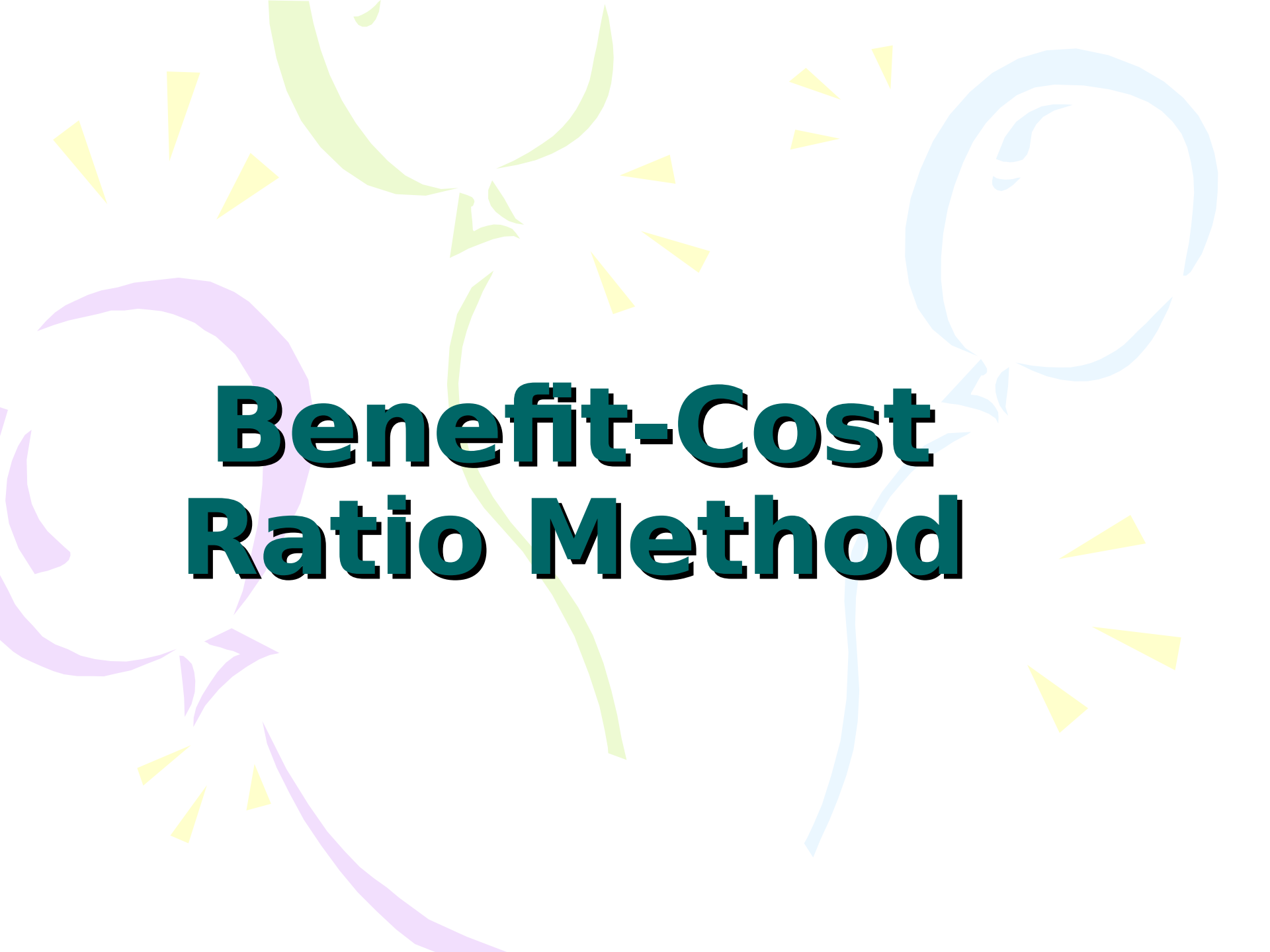


The background features several large, stylized, overlapping swirls in light green, light blue, and light purple. Scattered throughout are numerous small, yellow, starburst-like shapes, some of which are larger and more prominent than others, creating a festive and dynamic feel.

Benefit-Cost Ratio Method



General equation of
Benefit- cost analysis is;

$$B/C = \frac{\sum \left(\frac{B_t}{(1+i)^t} \right)}{\sum \left(\frac{C_t}{(1+i)^t} \right)}$$



Strong side of B/C Ratio

- **Criteria can be used to rank projects According to degree of acceptability**
- **Criteria can be used to decide whether a project should be financed or funded.**
- **Criterion which enable to make decision among different alternatives.**

Remember the example below;

- Assume that the available budget is \$800,000 only

<u>Project</u>	<u>PVC</u>	<u>PVB</u>	<u>NPV(10%)</u>	<u>B/C(10%)</u>
A	10,000	13,000	3,000	1.3
B	40,000	43,300	3,300	1.08
C	20,000	30,300	10,300	1.52
D	40,000	49,400	9,400	1.24
E	50,000	55,800	5,800	1.11

- When the projects ranked based on NPV and B/C approach, it looks like as follow:
 - NPV C, D, E, B and A = 22,000
 - B/C C, A, D, E and B = 23,900



Weak side of ...

- i. In case of mutually exclusive projects or projects different size and if one want to decide in favour of the project with the highest NPV, the B/C ratio doesn't give information on that.
- ii. Sensitive to discounting rate
- iii. When a project generates cost saving, such as cost saving can be either be represented as a net benefit or a negative cost. By using the latter we can increase the B/C ratio.

Example: If the benefit-cost ratio of alternative A,B, and C are 1.5, 1.7 and 1.65 respectively, the highest value 1.7 corresponding to alternative B doesn't necessarily mean it has the highest NPV.

Methods of calculating B/C

1. **Conventional B/C ratio**:- the benefits (usually annual) are determined for users. Thus the benefits are defined as;

B_n = U_n = net annual benefit (saving cost = the cost saved by the implementation of the new project).

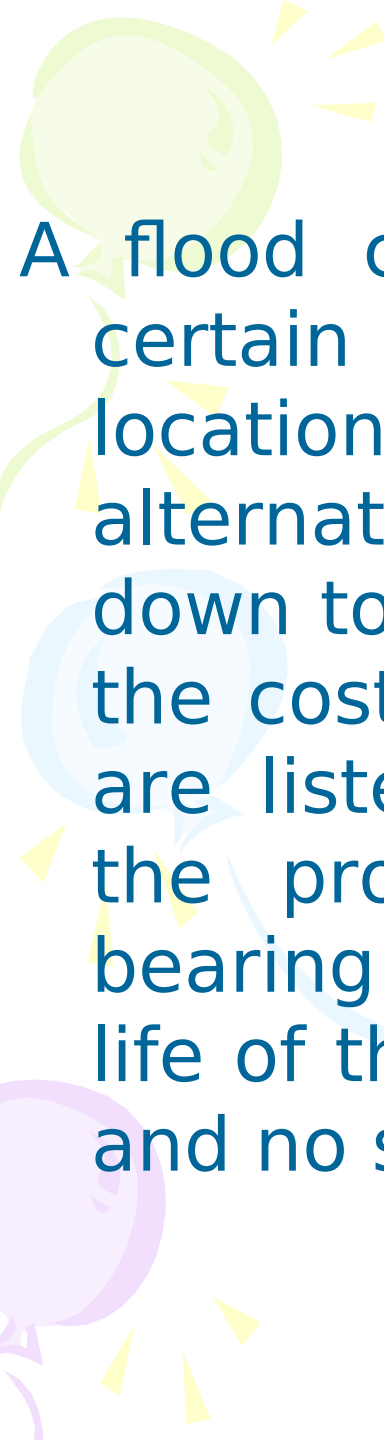
$$\text{Conventional B/C} = \frac{\text{Net Savings to Users}}{\text{Owner Net Capacity + Owner's net O \& M Cost}}$$

Methods of calculating B/C

2. Modified B/C ratio method:-This method uses the same input data but not operating and maintenance cost (M_n) is treated as negative benefits they are placed in the nominator rather than in the denominator.

$$\text{Modified B/C} = \frac{U_n - M_n}{C_n} = \frac{B_n - M_n}{C_n}$$

C_n = Net capital cost of replacing the present facility with the future facility

A decorative graphic on the left side of the slide featuring a large yellow sun with rays at the top, and several colorful balloons (blue, purple, and yellow) with strings hanging down. The sun and balloons are partially obscured by the text.

Example:

A flood control project is proposed for a certain area. There is a question as to the location of the dam and the numbers of alternative sites have been narrowed down to two, site A and site B. estimate of the costs associated with each of the site are listed below. The funds to construct the projects are available from bonds bearing interest rate of 6%. The expected life of the project at either site is 40 years and no salvage value is expected.



Cash Flow descriptions

Description	Existing Situation	Site A	Site B
Cost of construction	0	3,000,000	8,000,000
Annual O&M cost	0	56,000	94,000
Annual cost of flood damages	620,000	290,000	120,000
Annual loss	0	20,000	46,000

Solution

- **Site A**

$$\begin{aligned} Un &= 620,000 - 290,000 - 20,000 \\ &= 310,000 \end{aligned}$$

$$Mn = 56,000$$

$$\begin{aligned} Cn &= 3,000,000 (A/P, 6\%, 40) \\ &= 199,384.6 \end{aligned}$$

$$\begin{aligned} \text{Modified } B/C &= \frac{Un - Mn}{Cn} = \frac{310,000 - 56,000}{199,384.6} \\ &= 1.274 \end{aligned}$$

Solution

- Site B

$$Un = 620,000 - 120,000 - 46,000 \\ = 454,000$$

$$Mn = 94,000$$

$$Cn = 8,000,000 (A/P, 6\%, 40) \\ = 531,692.3$$

$$\text{Modified } B/C = \frac{Un - Mn}{Cn} = \frac{454,000 - 94,000}{531,692.3} \\ = \mathbf{0.677}$$

Therefore, Site **A** is selected because of its higher value of B/C ratio.