Project Management

Jan Hornwall, Director Project Management, Siemens PLM Software
Key Objectives of this Lecture

• You know the areas and processes of Project Management

• We have looked at some Best Practices in Project Management

• We have had a discussion on working in software development projects

• You understand why the Project Manager asks questions like *when will you be ready?*
Agenda

• Introduction of the Speaker & Siemens PLM Software

• Introduction to Projects and Project Management

• The Project Management Knowledge Areas and Processes
  • including best practices

• Discussion on main challenges with working in projects and together with a Project Manager

• Key Take Aways
Introduction of the Speaker

- From Sweden, living in Switzerland since 1992
- Master of Science in Physics Engineering, Chalmers University, Gothenburg
- Background as Software Engineer in Telecom; Unix, C++
- Working internationally in Project-, Program- and Team management since 1994
- In current role as Director Project Management, Siemens PLM Software since 2007
- Certified Project Management Professional by PMI & Senior Project Manager IPMA
- Founder of PMI chapter Switzerland (www.pmi-switzerland.ch)

- Privately:
  - Family: proud father of three lovely daughters, aged 23, 21 and 3
  - Passionate ski mountaineer, windsurfer, mountain biker and Lindy Hop dancer

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LinkedIn: www.linkedin.com/in/jan-hornwall

Please feel free to contact me for any questions on this material or any other Project Management questions!
The Largest, Brodest and Most Successful Deployments in the Industry
77'000 Customers and 9 Million Licensed Seats

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<tr>
<th>AEROSPACE</th>
<th>AUTOMOTIVE</th>
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Siemens PLM Software
Product Lifecycle Management
Spanning the lifecycle from concept of a product to retirement
PwC Global 100 Software Leaders (2016)

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https://www.pwc.com/gx/en/industries/technology/publications/global-100-software-leaders.html
Trends in our Market

**Development Production**

<table>
<thead>
<tr>
<th>In the past:</th>
<th>8 Years</th>
<th>11 Years</th>
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<tbody>
<tr>
<td>Now:</td>
<td>3 Years</td>
<td>6-8 Years</td>
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</table>

IoT = Internet of Things

SaaS = Software as a Service

Outcome Engineering

Industry 4.0

Digitalization

Digital Twin

Additive Manufacturing (3D Printing)
Introduction to Project Management

• What is a Project?
  A project is a temporary endeavor to create a unique product, service or result. (PMI)

• Why Project Management?
  • Almost all software products are obtained via projects, as opposed to manufactured products.
  • Enterprise Software is deployed and customized to customer business through projects

• The challenge with many projects is to manage the triple constraints:
  - Deliver on time
  - Deliver within budget
  - Deliver agreed functionality to agreed quality = performance
Introduction to Project Management

• What is a Program?
  A group of related projects and program activities that are managed in a coordinated way to obtain benefits not available from managing them individually (PMI)

• What is not a project or a program?
  Examples:
  • Monthly magazine
  • Maintenance / bug fixing of released product
  • Quarterly finance report
Introduction to Project Management

A typical lifecycle of a Project:

- Project Charter = Customer Order
- Project Management Plan
- Carrying out the work
- Closing the project

Cost and Staffing Level

Stress level of the Project Manager
Project Management Institute (PMI) is the world's leading not-for-profit professional membership association for the project, program and portfolio management profession. Founded in 1969. It publishes PMBOK Guide. Over 700’000 members world wide.

We will today review:

The Project Management Processes

The Project Management Knowledge Areas:

1. Project Integration Management
2. Project Scope Management
3. Project Time Management
4. Project Cost Management
5. Project Quality Management
6. Project Human Resources Management
7. Project Communications Management
8. Project Risk Management
9. Project Procurement Management
10. Project Stakeholder Management
The Project Management Knowledge Areas & Processes
- The Project Management Processes

The 5 main process areas are:
Agile Methods follows the same principle

The Agile: Scrum Framework at a glance

Inputs from Executives, Team, Stakeholders, Customers, Users

Product Owner

The Team

Sprint Backlog

Sprint Planning Meeting

Team selects starting at top as much as it can commit to deliver by end of Sprint

Sprint Backlog

Task Breakout

1-4 Week Sprint

Sprint end date and team deliverable do not change

Burndown/up Charts

Scrum Master

Every 24 Hours

Daily Scrum Meeting

Sprint Review

Finished Work

Sprint Retrospective
Agile Methods

Projects using agile methods are in two different situations:

1. In-house software development, or customer is flexible on scope and costs

2. Software is developed by a supplier with a contract with the customer:
   - fixed price
   - fixed scope / functionality
   - milestones with deliverables and invoice dates

The exemple we will look at is in this situation
Let’s Start with an Example of a Project

• You are working since two years at a software consultancy company *MacApple*
• A large customer has approached you to develop a specific application, with high quality, interfacing two existing systems. A preliminary product specification exists.
• It needs to be ready in 9 months and the customer wants a fixed price

• You are the appointed Project Manager for this project. Your project team consists of 6-8 persons, in addition to you as full time PM.

• You use an agile approach internally when developing software, the customer has however requested three releases:
  • Release A in 6 months, covering specific use cases, around 60%
  • Release B, with interfaces, in 8 months, covering all use cases
  • A final Release with updates after customer tests, after 9 months

• The contract with the customer is finalized by sales
Example of a Project

Application from MacApple

Customer Environment

ABC

HAL

Applications
Example of a Project

How do you start?
The Project Management Knowledge Areas
- Project Scope Management

**Project Scope Management** is about ensuring that the project includes all the work required, and only the work included, to complete the project successfully.

- Plan Scope / Statement of Work
- Collect Requirements / Use Cases / Scenarios
- Define Objectives / Scope / Deliverables / Acceptance Criteria
  - Establish Scope Baseline
  - Define out-of-scope and assumptions
- **Create the Work Breakdown Structure (WBS)**

Scope covers:
- Product Scope – e.g. specifications, functions, features
- Project Scope – e.g. testing, data migration, training
Project Time Management is about getting the project done on time.

- Define Activities
- Sequence Activities / Dependencies
- Estimate Activity Resources & Duration
- Develop Schedule
- Define Milestones and Gates
- Control Schedule

Planning is iterative; monitor and revise schedules during the project.

Agile methodologies influence this area of course.
Estimation Techniques:
A good WBS (!) is the base for any estimation, down to task level of 1-2 weeks duration.

1. Three-Point Estimating (PERT) uses three estimates to define an approximate range for an activity’s duration:
   - **Most likely (M):** given the resources likely to be assigned, their productivity, known dependencies and normal interruptions.
   - **Optimistic (O):** Based on the best-case scenario for the activity
   - **Pessimistic (P):** Based on the worst-case scenario for the activity

   Duration = \( \frac{O + 4M + P}{6} \) (beta distribution)

   Example; Estimate of 8 days with 4 days as optimistic and 20 days as pessimistic results in 9.5 days

   **Note:** it’s pointless to use 4, 8, 12...
The Project Management Knowledge Areas
- Project Time Management

2. **Expert Judgment**: consult experts and compare estimates
   -> challenge: do they know the skill level of resources available?

3. **Estimation by analogy**: compare with past projects in the same application domain
   -> challenge: limited applicability

4. **Algorithmic cost modelling**: use historical data, e.g., lines of code or Function Points
   -> challenge: requires strict procedures to capture data, can be very effective

5. **Pricing to win**: the project costs whatever the customer has to spend on it
   -> very risky if fix price contract (unlikely) if not scope is flexible (agile)
   -> trust is required if Time & Material contract

- Each method has strengths and weaknesses
- Estimation should be based on several methods
- If these do not return approximately the same result, more effort is required to get to one estimate
Best Practice - Estimation: Build company specific estimator tools:

- Covering time needed for documentation, meetings, review, tests, assist customer tests
- Covering company specific tasks and experiences
The Project Management Knowledge Areas
- Project Time Management

Let's look at an example:

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<th>Duration (days)</th>
<th>Dependencies</th>
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What is the minimum total duration of this project?
The Project Management Knowledge Areas
- Project Time Management

Build Network Diagram

Analyze the Critical Path:

The Critical Path is the sequence of activities that represents the longest path through a project – this determines the shortest duration

**Answer is 55 days.**

Identify also activities that are close to becoming critical path, ensure those are not delayed.
The Project Management Knowledge Areas - Project Time Management

The same example in a Scheduling tool (MS Project) – Gantt Chart view:
Highlight of Critical Path in Gantt Chart view:
Changing Task 6 from 5 days to 9 days creates a new critical path, and delays the finish one day:
The Project Management Knowledge Areas
- Project Time Management

**Question:** you have estimated **five days** to implement and test a certain function. After **three days** you are finished, it is tested and it works! You face three options now:

A. Review and improve the code for two days to see if you can make it of higher quality and more structured. It will also make it easier to re-use and maintain later. Total effort is 5 days.

B. Develop a cool feature that you came up with, spending two days on this. Total effort is 5 days.

C. Report back to the project manager to start working on another task. Total effort is 3 days.

**What would you do?**

**Parkinson's law** is the adage that "work expands so as to fill the time available for its completion".
The Project Management Knowledge Areas
- Project Human Resource Management

**Project Human Resource Management** is about organizing, managing, developing and leading the project team.

- **Plan and acquire Project Team**
  - Project Organization
  - Define roles and responsibilities
  - Skills and experiences required
- **Manage & Develop Project Team**
  - Adding and on-boarding team members
  - Plan and develop skills
  - Provide Feedback on performance
  - Manage conflicts & Motivate Team
- **Administration:**
  - Manage & negotiate internal resource agreements
  - Manage & negotiate contracts of external resources
  - Manage work permits
The Project Management Knowledge Areas
- Project Human Resources Management

Team Organization - Teams should be relatively small (< 8 members)
  • minimize communication overhead
  • team quality standard can be developed
  • programs are regarded as team property (“egoless programming”)
  • members can work closely together
  • continuity can be maintained if members leave

  • Break big projects down into multiple smaller projects
  • Small teams may be organized in an informal, democratic way
Best Practice: Resource Management and Levelling in Scheduling Tool

Any over-allocation is shown in tool:

Task 7 assigned to Jim:
The Project Management Knowledge Areas
- Project Procurement Management

**Project Procurement Management** is about purchase or acquire products, services and resources needed in the project.

Examples:
- Resources from external suppliers
- Specialist services
- Hardware, computers, storage
- Cloud services, apps

This also includes **evaluation of suppliers** and **contracting** these products and services.
Project Cost Management is about getting the project done within budget.

- Estimate Costs and Determine Project Budget
- Control Cost - the Project Manager needs to determine actual cost incurred and also make a forecast of total cost.

The Project Manager will ask how much have you spent on an activity and also how much will you need to complete it.

Reserves also affect cost management:
- Risk contingency reserve
- Management reserve
Project Quality Management is about ensuring that the project will satisfy the needs for which it was undertaken.

- Document review; peer reviews, formal review meetings (plan time for this!)
- Code review (also plan time for this!)
- Usability test lab / Prototyping
- Testing:
  - Unit tests
  - User tests
  - Performance / Stress tests
  - Acceptance tests
- Pilot usage
- Root cause analysis
- Project Retrospectives

Cutting back in testing and reviewing is a recipe for disaster!
Best Practice: Project Retrospective

A project retrospective review is an in-depth discussion that happens after the completion of a project, event or activity. It is structured to help the people involved reflect on the project in detail.

Lessons Learned and Best Practices are collected and shared afterwards.

Agile Retrospective approach; retrospective after each sprint.
**Project Risk Management** is about identifying, assessing and controlling risk on a project.

The objectives are to increase the likelihood and impact of positive risks (opportunities) and decrease the likelihood and impact of negative risks in the project.

Risk response strategies (negative risks):
- Avoid
- Transfer
- Mitigate
- Accept

Risks are assessed in terms of Probability and Impact.
### The Project Management Knowledge Areas - Project Risk Management

#### Examples of typical Risks:

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<th>Risk</th>
<th>Risk Response</th>
<th>Probability</th>
<th>Impact</th>
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</table>
| Lack of skilled resources creates a delay                           | *Mitigate*: Staffing with top talent and experts, build team, assign resources well in time.  
*Transfer*: Out-source well defined work packages                  | 50%          | 5      |
| Unrealistic schedules and budgets leads to delays or budget overruns | *Mitigate*: Incremental / agile development  
*Avoid*: review early and get more time and/or cut functionality    | 60%          | 4      |
| Developing wrong functions leads to unsatisfied customer            | *Mitigate*: user surveys, prototyping, agile, sign-off on requirements       | 20%          | 3      |
| Frequent and many changes of requirements cause delays              | *Mitigate*: strict change control with extra costs shown.  
Agree Requirement Freeze milestone early. Track changes for the record | 40%          | 5      |
The Project Management Knowledge Areas
- Project Risk Management

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The Project Management Knowledge Areas
- Project Risk Management

**Best Practice:** Risk Assessment Workshop

- Brain-storm risks on Post-It notes
- Sort into risk categories
- Group similar risks together
- Assess Probability and Impact
- Start identify risk responses for the top risks

In addition, this is a great exercise for project members from different areas to understand the whole project and the risks.
But even companies with the most rigorous risk management in place fail, example:
Mars Climate Orbiter 1999 crashed
Root cause: Metric vs US units
The Project Management Knowledge Areas  
- Project Communications Management

**Project Communications Management** is about ensuring that the project team has the necessary information and resources to complete the job.

- Project Kick-Off
- Meetings, stand-up meetings
- Project Progress reporting
- Repositories, keeping documents up to date
- Code sharing
- **Sharing knowledge, internal social media, social collaboration**
- Newsletters

Quotes:

> Project teams often detest progress reporting because it manifests their lack of progress.

Communication is key, make sure you communicate on all levels!
The Project Management Knowledge Areas
- Project Communications Management

**Best Practice:** Track deliverables, also specifications and use cases in excel:

This is an excellent way to spot delays early and to communicate plan and progress to project team and to management.

Software development is tricky for management, hard to see progress; make transparent.
The Project Management Knowledge Areas
- Project Integration Management

**Project Integration Management** is about managing all parts of the project to ensure that the project’s objectives are met. It spans across all other nine knowledge areas and processes.

Mainly it is about leadership, driving decisions and negotiate, enabling the project team to work effectively.

- Develop Project Charter / Customer Contracts
- Develop Project Management Plan
- Manage, Monitor and Control Project Work
- Coordination
- **Change Control**
- Close Project or Phase

At any instant, the Project manager must know what is the most important now while at the same time looking into the future.
Key Take Aways

• Project Management is about managing all parts of the project to ensure that the project’s objectives are met, on time and within budget.

• Project Management is about leadership, driving decisions and negotiate, enabling the project team to work effectively.

• Project Management is a team effort; it requires the support of all team members, even though some project management process can seem “strange” and “unnecessary”.

• Typically, the Project Management effort is 10-15% of total project effort
References, Links

• PwC Global 100 Software Leaders: http://www.pwc.com/gx/en/industries/technology/publications/global-100-software-leaders.html

• PMI www.pmi.org
• PMI Switzerland www.pmi-switzerland.ch


• Agile Retrospectives: www.funretrospectives.com

• Function Point estimation technique http://en.wikipedia.org/wiki/Function_point

• Siemens PLM Software: www.plm.automation.siemens.com/
Appendix – Additional Information

Literature

Sources

Recommended Reading
> The Mythical Man-Month, F. Brooks, Addison-Wesley, 1975
> Succeeding with Objects: Decision Frameworks for Project Management, A. Goldberg and K. Rubin, Addison-Wesley, 1995
### Chief Programmer Teams (example)

- Consist of a kernel of specialists helped by others as required
  - **Chief programmer** takes full responsibility for design, programming, testing and installation of system
  - **Backup programmer** keeps track of CP’s work and develops test cases
  - **Librarian** manages all information
  - Others may include: project administrator, toolsmith, documentation editor, language/system expert, tester, and support programmers …

- Reportedly successful but problems are:
  - Can be difficult to find talented chief programmers
  - Might disrupt normal organizational structures
  - May be de-motivating for those who are not chief programmers

### Egoless Programming (example)

- No code “ownership”
- Frequent code reviews to expose defects
  - Review the code, not the developer
- Promotes more “democratic”, less hierarchical team structure
Directing Teams

Managers serve their team
> Managers ensure that team has the necessary information and resources

1. “The manager’s function is not to make people work, it is to make it possible for people to work” — Tom DeMarco

Responsibility demands authority
> Managers must delegate
  – Trust your own people and they will trust you.

Directing Teams ...

Managers manage
> Managers cannot perform tasks on the critical path
  – Especially difficult for technical managers!

Developers control deadlines
> A manager cannot meet a deadline to which the developers have not agreed
Appendix – Additional Information

What you should know!

> How can prototyping help to reduce risk in a project?
> What are milestones, and why are they important?
> What can you learn from an activity network? An activity timeline?
> Why should programming teams have no more than about 8 members?

Can you answer these questions?

> What will happen if the developers, not the customers, set the project priorities?
> What is a good way to measure the size of a project (based on requirements alone)?
> When should you sign a contract with the customer?
> Would you consider bending slip lines as a good sign or a bad sign? Why?
> How would you select and organize the perfect software development team?