Resource management

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Today's table of content

→ 12:15-12:25: Presentations

→ 12:25-13:00: Lecture on Project Ressource Management

→ 13:00-13:45: Group work

→ 13:45-14:00: Presentations

→ 14:00-14:45: Lecture on teamwork

→ 14:45-15:45: Group work

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Today, we will talk about the processes to

identify
acquire
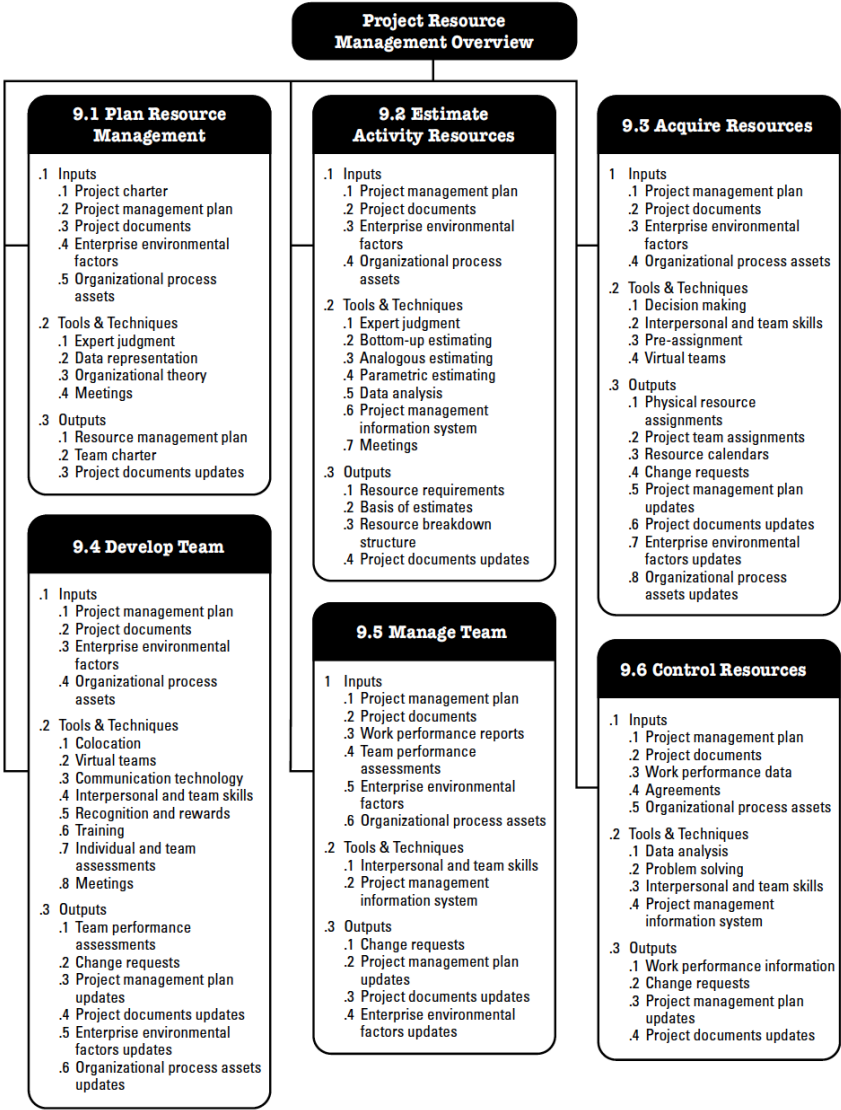manage

resources needed for a successful project completion

Figure 9-1. Project Resource Management Overview

There are two types of resources to consider during a project

Physical resources

- Tangible resources
  - Hardware
  - Raw materials
  - Spare parts
  - Equipment
  - Facilities
  - Etc…

- Intangible resources
  - Software
  - Patents
  - Etc…

Human resources

- Competencies and skills
- How to develop the project team to ensure a good work environment and maximize performance.
  - Tuckman's ladder
  - Belbin team roles

- How to handle conflict in the project team.

… The focus of this lecture will be more on 'human resources'.

Intangible vs. Tangible Resources

	Rank		Name	Market Cap	Price	Today	Price (30 days)	Country
☆	1		Tesla TSLA	$724.71 B	$225.31	▼ 5.34%		🇺🇸 USA
☆	2		Toyota TM	$248.48 B	$190.20	▲ 0.95%		• Japan
☆	3		Xiaomi XIACF	$186.31 B	$7.74	▲ 0.58%		🇨🇳 China
☆	4		BYD 002594.SZ	$164.92 B	$54.90	▲ 3.25%		🇨🇳 China
☆	5		Ferrari RACE	$80.56 B	$446.43	▼ 1.71%		🇮🇹 Italy
☆	6		Mercedes-Benz MBG.DE	$63.84 B	$66.31	▼ 0.93%		🇩🇪 Germany
☆	7		Volkswagen VOW3.DE	$59.76 B	$118.50	▼ 0.78%		🇩🇪 Germany
☆	8		BMW BMW.DE	$54.90 B	$91.48	▼ 1.06%		🇩🇪 Germany

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Intangible vs. Tangible Resources

Market cap history of Novo Nordisk from 1996 to 2025

companiesmarketcap.com

https://companiesmarketcap.com/novo-nordisk/marketcap/

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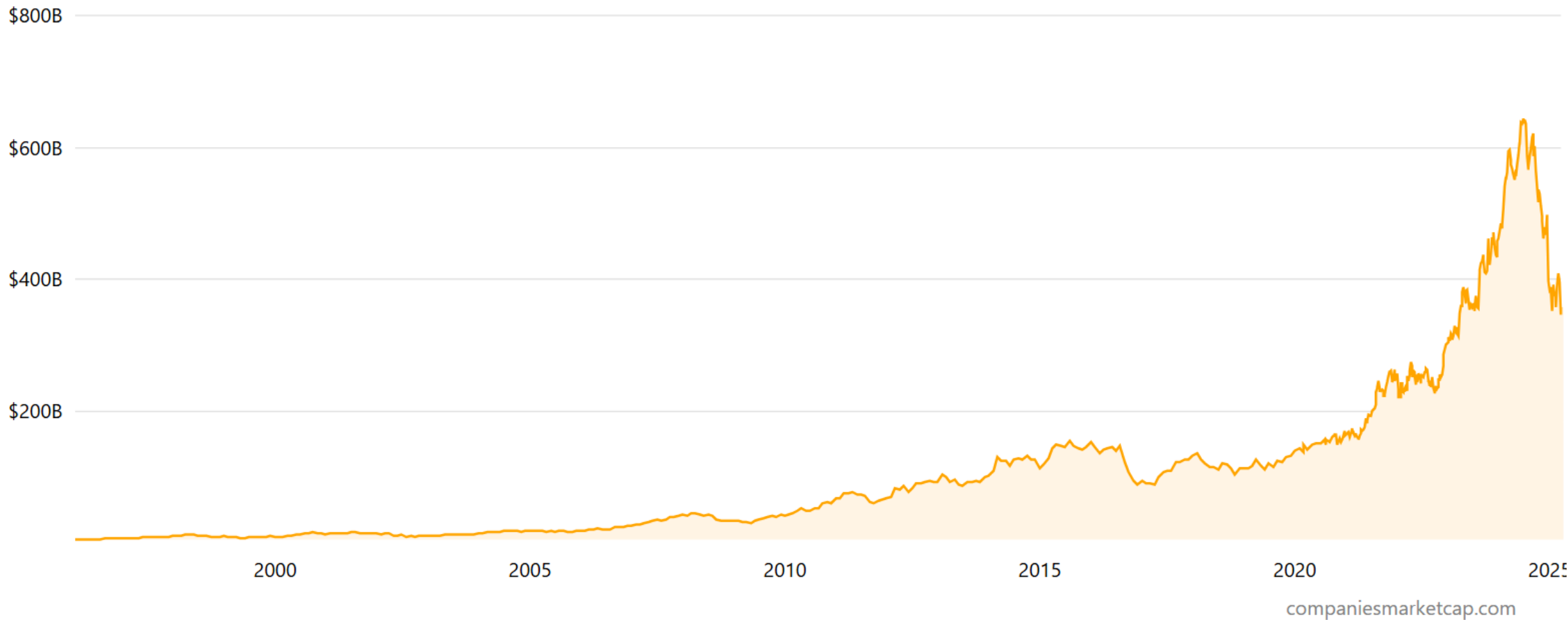
A project is difficult to divide into detached processes

"The Project Resource Management processes are presented as discrete processes with defined interfaces while, in practice, they overlap and interact in ways that cannot be completely detailed in the PMBOK® Guide"
That is not only the case for project resource management but the entire project!
Things rarely work out as planned.
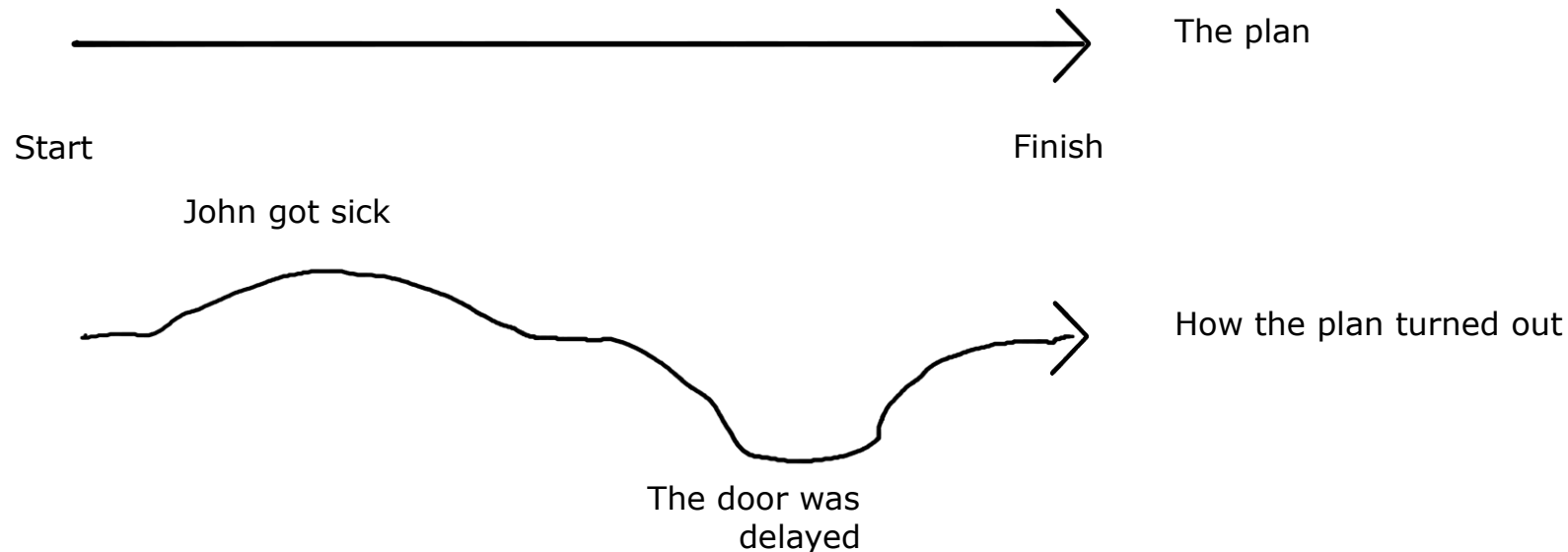
The plan

Start   Finish

John got sick

How the plan turned out

The door was
delayed

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Agenda

1. Introduction

2. Plan resource management

3. Estimate activity resources

4. Acquire resources

5. Develop team

6. Manage team

7. Control resources

8. Group Work and Presentations

THE PROCESS OF DEFINING HOW TO ESTIMATE, ACQUIRE, MANAGE AND USE OF TEAM AND PHYSICAL RESOURCES

Plan Resource Management

Inputs

.1 Project charter
.2 Project management plan
  • Quality management plan
  • Scope baseline
.3 Project documents
  • Project schedule
  • Requirements documentation
  • Risk register
  • Stakeholder register
.4 Enterprise environmental factors
.5 Organizational process assets

Tools & Techniques

.1 Expert judgment
.2 Data representation
  • Hierarchical charts
  • Responsibility assignment matrix
  • Text-oriented formats
.3 Organizational theory
.4 Meetings

Outputs

.1 Resource management plan
.2 Team charter
.3 Project documents updates
  • Assumption log
  • Risk register

Figure 9-2. Plan Resource Management: Inputs, Tools & Techniques, and Outputs

The process of defining how to estimate, acquire, manage and use of team and physical resources

The resource management plan may include:

1. Identification of resources needed
2. Plan how to acquire resources
3. Definition of roles and responsibilities

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Some useful and easy tools you can use while developing your plan are:

- Organizational charts that show relationships between people on the team as well as roles and responsibilities.

- Responsibility Assignment Matrix (RAM)

  - A subset of this is a RACI Chart

    - Responsible, Accountable, Consult, and Inform

.

	Author	Editor	Marketer	Designer and Printer	Distributor
Writing and editing	R	A	I	I	
Designing and typesetting	C	A	C	R	
Printing and delivering	I	I	C	R	I
Marketing and sales	C	C	A		R
Updating and revising	R	A	C	R	I

R = Responsible A = Accountable C = Consult I = Inform

Responsibility Matrix for a Market Research Project

Project Team

Task	Richard	Dan	Dave	Linda	Elizabeth
Identify target customers	R	S		S	
Develop draft questionnaire	R	S	S		
Pilot-test questionnaire		R		S	
Finalize questionnaire	R	S	S	S	
Print questionnaire					R
Prepare mailing labels					R
Mail questionnaires					R
Receive and monitor returned questionnaires				R	S
Input response data			R		
Analyze results		R	S	S	
Prepare draft of report	S	R	S	S	
Prepare final report	R		S		

R = Responsible
S = Supports/assists

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The process of estimating team resources and the type and quantities of materials, equipment etc.

Estimate Activity Resources

Inputs

.1 Project management plan
- Resource management plan
- Scope baseline

.2 Project documents
- Activity attributes
- Activity list
- Assumption log
- Cost estimates
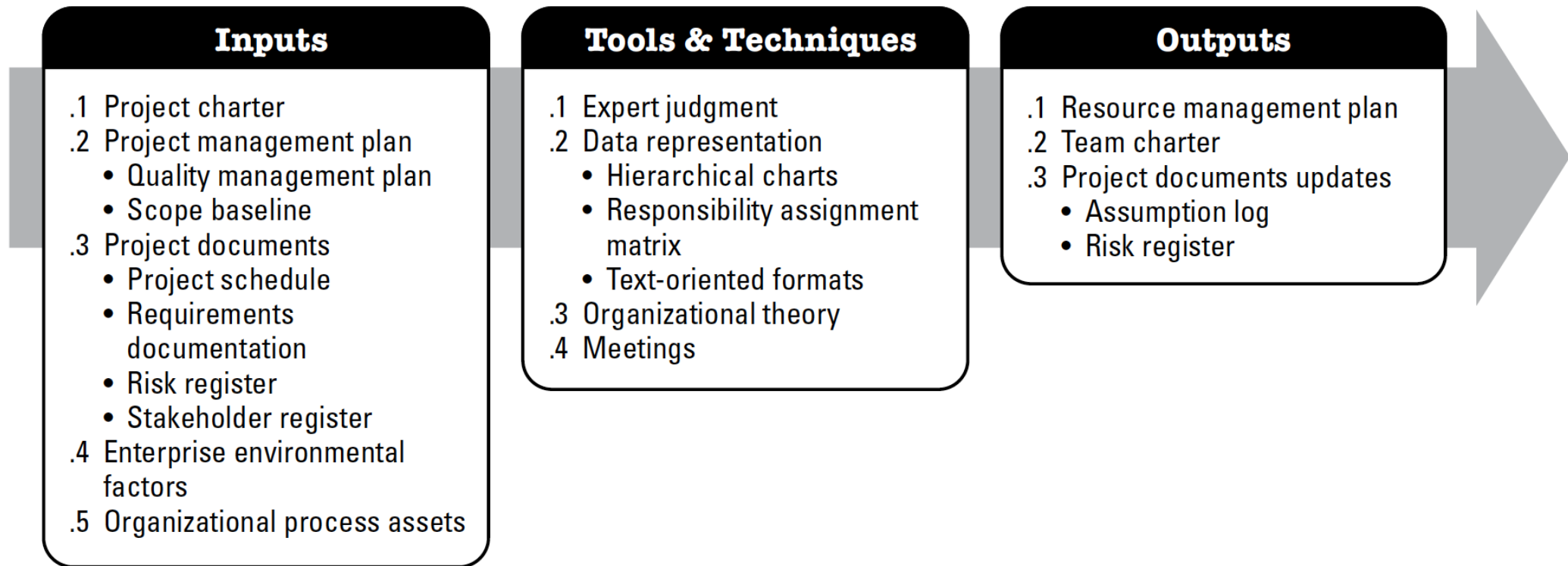- Resource calendars
- Risk register

.3 Enterprise environmental factors

.4 Organizational process assets

Tools & Techniques

.1 Expert judgment
.2 Bottom-up estimating
.3 Analogous estimating
.4 Parametric estimating
.5 Data analysis
- Alternatives analysis
.6 Project management information system
.7 Meetings

Outputs

.1 Resource requirements
.2 Basis of estimates
.3 Resource breakdown structure
.4 Project documents updates
- Activity attributes
- Assumption log
- Lessons learned register

Figure 9-5. Estimate Activity Resources: Inputs, Tools & Techniques, and Outputs

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Using historical data and knowledge from experts can assist in successful estimations

Expert judgement – tap into the knowledge of experts to get a more precise indication of what resources are required.

Bottom up – work from the ground up to estimate. Again, experience and prior knowledge comes into play.

Parametric estimating – a more analytical approach looking at historical data. Example - if there are 14 days of painting for 1 painter and the due date is 7 days, then 2 painters are required to finish the job in time.

Get a good start to increase the odds of reaching the deadline

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Resource Breakdown Structure
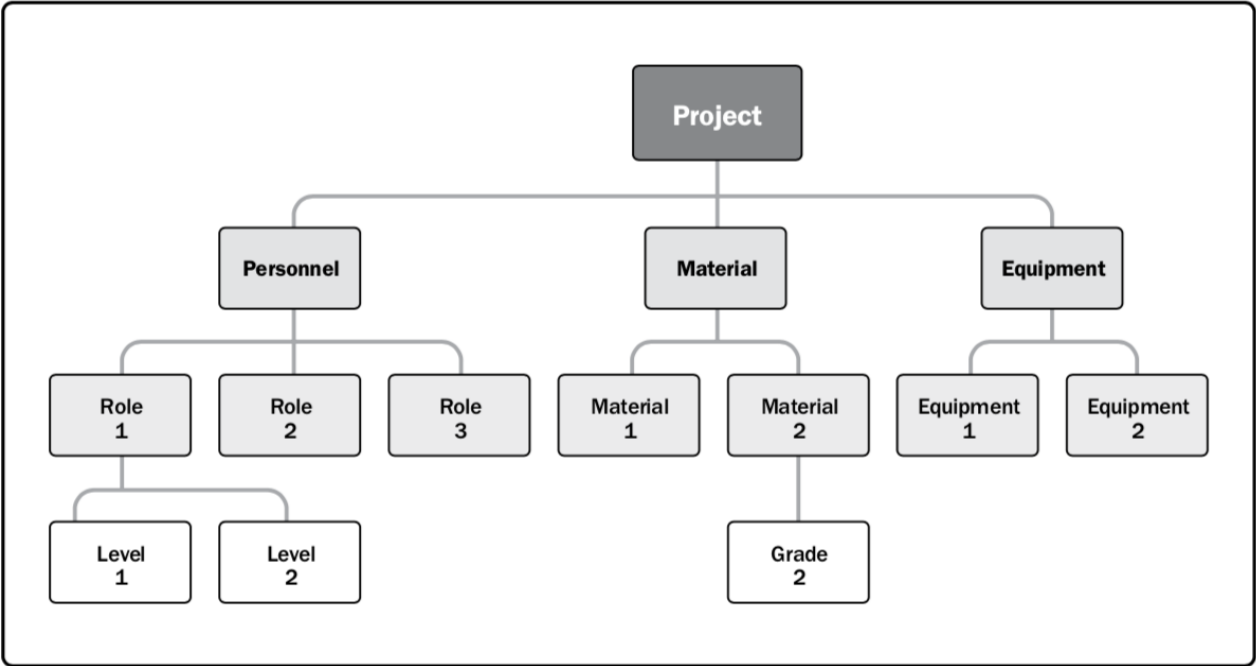
Figure 9-7. Sample Resource Breakdown Structure

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Library Management System

Facility
- Meeting Room x 1
- Conference Room

Equipment
- Development
  - Tablet x 2
  - Smartphone x 5
- Projector x 2

Software
- MS Office (License x 10)
- Visual Paradigm (License x 5)

Staffing
- Android Developer x 4
- Web Designer x 2
- UI Specialist x 2

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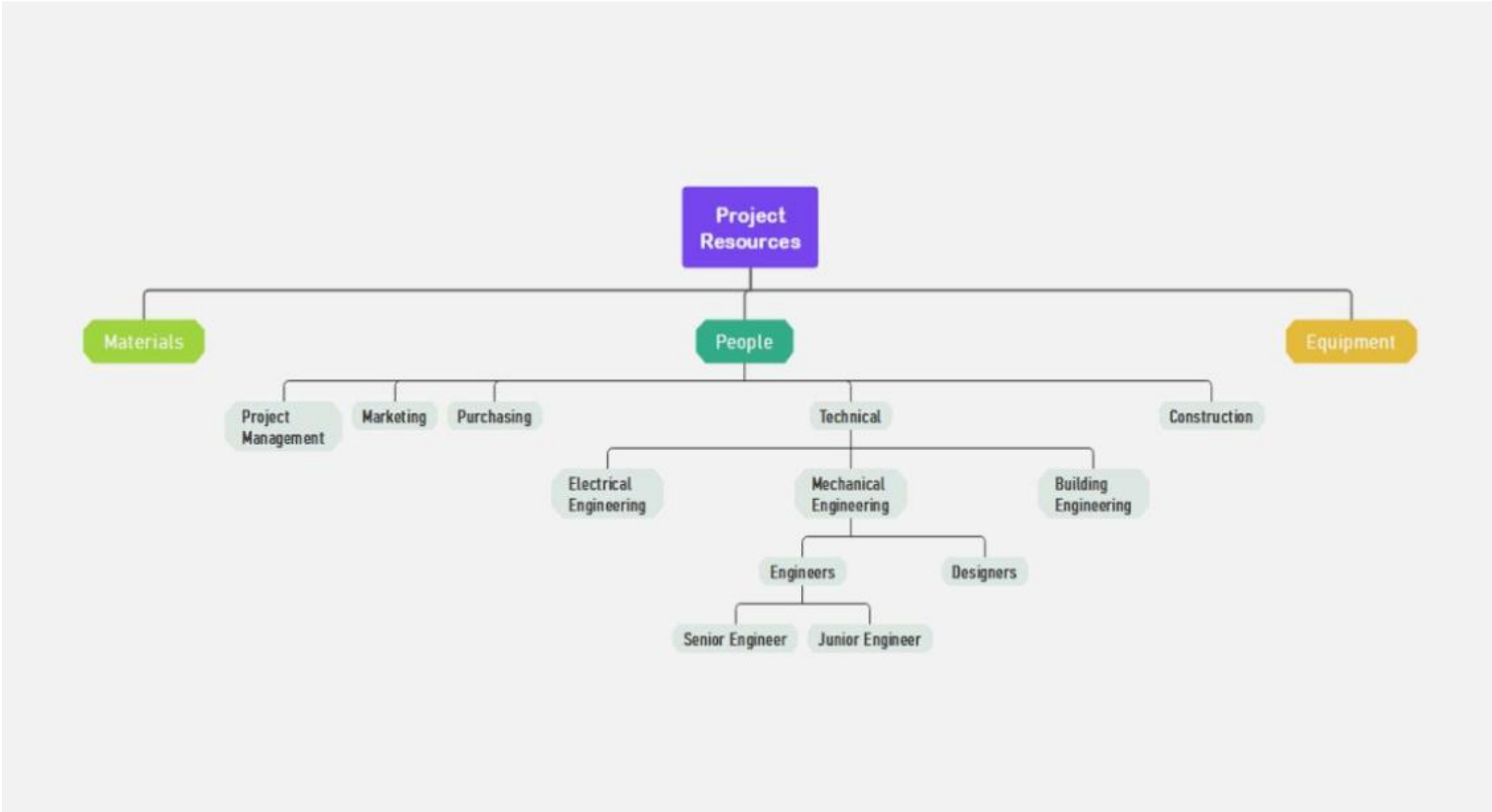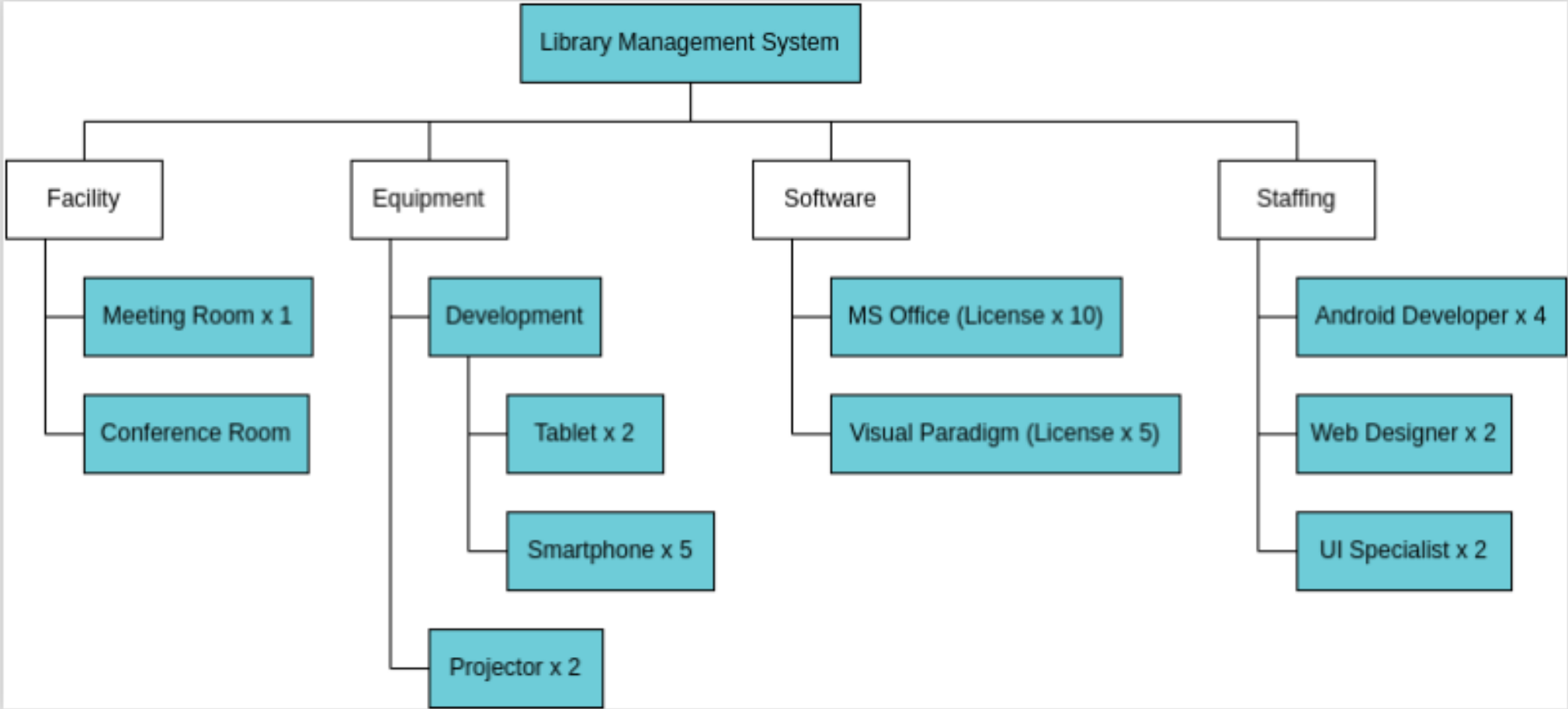
Resource Calendar

→ A resource calendar identifies the working days, shifts, start and end of normal business hours, weekends, and public holidays when each specific resource is available.

→ Information on which resources (such as team resource, equipment, and material) are potentially available during a planned activity period is used for estimating resource utilization.

→ Resource calendars also specify when and for how long identified team and physical resources will be available during the project.

→ This information may be at the activity or project level. This includes consideration of attributes such as resource experience and/or skill level, as well as geographical locations.

Agenda

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The process of obtaining

team members facilities equipment materials

etc.

Acquire Resources		
Inputs	**Tools & Techniques**	**Outputs**
.1 Project management plan • Resource management plan • Procurement management plan • Cost baseline .2 Project documents • Project schedule • Resource calendars • Resource requirements • Stakeholder register .3 Enterprise environmental factors .4 Organizational process assets	.1 Decision making • Multicriteria decision analysis .2 Interpersonal and team skills • Negotiation .3 Pre-assignment .4 Virtual teams	.1 Physical resource assignments .2 Project team assignments .3 Resource calendars .4 Change requests .5 Project management plan updates • Resource management plan • Cost baseline .6 Project documents updates • Lessons learned register • Project schedule • Resource breakdown structure • Resource requirements • Risk register • Stakeholder register .7 Enterprise environmental factors updates .8 Organizational process assets updates

Figure 9-8. Acquire Resources: Inputs, Tools & Techniques, and Outputs

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Project resources are pieces in a puzzle

→ Without the material and the team to utilize the material, the project cannot be completed.

→ Decisions making:

    → Availability – are the resources available when required?

    → Cost – are the resources within budget?

    → Ability – are the team members covering the capabilities (experience, knowledge, skills, attitude and internal factors) needed?

→ Negotiation – usually, acquisition of resources happens after negotiations. The project manager has to negotiate for acquisition terms. During the project, if resources are delayed, negotiation can include aiming for better terms.

→ However, don't fall into a "us vs. them" attitude because often multiple parties need the same resources.

→ **Apply a holistic view and ensure you are not taking resources from projects that are higher prioritized** – think long term instead of short term.

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Create Resource Breakdown Structure and a RACI

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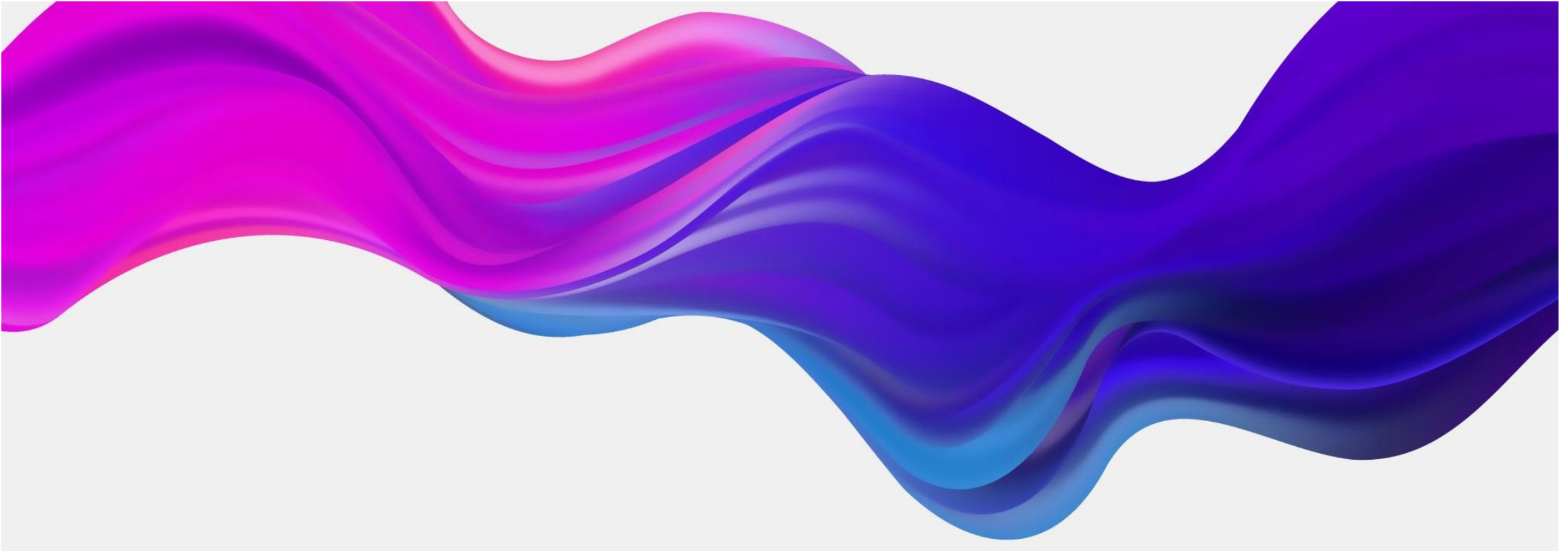
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Project management - from control to self-organization

→ Project management styles are shifting away from a command and control structure for managing projects and toward a more collaborative and supportive management approach that empowers teams by delegating decision making to the team members.

→ Emotional intelligence (EI). The project manager should invest in personal EI by improving inbound (e.g., self-management and self-awareness) and outbound (e.g., relationship management) competencies. Research suggests that project teams that succeed in developing team EI or become an emotionally competent group are more effective. Additionally, there is a reduction in staff turnover.

→ Self-organizing teams. The increase in using agile approaches has given rise to the self-organizing team, where the team functions with an absence of centralized control. In projects that have self-organizing teams, the project manager role provides the team with the environment and support needed and trusts the team to get the job done. Successful self organizing teams usually consist of generalized specialists, instead of subject matter experts, who continuously adapt to the changing environment and embrace constructive feedback.

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The process of improving competencies and team member interaction to enhance performance

Develop Team

Inputs	Tools & Techniques	Outputs

.1 Project management plan
   • Resource management plan
.2 Project documents
   • Lessons learned register
   • Project schedule
   • Project team assignments
   • Resource calendars
   • Team charter
.3 Enterprise environmental factors
.4 Organizational process assets
	.1 Colocation
	.2 Virtual teams
	.3 Communication technology
	.4 Interpersonal and team skills
	   • Conflict management
	   • Influencing
	   • Motivation
	   • Negotiation
	   • Team building
	.5 Recognition and rewards
	.6 Training
	.7 Individual and team assessments
	.8 Meetings
		1. Team performance assessments
		.2 Change requests
		.3 Project management plan updates
		   • Resource management plan
		.4 Project documents updates
		   • Lessons learned register
		   • Project schedule
		   • Project team assignments
		   • Resource calendars
		   • Team charter
		.5 Enterprise environmental factors updates
		.6 Organizational process assets updates

Figure 9-10. Develop Team: Inputs, Tools & Techniques, and Outputs

A well functioned team with good collaboration is more likely to deliver good results

Teamwork is a **critical factor for project success** and developing effective project teams is one of the **primary responsibilities** of the project manager.

There are **tools** that can assist in developing a team:

Tuckman's ladder

Belbin's team roles

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Tuckman's ladder
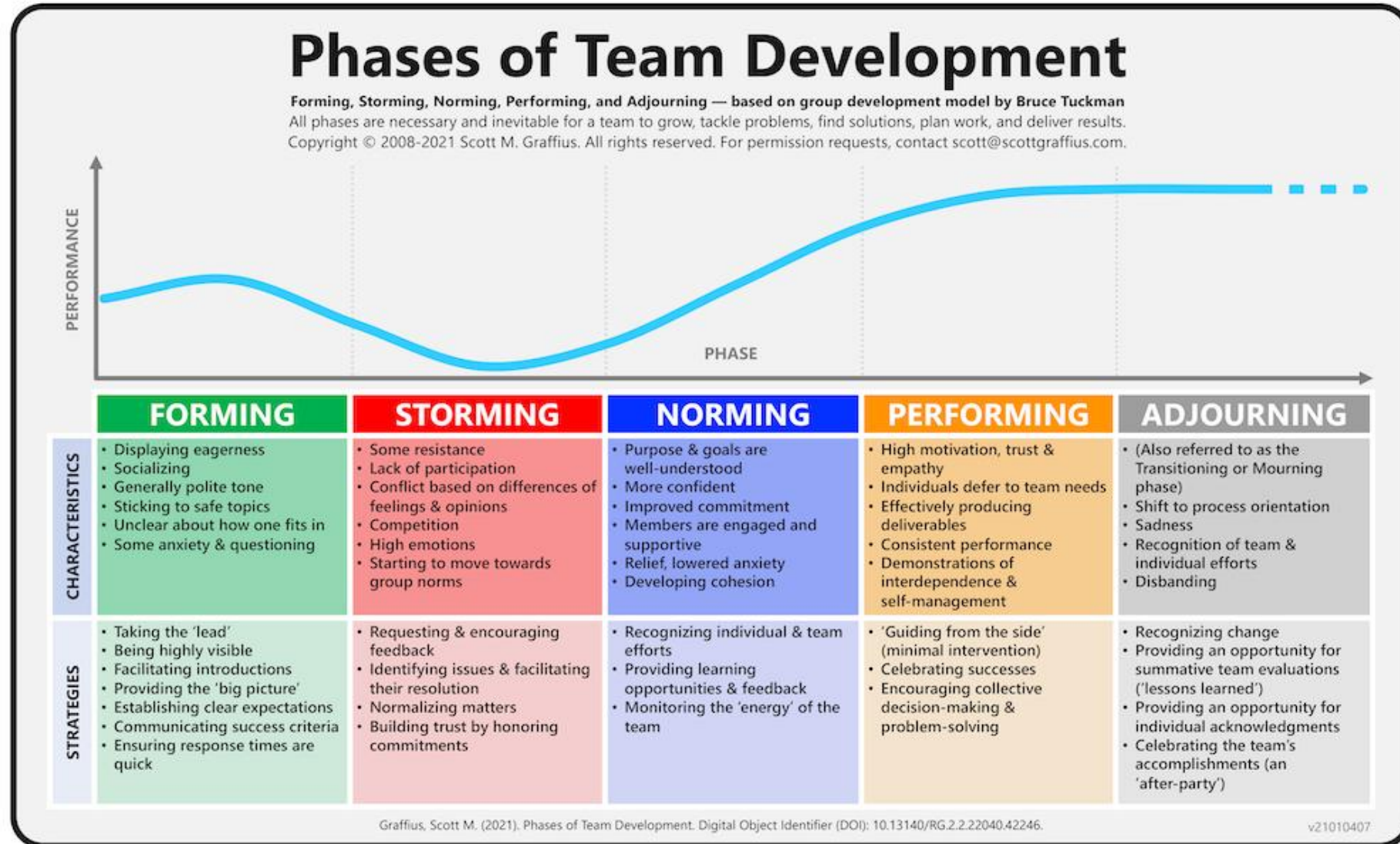
Belbin's team roles

→ The **3 archetypes**:

1. Thinking oriented
2. Action oriented
3. People oriented

→ Broken down to the **9 team roles** shown in the illustration

→ The 9 roles each have their own uniqueness along with their own strengths and weaknesses. These 9 roles **complement each other** and enable to exploit the strengths and negate the weakness by creating the awareness.

Belbin team roles summary

Archetype	Role / Strength / Weakness
Thinking-oriented roles	Plant / Gifted, creative & knowledgeable / Weak communication
	Monitor / Separate good ideas from bad / Critical & skeptical
	Specialist / Specialized knowledge & skills / Narrowminded
Action-oriented roles	Shaper / Take lead & push team / Impatient & stubborn
	Implementer / Disciplined and efficient / Inflexible & adapt slowly
	Completer / Tenacious & precise / Perfectionist & officious
People-oriented roles	Chairman / Natural team leader / Manipulative & offload own work
	Team worker / Keep the cogs turning / Indecisive & insecure
	Resource investigator / Communicative / Easily loses interest

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Belbin's team roles

→ Each team needs access to each of the 9 roles to become a high performing team.

→ Typically, not all roles are required at the same time

→ The 9 roles are not equal to 9 different team members. Most team members can cover 2-3 of the roles. The roles can change over time and team members can perhaps adopt other roles if needed.
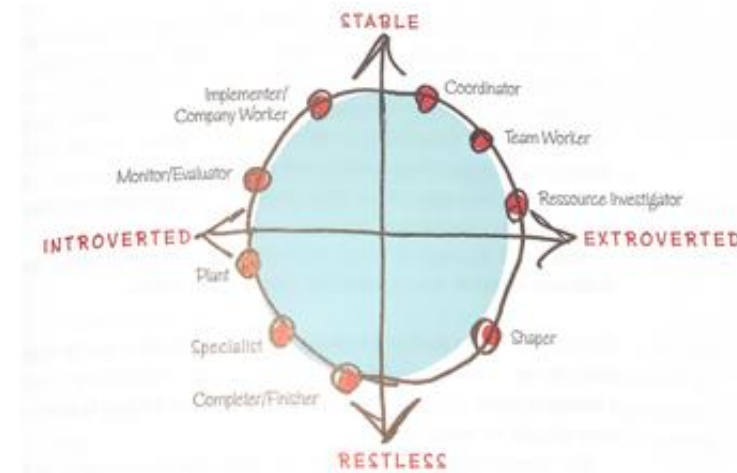

Figure 136 *Belbin's team roles*

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Report example from the past: use strengths and weaknesses

Appendix A: Team analysis

After the formation of a 6 member team for the Project Management course, the team decided to get an overview of who everyone is, what they feel they can bring to the table, and what they can do for the project. As a simple exercise, the team did a thorough Team Analysis where each team member filled in the information for the following three specific fields: *Theoretical knowledge*, *Personal competencies*, and *Work or experience-based skills*. The following figure depicts the groups' Team Analysis table:

Theoretical knowledge	Personal Competences	Work or experience-based skills
- Physics - IT/Technology - Business - Design - Manufacturing - Electronics - Material properties - Marketing	- Economics - MacGyver solutions - Project coordination - Business operation - Electrical engineering - CAD/3D modelling - Network infrastructure - Group work delegation - Dynamic working environments - Marketing - PR	- Leadership skills - MacGyver solutions - Direct - Calm - Results-oriented - Customer relations - Working for government-owned organisations (SDU & OTG) - Handling bureaucracy - PR
- Electronics - Linux - Networks - Object Oriented Programming - Software Architecture - Cyber Security	- JavaScript, Typescript, NodeJS, API Creation, Web Backend - Databases (SQL) - PHP, HTML, C, C++, Python - CAD 3D Design/Printing	- OpenAI API, creation of virtual assistants (Discord Bots, chat bots...) - Communication team management for a small structure - Teamwork, team

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Example from report – reflecting at the end

To build a well-functioning team, many different aspects need to be taken into consideration. To ensure a well-functioning team, different personalities should be combined. This can e.g., be done by using the Belbin personality test, and ensuring that each team role is represented within the team. If there are too many of one or similar roles, it may result in inefficient work. Having different personalities makes the team more adaptable and helps minimize weaknesses. In addition, it gives the team diverse perspectives, better ability for decision-making, and increased motivation. In projects like this, where the team members are not allocated 100% of their work time to the project, the different personalities help to increase productivity and efficiency.

In summary, teamwork and collaboration are crucial components of any successful project. By leveraging the diverse perspectives, expertise, and experiences of team members, the project can benefit from improved efficiency, better decision-making, and increased motivation.

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Agenda

The process of tracking performance and resolve issues to enhance performance

Manage Team

Inputs

.1 Project management plan
  • Resource management plan
.2 Project documents
  • Issue log
  • Lessons learned register
  • Project team assignments
  • Team charter
.3 Work performance reports
.4 Team performance assessments
.5 Enterprise environmental factors
.6 Organizational process assets

Tools & Techniques

.1 Interpersonal and team skills
  • Conflict management
  • Decision making
  • Emotional intelligence
  • Influencing
  • Leadership
.2 Project management information system

Outputs

.1 Change requests
.2 Project management plan updates
  • Resource management plan
  • Schedule baseline
  • Cost baseline
.3 Project documents updates
  • Issue log
  • Lessons learned register
  • Project team assignments
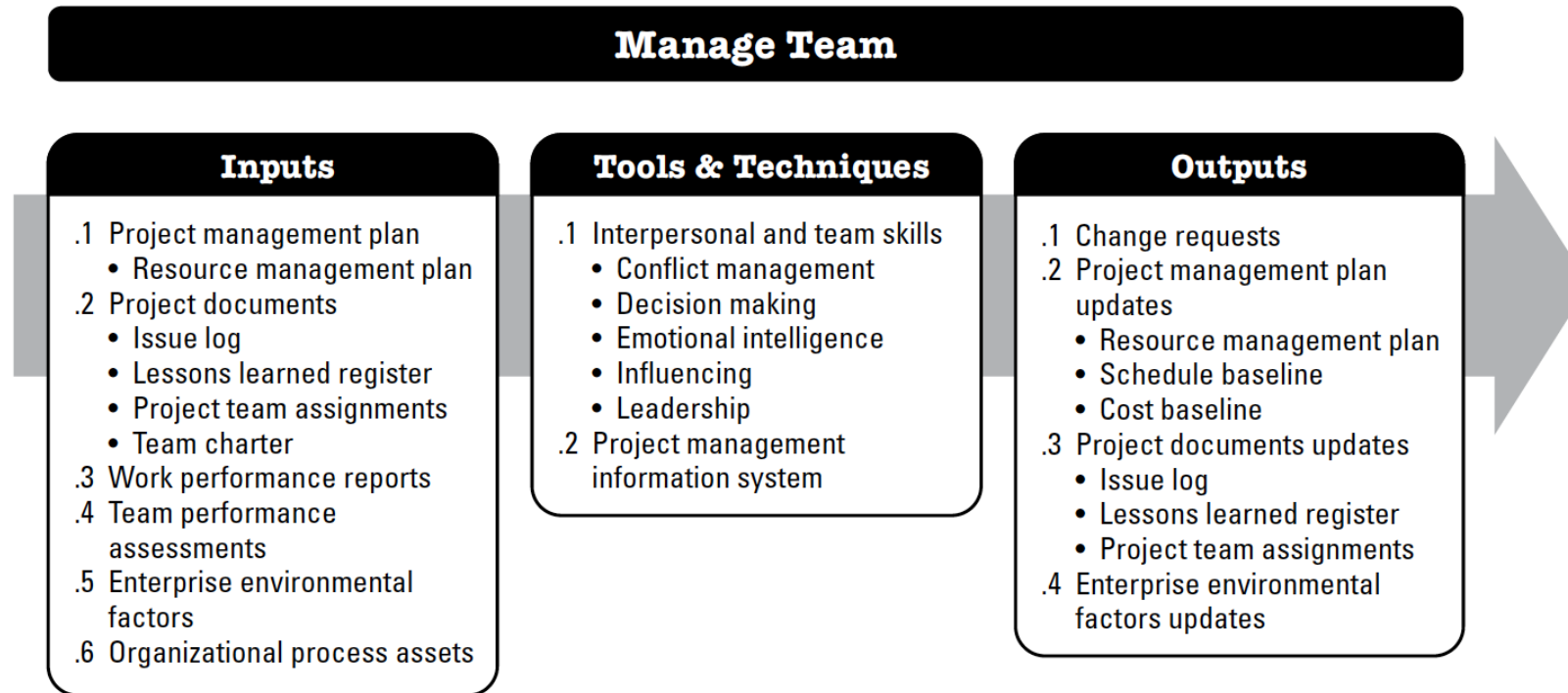.4 Enterprise environmental factors updates

Figure 9-12. Manage Team: Inputs, Tools & Techniques, and Outputs

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The key in conflict management is to turn the issue into something positive

Conflicts are inevitable in a project. The conflicts can originate from other team members, tight schedule, lack of resources and others.

Conflicts **can be turned into positive outcome** if handled properly. Lack of resources or difference in opinion can be turned into new and creative ways of dealing with a situation.

The **leadership and influence of the project manager is important**. If the project manager is capable of both the "hard" and "soft" skills, the team members are more likely to listen and follow the guidance.

Best to **handle the issue early** on and avoid imposing regulations. However, might be necessary to do so.

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Thomas/Kilmann's 5 general techniques to dealing with conflict

Avoiding: **Lose/lose**. The avoidance strategy seeks to put off conflict indefinitely.

Competing. **Win/lose.** Competition operates as a zero-sum game in which one side wins and the other loses.

Accommodating: **Lose/win.** The accommodating strategy essentially entails giving the opposing side what it wants

Compromising: **Lose/lose.** The compromising strategy typically calls for both sides of a conflict to give up elements of their position in order to establish an acceptable/agreeable solution

Collaborating: **Win/win**. Collaboration works by integrating ideas set out by multiple people. The objective is to find a creative solution acceptable to everyone

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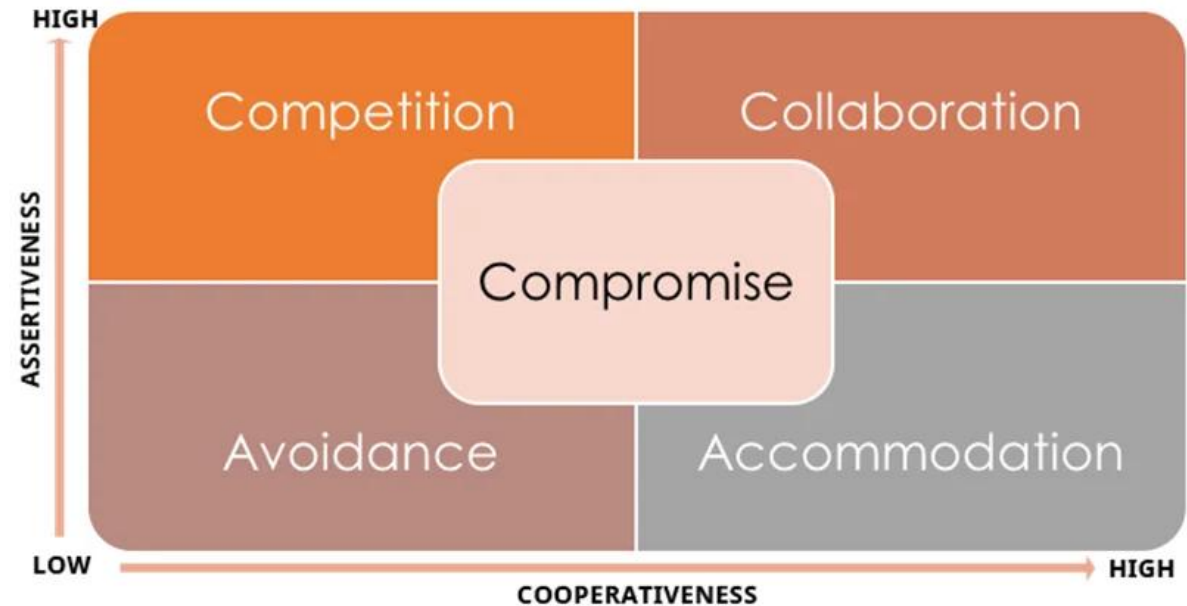
A strong project manager might be able to turn many conflicts into collaborative win/win's by being strong at arguing and early alert

[The parable of the orange](#)

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Control resources:
The process of ensuring availability of the resources assigned and allocated to the project

Control Resources

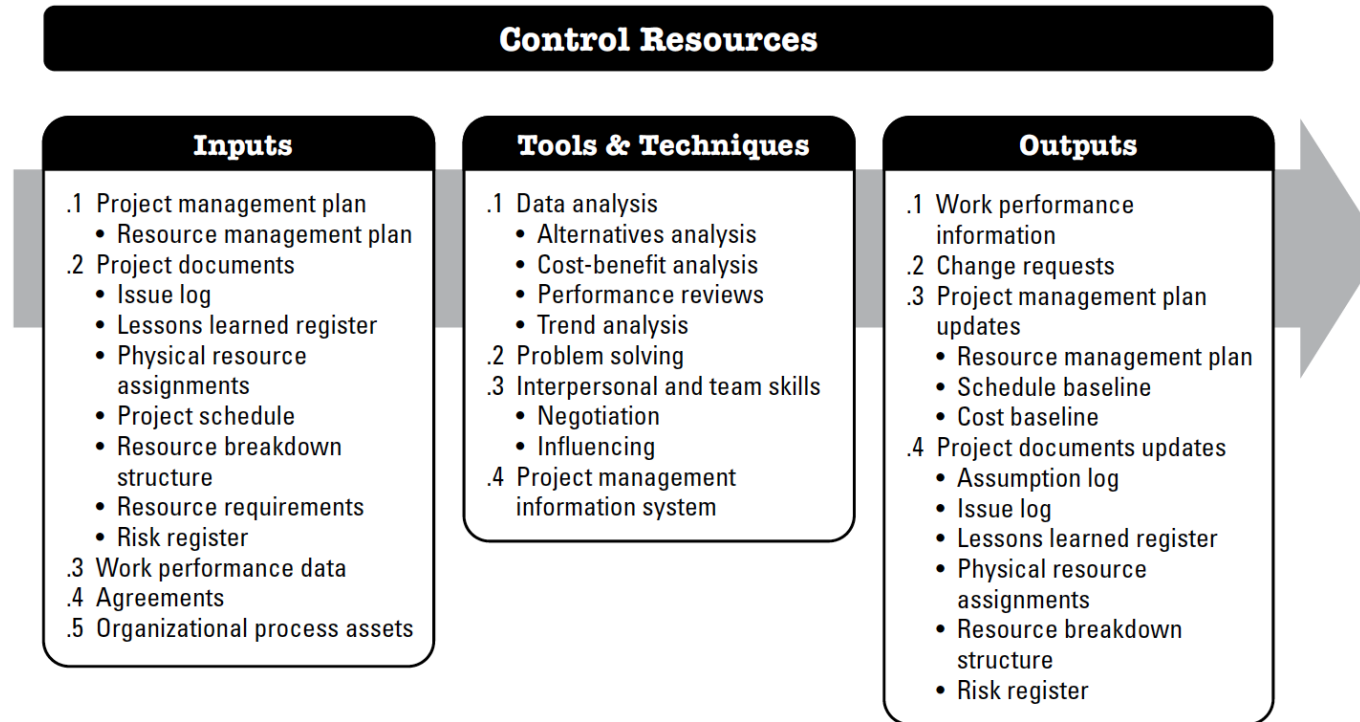| Inputs	Tools & Techniques	Outputs
.1 Project management plan • Resource management plan .2 Project documents • Issue log • Lessons learned register • Physical resource assignments • Project schedule • Resource breakdown structure • Resource requirements • Risk register .3 Work performance data .4 Agreements .5 Organizational process assets	.1 Data analysis • Alternatives analysis • Cost-benefit analysis • Performance reviews • Trend analysis .2 Problem solving .3 Interpersonal and team skills • Negotiation • Influencing .4 Project management information system	.1 Work performance information .2 Change requests .3 Project management plan updates • Resource management plan • Schedule baseline • Cost baseline .4 Project documents updates • Assumption log • Issue log • Lessons learned register • Physical resource assignments • Resource breakdown structure • Risk register

Figure 9-14. Control Resources: Inputs, Tools & Techniques, and Outputs

Remember to monitor the available resources to identify and mitigate potential disruptive situations

→ Various analyses can be applied to ensure that there is an optimal utilization of the resources, e.g. looking at historical data.
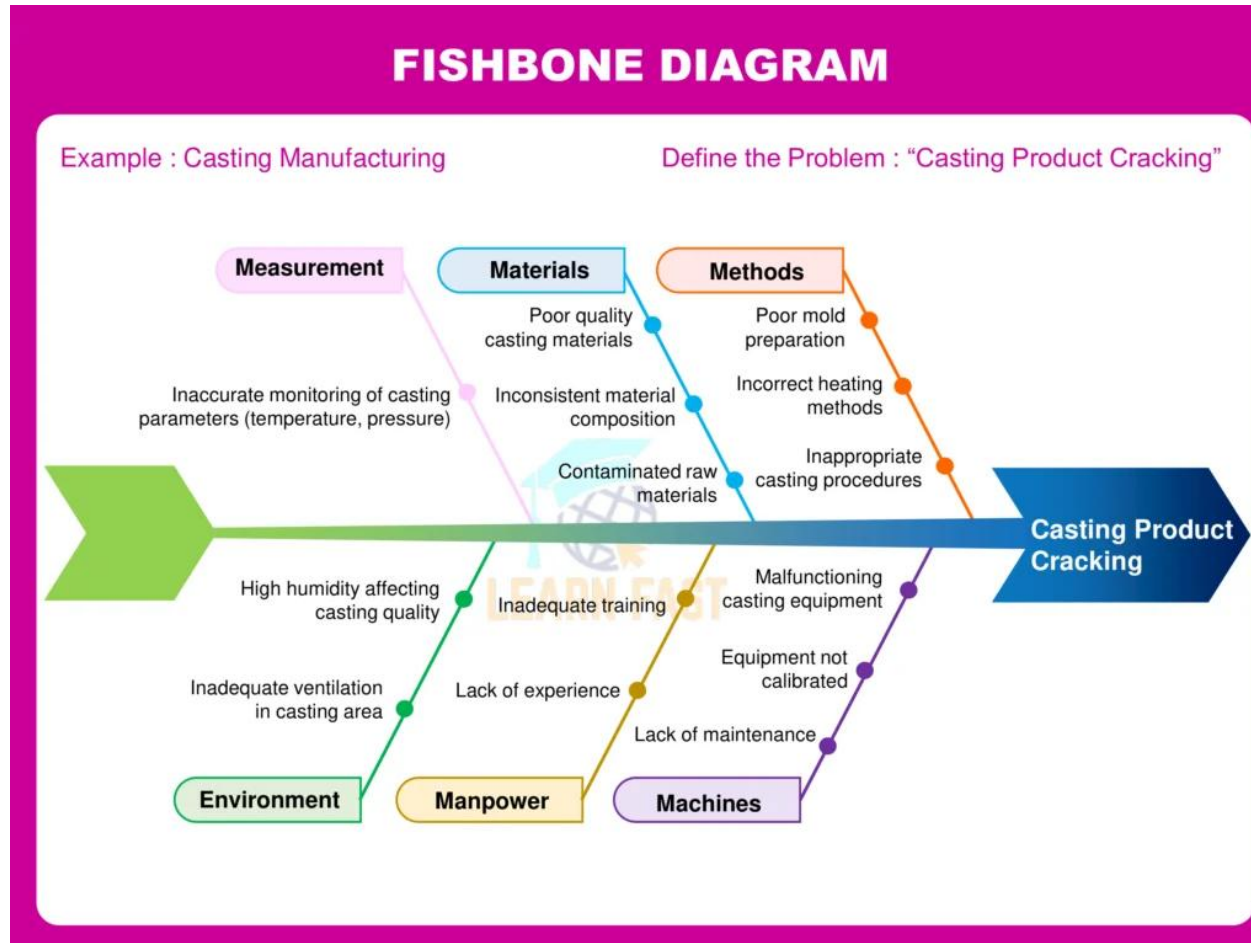
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If (or when) resources are not available, various techniques of problem solving can be applied.
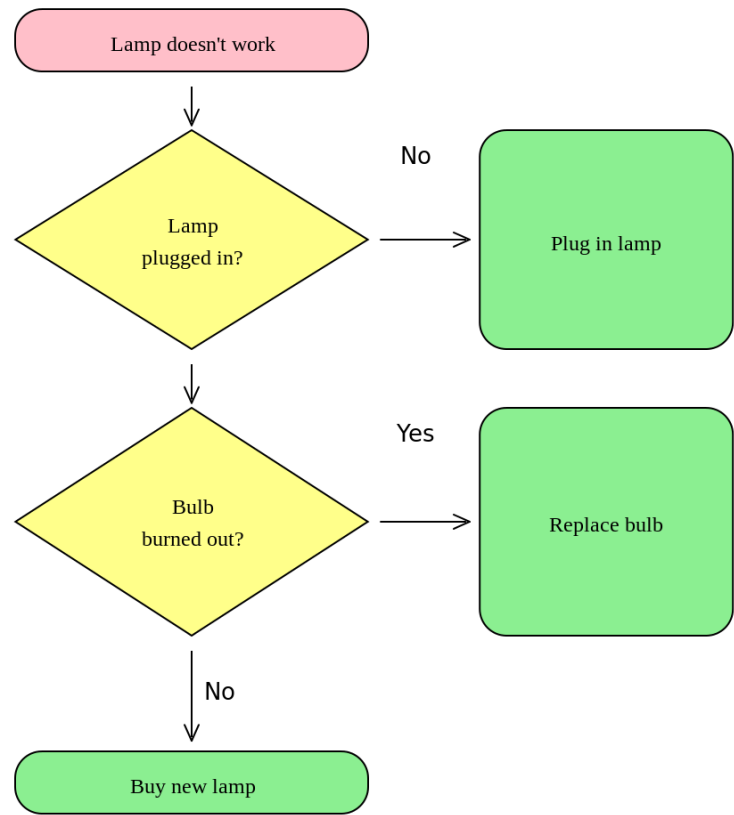
Always remember to find the root cause

Control resources techniques:

→ Cause and effect diagrams

→ Flowcharts

→ Check sheets

→ Histograms

→ Control charts
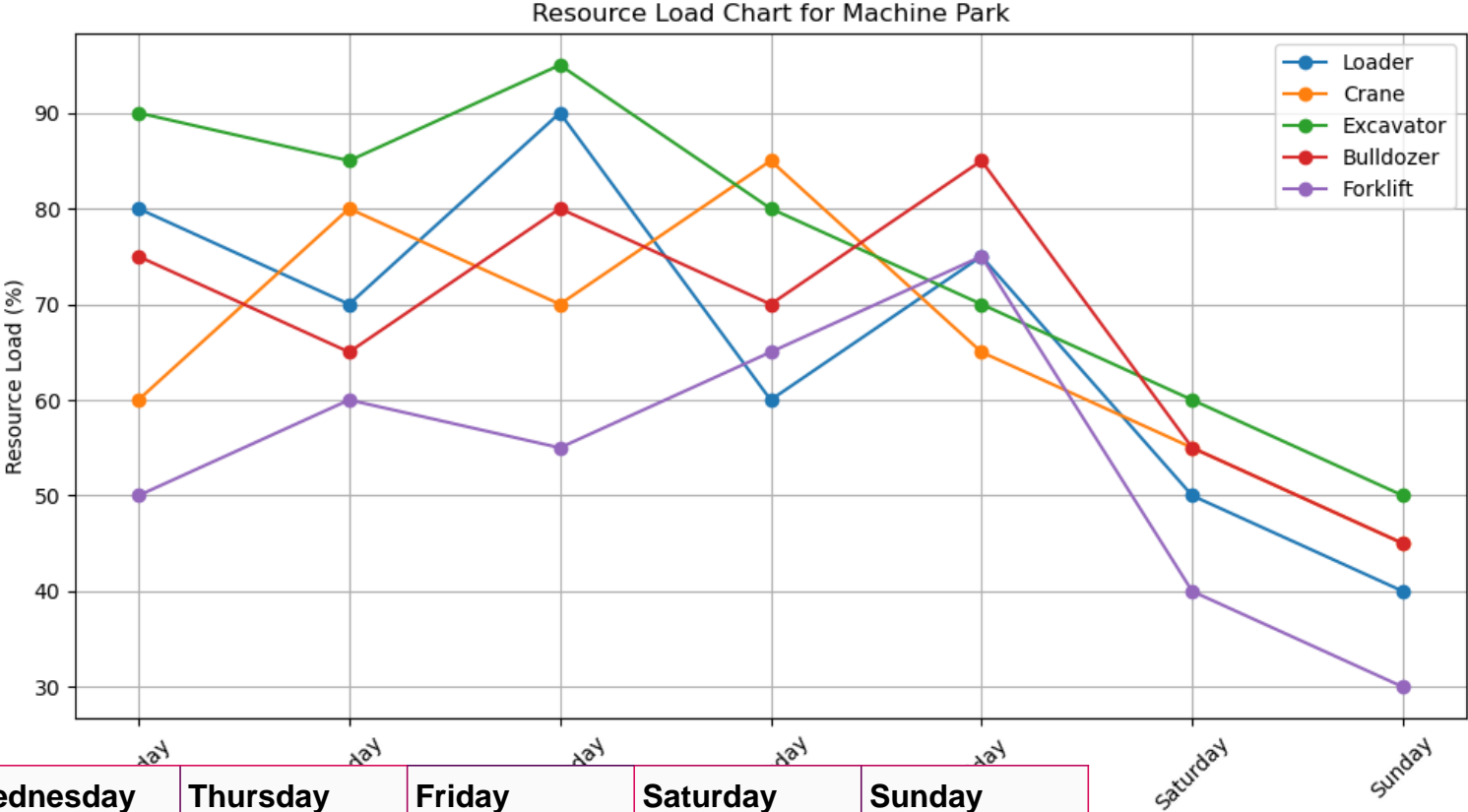
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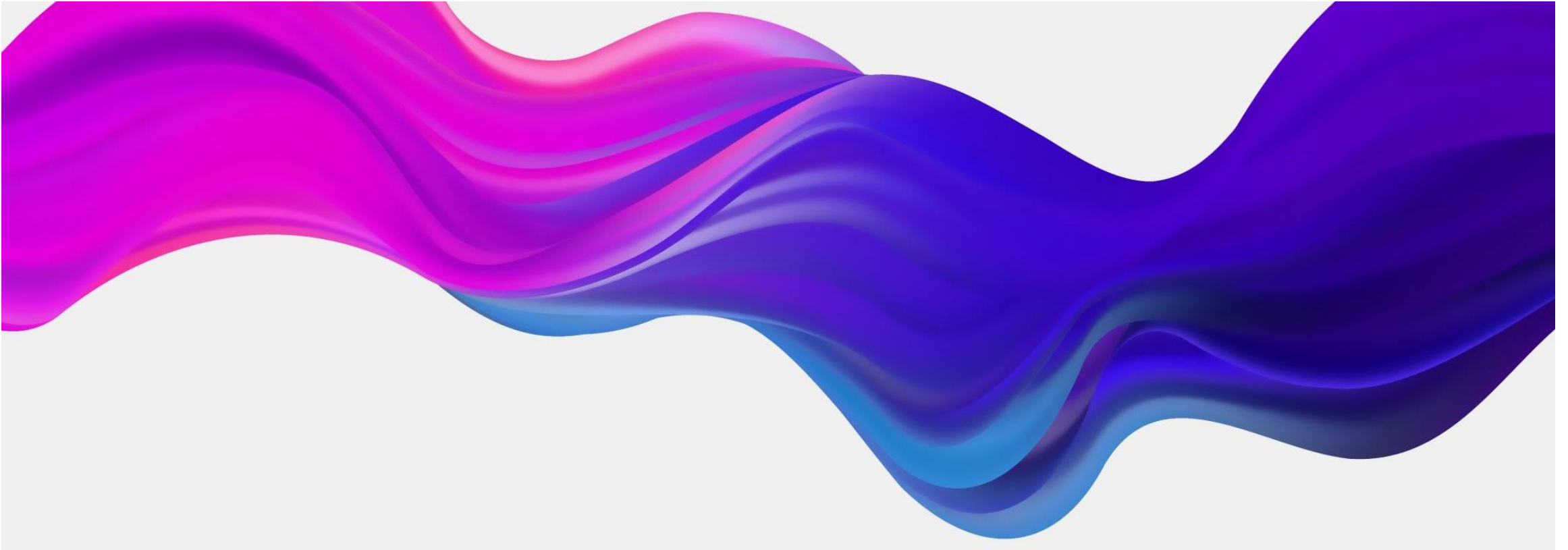# Cause and Effect Diagram

Flowchart

Resource load Chart

Resource Load Chart for Machine Park

Machine	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Loader	80%	70%	90%	60%	75%	50%	40%
Crane	60%	80%	70%	85%	65%	55%	45%
Excavator	90%	85%	95%	80%	70%	60%	50%
Bulldozer	75%	65%	80%	70%	85%	55%	45%
Forklift	50%	60%	55%	65%	75%	40%	30%

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Reflect on your team composition

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→ 12:50-13:00: Break

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→ 13:30-14:30: Group work

→ 14:30-14:45: Presentations

→ 14:45-15:45: Group work

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