

ISE 307 — In-Class Activity 12

Payback, Discounted Payback & NPW (Group 1: Padel Club, Section 01)

Team members (name, initials):

- | | |
|----------|----------|
| 1. _____ | 4. _____ |
| 2. _____ | 5. _____ |
| 3. _____ | 6. _____ |

Context. Padel is one of the fastest-growing sports in Saudi Arabia. A well-run club supports Vision 2030's Quality of Life Program and community wellbeing. Your team is evaluating **three** possible investments for the **Padel Club**. For *each* project option (A, B, C on the next pages), complete the ledger, then compute the **payback period**, the **discounted payback period (DPP)** at a MARR of 10%, the **net present worth (NPW)** at 10%, and the **net future worth (NFW)** at 10%. Then use **Part 4** to make a funding recommendation under your team's budget. See an example below.

Example

A project costs **100,000** at year 0 and returns **40,000** at the end of each year 1–4. MARR = 10%.

1. **Payback period (PP)** = first year cumulative *undiscounted* cash flow ≥ 0 + fraction $\left(\frac{\text{shortfall at } k-1}{\text{cash flow in year } k} \right)$.
2. **Discounted payback period (DPP)** = same rule as PP, but using *discounted* flows $A_n (P/F, 10\%, n)$.
3. **Net present worth (NPW)** = $\sum_{n=0}^N A_n (P/F, 10\%, n)$.
4. **Net future worth (NFW)** = $NPW \times (F/P, 10\%, N)$.

Year n	0	1	2	3	4
Cash flow A_n	−100,000	40,000	40,000	40,000	40,000
Cumulative (undiscounted)	−100,000	−60,000	−20,000	20,000	60,000
$(P/F, 10\%, n)$	1.0000	0.9091	0.8264	0.7513	0.6830
Discounted flow	−100,000	36,363.64	33,057.85	30,052.59	27,320.54
Cumulative (discounted)	−100,000	−63,636.36	−30,578.51	−525.92	26,794.62

$$\mathbf{PP} = \text{previous year cumulative } \textit{undiscounted} \text{ cash flow} \geq 0 + \text{fraction} \left(\frac{\text{shortfall at } k-1}{\text{cash flow in year } k} \right)$$

$$= 2 + \frac{|-20,000|}{40,000} = 2.5 \text{ years} \Rightarrow \boxed{3 \text{ years}}$$

$$\mathbf{DPP} = \text{previous year cumulative } \textit{discounted} \text{ cash flow} \geq 0 + \text{fraction} \left(\frac{\text{shortfall at } k-1}{\text{cash flow in year } k} \right)$$

$$= 3 + \frac{|-525.92|}{27,320.54} = 3.019 \text{ years} \Rightarrow \boxed{4 \text{ years}}$$

$$\mathbf{NPW} = \sum_{n=0}^N A_n (P/F, 10\%, n)$$

$$= -100,000 + 40,000 (P/F, 10\%, 1) + 40,000 (P/F, 10\%, 2) + 40,000 (P/F, 10\%, 3) + 40,000 (P/F, 10\%, 4)$$

$$= -100,000 + 36,363.64 + 33,057.85 + 30,052.59 + 27,320.54 = \boxed{26,794.62 \text{ SAR}}$$

$$\mathbf{NFW} = NPW \times (F/P, 10\%, N) = 26,794.62 \times (F/P, 10\%, 4) = 26,794.62 \times 1.4641 = \boxed{39,216.00 \text{ SAR}}$$

Decision A — New Product. Add two covered padel courts (roofed for summer heat)

Background: Shaded, climate-controlled courts let members play through the Dhahran summer, when uncovered courts sit empty from June to September. The resulting cash flows are as follows:

Year	0	1	2	3	4
Cash flow (SAR)	−280,000	95,000	110,000	120,000	130,000

Fill the ledger (MARR = 10%, $(P/F, 10\%, n)$ factors are provided in the table):

Year n	0	1	2	3	4
Cash flow A_n	−280,000				
Cumulative (undiscounted)	−280,000				
$(P/F, 10\%, n)$	1.0000	0.9091	0.8264	0.7513	0.6830
Discounted flow	−280,000				
Cumulative (discounted)	−280,000				

1. **Payback period (PP)**

2. **Discounted payback period (DPP)**

3. **Net present worth (NPW)**

4. **Net future worth (NFW)**

Decision B — Service Improvement. Online booking app + smart court lighting

A booking app cuts no-shows and phone-desk labor; motion-linked LED lighting lowers the electricity bill on off-peak hours.

Given cash flows.

Year	0	1	2	3	4
Cash flow (SAR)	−60,000	+22,000	+26,000	+28,000	+30,000

Fill the ledger (MARR = 10%; use $(P/F, 10\%, n)$ from the sheet):

Year n	0	1	2	3	4
Cash flow A_n	−60,000				
Cumulative (undiscounted)	−60,000				
$(P/F, 10\%, n)$	1.0000	0.9091	0.8264	0.7513	0.6830
Discounted flow	−60,000				
Cumulative (discounted)	−60,000				

Compute (show factor notation, then substitute):

Payback period	Discounted payback (DPP)	NPW at 10%

Decision C — Expansion. Pro shop and cafe corner inside the club

Selling rackets, grips, and drinks captures spending that members currently take off-site, and gives the club a social hub.

Given cash flows.

Year	0	1	2	3	4
Cash flow (SAR)	−120,000	+30,000	+40,000	+55,000	+65,000

Fill the ledger (MARR = 10%; use $(P/F, 10\%, n)$ from the sheet):

Year n	0	1	2	3	4
Cash flow A_n	−120,000				
Cumulative (undiscounted)	−120,000				
$(P/F, 10\%, n)$	1.0000	0.9091	0.8264	0.7513	0.6830
Discounted flow	−120,000				
Cumulative (discounted)	−120,000				

Compute (show factor notation, then substitute):

Payback period	Discounted payback (DPP)	NPW at 10%

Part 4 — Team Funding Decision

Your team's budget can fund the **up-front investment of at most TWO** of the three decisions above.
Your capital budget is: 410,000 SAR (year-0 capital)

Q1. Which projects will your team fund?

Q2. Justify your choice. Which criterion did you weigh most — NPW (value created), payback/DPP (how fast you get your money back and liquidity risk), or strategic fit with the project's mission? Explain!

Q3. What did the budget force you to give up? Which project(s) you did *not* fund. How would you justify them to the proposers?