HR Metrics & Analytics
MSB21T2001

Index-Session 40

Session Objectives

- **Resource Optimization**

Recap

- HR analytics will gradually penetrate the entire organizational structure and will provide new insights into competitive advantage, making use of data. With data-driven informed decision-making in all critical areas of human resources such as recruitment and selection, performance management and so on, future human resources will have a direct impact on business growth and the bottom line.
- Also, future HR tasks would demand more strategic thinking, as human resources will increasingly become a strategic business partner. Here also, HR analytics and technology-enabled HR processes could make this possible.
- Some common skills essentially required for future HR managers are statistics, programming, business and HR management and data visualization. For HR analytics, employees' data are used for modelling HR decision-making process extensively. This requires strict adherence to ethical norms.
- Empowerment of HR function can be possible once HR managers can manage HR activities with HR analytics. HR analytics can help in doing many transactional HR jobs at much faster pace, thus leaving HR managers to focus more on strategic HR activities to justifiably align human resources with the business.

Concept discussion

Resource Optimization

- Resource optimization problem is more frequently observed in an HR decision-making process, particularly in manpower planning. We can explain this using the example:
- Suppose you are in a continuous process industry. Your company processes industrial molasses to produce rectified spirit, which is used as raw material for country liquor, homeopathic medicine and other pharmaceutical formulation.
- For erratic supply of industrial molasses, your company now simultaneously runs three more production lines, i.e., a husk based, multi-feed and sweet-beat-based processing for rectified spirit.
- With such extended production lines, your company's in-built processing capacity is 120,000 litre per day with 30,000 litre per production line.
- As the operation is highly dependent on raw materials' availability, your operational manpower requirement varies on a day-to-day basis.
- For this reason, your company has kept a skeleton manpower in planning, maintenance, quality control, electrical and pollution control jobs.
- For all other operations, your company follows a flexible hiring policy, i.e., hiring on an as-and-when-required basis.

Resource Optimization

- Being a continuous process industry, when full-scale operation is on, you need to run all the units round the clock.
- From raw material feed to the incoming pit and till the final yield of the finished product, it requires almost 12 hour cycle time, which again varies depending on the quality of raw material and the yeast strains used for fermenting.
- In the final stage of fermenting, more workers need to be present for continuous monitoring.
- Operators who are hired on flexible basis are graded as A, B and C, depending on their skill sets and experience, and their hourly rate of wages is also different.
- The shift arrangement of your company has been so designed that there is some overlapping time between shifts, and at least 70 workers are present at any point of time.
- Each operator has to work for 8 hours a day

Resource Optimization

- As per the existing practice, shift arrangement is divided into six types as follows:
  - Shift 1 6 am to 2 pm
  - Shift 2 9 am to 5 pm
  - Shift 3 12 pm to 8 pm
  - Shift 4 3 pm to 1 pm
  - Shift 5 6 pm to 2 am
  - Shift 6 9 pm to 5 am
- The intervening time period, i.e., 5 am to 6 am is the plant's shut-down time to clear the sludge.

Resource Optimization

Shift-wise assignment of operators and the cost per operator is presented in the following table:

Decision Variable	X_1	X_2	X_3	X_4	X_5	X_6
Details	**Shift 1**	**Shift 2**	**Shift 3**	**Shift 4**	**Shift 5**	**Shift 6**
No. of operators	40	45	43	51	42	44
Daily cost per operator ($)	180	170	178	180	188	176

To solve this problem, we need to understand the nature of job and the optimum requirements of manpower in each shift.

Xj represents the number of operators in shift j, where j = 1, 2, 3, 4, 5 or 6.

Constraints for different shifts are the number of operators shown against each shift.

Resource Optimization

- Our objective is to minimize the total costs of workers who work in the six shifts, i.e.,
- $Z = 180X1 + 170X2 + 178X3 + 180X4 + 188X5 + 176X6$
- Subject to
  - $X1 + X2 \geq 70 \leq 85$ (considering the overlapping manpower between shifts)
  - $X1 + X2 + X3 \geq 70 \leq 128$
  - $X2 + X3 \geq 70 \leq 88$
  - $X2 + X3 + X4 \geq 70 \leq 139$
  - $X3 + X4 \geq 70 \leq 94$
  - $X3 + X4 + X5 \geq 70 \leq 136$
  - $X4 + X5 \geq 70 \leq 93$
  - $X4 + X5 + X6 \geq 70 \leq 137$
  - $X5 + X6 \geq 70 \leq 86$
  - And $Xj \geq 0$ (non-negativity constraints); for j = 1, 2, 3, 4, 5 and 6.
- We need not perform the manual calculation as linear programming now can be performed using various standard software, and even Microsoft Excel Solver. What is important for us is to formulate the problem and proper identification of variables.

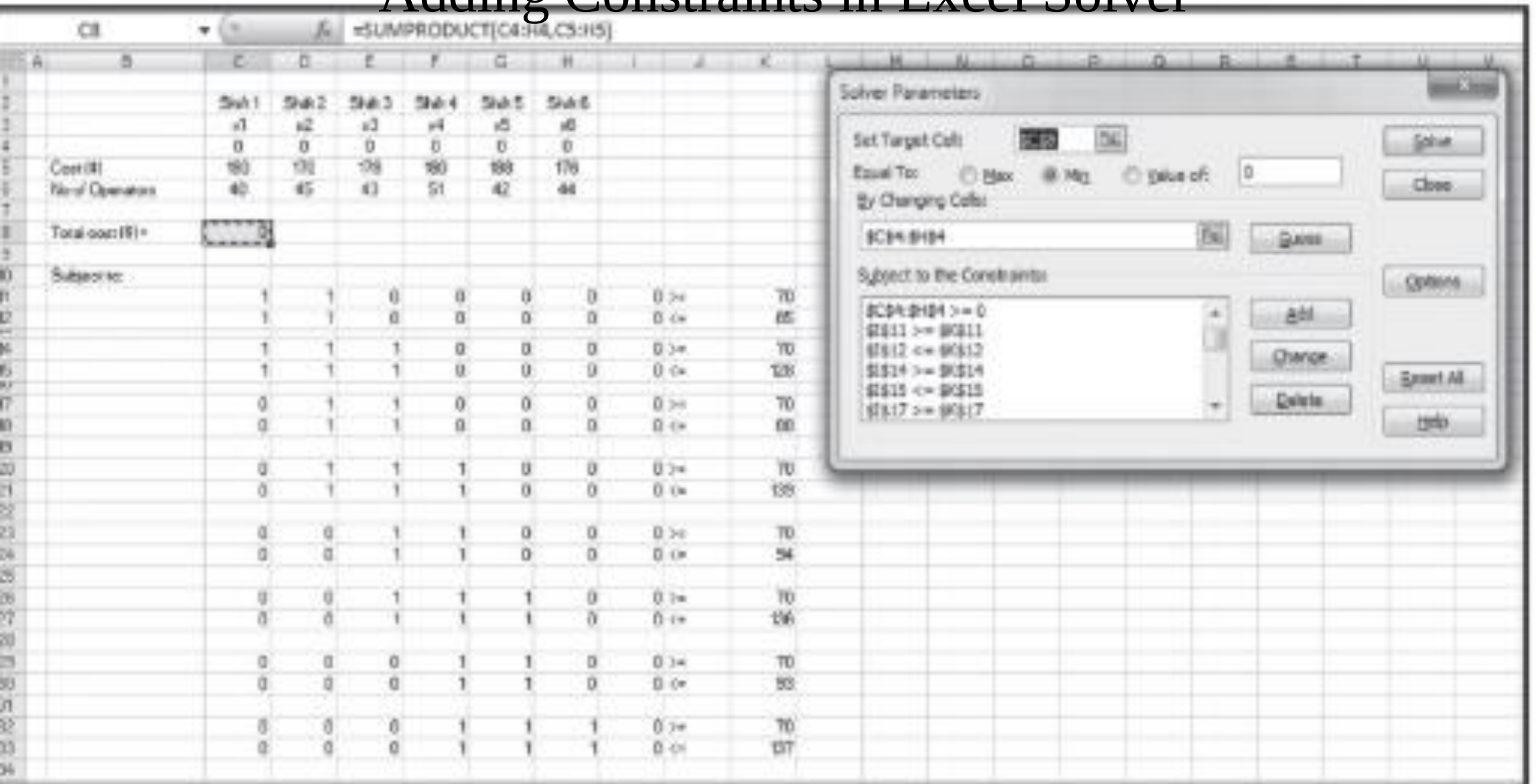
Resource Optimization

- As HR professional, we may not be that conversant with all operations research tools, but using Microsoft Excel Solver we could obtain the shift-wise hiring pattern of an operator as follows:
- Min Z 36860
- X1 1
- X2 69
- X3 3
- X4 67
- X5 3
- X6 67
- It means the company must go for shift-wise hiring as per the aforementioned results, meeting all their constraints.
- The problem formulation and solution arrived using the Excel Solver is shown

- Entering Data in Excel

	Shift 1	Shift 2	Shift 3	Shift 4	Shift 5	Shift 6			
	x1	x2	x3	x4	x5	x6			
	0	0	0	0	0	0			
Cost ($)	180	170	178	180	188	176			
No of Operators	40	45	43	51	42	44			
Total cost ($) =	0								
Subject to:									
	1	1	0	0	0	0	0	>=	70
	1	1	0	0	0	0	0	<=	85
	1	1	1	0	0	0	0	>=	70
	1	1	1	0	0	0	0	<=	128
	0	1	1	0	0	0	0	>=	70
	0	1	1	0	0	0	0	<=	88
	0	1	1	1	0	0	0	>=	70
	0	1	1	1	0	0	0	<=	139
	0	0	1	1	0	0	0	>=	70
	0	0	1	1	0	0	0	<=	94
	0	0	1	1	1	0	0	>=	70
	0	0	1	1	1	0	0	<=	136
	0	0	0	1	1	0	0	>=	70
	0	0	0	1	1	0	0	<=	93
	0	0	0	1	1	1	0	>=	70
	0	0	0	1	1	1	0	<=	137
	0	0	0	0	1	1	0	>=	70
	0	0	0	0	1	1	0	<=	86

Adding Constraints in Excel Solver



Final Solution from Excel Solver

	Shift 1	Shift 2	Shift 3	Shift 4	Shift 5	Shift 6		
	x1	x2	x3	x4	x5	x6		
	1	65	3	67	3	67		
Cost ($)	180	170	170	180	168	175		
No of Operators	40	45	43	51	42	44		
Total cost ($) =	36860							
Subject to:								
	1	1	0	0	0	0	70 >=	70
	1	1	0	0	0	0	70 <=	85
	1	1	1	0	0	0	73 >=	70
	1	1	1	0	0	0	73 <=	109
	0	1	1	0	0	0	72 >=	70
	0	1	1	0	0	0	72 <=	88
	0	1	1	1	0	0	139 >=	70
	0	1	1	1	0	0	139 <=	139
	0	0	1	1	0	0	70 >=	70
	0	0	1	1	0	0	70 <=	94
	0	0	1	1	1	0	73 >=	70
	0	0	1	1	1	0	73 <=	136
	0	0	0	1	1	0	70 >=	70
	0	0	0	1	1	0	70 <=	93
	0	0	0	1	1	1	137 >=	70
	0	0	0	1	1	1	137 <=	137
	0	0	0	0	1	1	70 >=	70
	0	0	0	0	1	1	70 <=	86

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In case, you find any difficulty in understanding the concepts of lecture, please feel free to contact.

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Thanks