2,484 (A)

Type-Y reveals feedback control system. A feedback control system identifies variances that has already taken place, by comparing the actual historical results with the budgeted results.

Type-Y

'Gross Collection' Report for July

Activity	Monthly			Cumulative		
	Budget	Actual	Variance	Budget	Actual	Variance
Accounting	2,415	2,622	207 (F)	6,210	6,486	276 (F)
Auditing	1,380	966	414 (A)	3,450	2,691	759 (A)
Taxation	1,725	1,587	138 (A)	3,450	3,105	345 (A)
Total	5520	5175	345 (A)	13110	12282	828 (A)

Note- *Both Feedback and Feedforward Controls may coexist in the same system, but the two designs function in very different ways.*