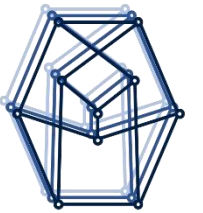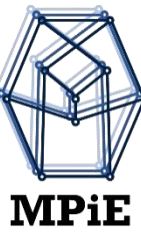MPiE

Management Practice

1. Introduction

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MPiE

Welcome

Interested in the linking engineering and management

Course

Aim of this course:

Learn management approaches to improve the practice of engineering

Final assessment (0.5 Examination Units):

C27 - A 1.5 hrs written exam, which relates to the coursework that you will complete as part of MPiE.

B2E2 - A 3 hrs written exam, of which 1.5 hrs relates to the coursework that you will complete as part of MPiE – EEM selection.

Literature for the course:

Eisner, Howard. *Essentials of project and systems engineering management*. John Wiley & Sons, 2008.

Learning objective for this session:

- Understand the organisation and structure of the course
- Understand the value of engineering management practice
- Can apply different brain storming techniques

Literature for this session:

- Bloom, Nicholas, et al. "Does management matter? Evidence from India." *The Quarterly Journal of Economics* 128.1 (2013): 1-51.

Course

- The literature and lectures are complementary, so please read and attend/view to successfully pass your exam.

- There are active elements that require you to complete. Please do.

- This course is ideally to be viewed from a systems engineering perspective.

- Systems Engineering integrates all the disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation.

- We will look at management, with an emphasis on managing the design, development and engineering of systems.

Source: The International Council on Systems Engineering (INCOSE)

Engineering management introduction

How many of you have led/managed a group of individuals (volunteer work / societies/ etc.)?

How many of you received any training in leadership and management skills?

A small poll

- Across a range of companies the following question was asked to engineering managers:

"Before becoming a manager did you participate in any formal management training?"

Response

Yes
No

Source: by Former Twitter Director of Engineering - David Loftesness
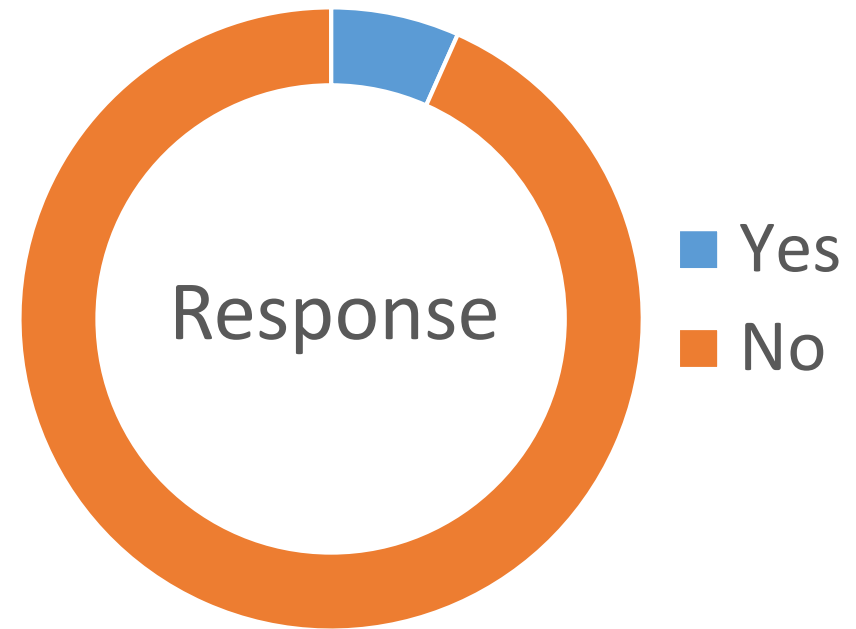
Mind the gap

- One is often surprised that the skills and methods required to be successful as an single contributor do not map directly on success as a manager.

- There is a gap in skills and competencies required for this.

Definition of management

- "The process of dealing with or controlling things or people."

- Management is concerned with the effective use and coordination of materials and labour within organisations in the pursuit of the organisation's **defined objectives**. It considers the interrelationship and interactions between distinct parts of an organisation, and between the organisation and its environment.

Source: Oxford Dictionaries; Economics and Management University of Oxford

Management in engineering

Engineering Management professionals are engineers with the advanced knowledge and skills both technical and managerial in managing engineering activities and organizations.

How to become one that can effectively take on an ever changing landscape? And if the landscape is dynamic is there indeed any value in management?
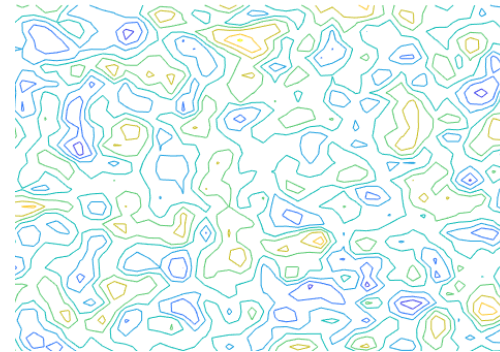
Value of management

- There is the belief **that competition will drive badly managed firms out** of the market. As a result any residual variations in management practices will reflect firms' optimal responses to differing market conditions.

- For example, firms in low-income countries may not adopt quality control systems because wages are so low that repairing defects is cheap. Hence, their management practices are not "bad", but the **optimal response** to low wages.

- Management itself can be hard to measure, so it easy to see why such a statement would seem plausible.

- The effect of management is however measurable using specific (commercial) outcome measures.

Source: http://www.nber.org/papers/w16658

Value of management

- More literature is now measuring different management practices and large variations across entities are found and there seems to be a strong association between the practices and productivity, as well as profitability.

- A range of management approaches are applied throughout the industries.

Source: Lucas (1978, p. 511); MacDuffie (1995), Ichniowski, Shaw and Prennushi (1998), Cappelli and Neumark (2001) and Bloom and Van Reenen (2007).

Snapshot of management practices

	Association of project Management (APM)	Project Management Institute (PMI)	PRINCE2
Feature	Pragmatic approach to project management based on published body of knowledge	Based on detailed body of knowledge	Detailed step-by-step process
Sector	Across sectors (UK)	Applied globally (US focus)	Often seen in IT and product focused sectors (often used in public sector in UK)

Source: 2020projectmanagement

An experiment

A **management field experiment** was conducted in some large Indian textile firms.

The researchers provided free **consulting on modern management practices** to a randomly chosen set of treatment plants and compared their performance to the control plants.

Figure 2: The adoption of key textile management practices over time
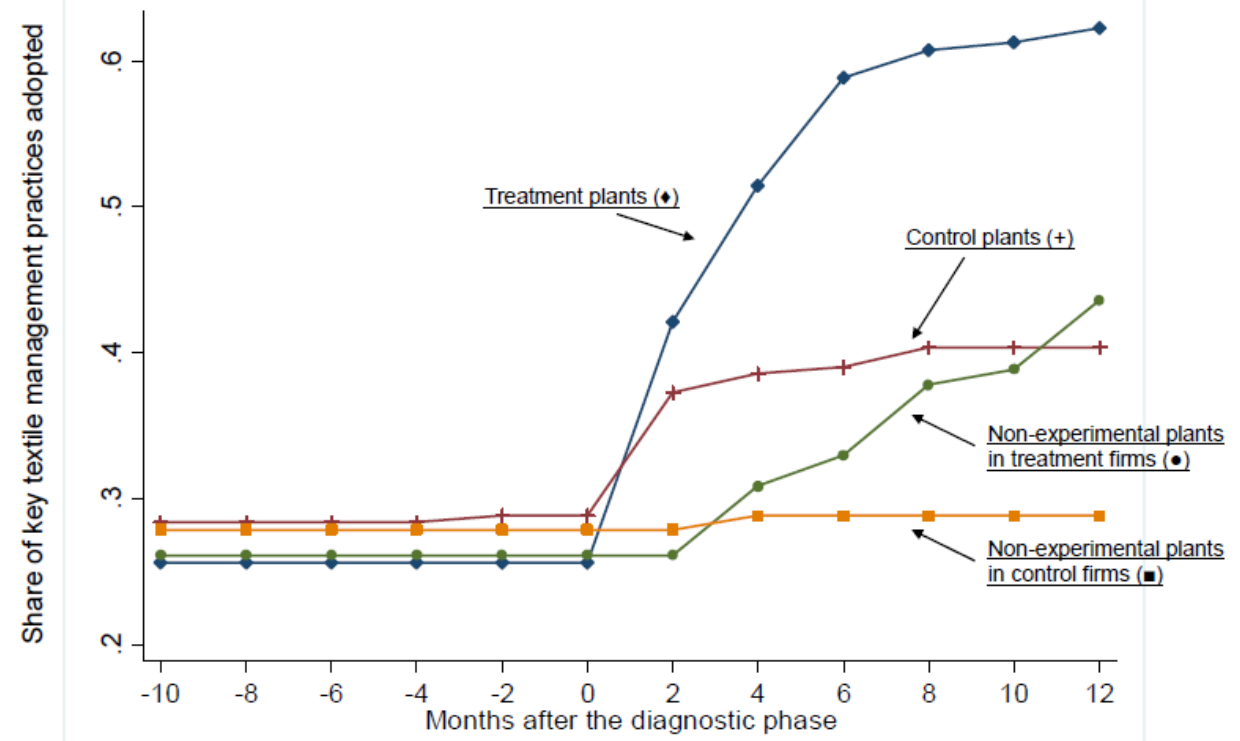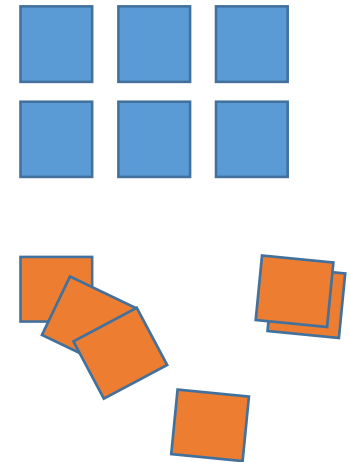
An experiment – management practices

Factory Operations: Regular maintenance of machines and recording the reasons for breakdowns to learn from failures. Keeping the factory floor tidy to reduce accidents and ease the movement of materials

Quality control: Recording quality defects by type, analyzing these records daily, and formalizing procedures to address defects to prevent them recurring.

Inventory: Recording yarn stocks on a daily basis, with optimal inventory levels defined and stock monitored against these. Yarn sorted, labelled and stored in the warehouse by type and color, and this information logged onto a computer.

Human-resource management: Performance-based incentive system for workers and managers. Job descriptions defined for all workers and managers.

Sales and order management: Tracking production on an order-wise basis to prioritize customer orders by delivery deadline. Using design-wise efficiency analysis so pricing can be based on design (rather than average) production costs.

An experiment – outcome

Results of integrating modern management practice:

1. It **raised average productivity** by 11% through improved quality and efficiency and reduced inventory.

Other effects noted:

1. It **increased decentralization of decision** making, as better information flow enabled owners to delegate more decisions to middle managers.

2. It **increased the use of computers**, necessitated by the data collection and analysis involved in modern management.

Source: http://www.nber.org/papers/w16658

Moving to the other end of the scale

How is engineering management affecting start-ups and early SMEs?

The start-up community is actively looking for engineering managers, as there is a growing need of technical management in companies.

Within a start-up the absence of structure might hinder important activities, such as sharing knowledge and team coordination, especially when the company grows.

Providing structure and clarity is important from a management point of view.

Start-up

We define a start-up using the criteria: "new", "active" and "independent". This can be captured as:

"which did not exist before during a given time period (new),which starts hiring at least one paid employee during the given time period (active),3 and which is neither a subsidiary nor a branch of an existing firm (independent)."

(i) Start-ups fail at an early stages and roughly only 1/3 turn into companies, showcasing a high rate of failure

(ii) The failure is due to a range of factors, such as such as limited finance, lack of understanding the need and team management problems to name just a few.

Source: Giardino et al 2014; Vesper, 1990; Núñez, 2007; Michael I. Luger and Jun Koo, 2003

Success factor start-ups

Several studies have documented that the success in small software companies is particularly dependent on having better technical and management practices in (software) processes.

It has been shown that better practices can mitigate some of the most common occurring problems.

Across different segments and entities the effect of good management practice has been shown.

Source: X. Larrucea et al., "Software Process Improvement in Very Small Organizations," 2016; Crowne, "Why Software Product Startups Fail and What to Do about It", 2002

Managing the development process

Process management represents the engineering activities used to **manage product development** in start-ups. Because the flexibility to accommodate frequent changes is essential in the start-up context, agile or lean methods (we will get back to these later in the course).

Several techniques can be applied by the team to be flexible in terms of organisation and idea generation.

We will focus on the often used technique of **brainstorming** to address a problem or question.

Brainstorming - background

Brainstorming is a technique that engineers use to generate, express and organise ideas.

The advertising executive, Alex Faickney Osborn (1888 – 1966), is seen as the person who defined the brainstorming technique.

The rules for brainstorming emphases **quantity** and the prohibition of **evaluation**. These rules were designed to increase the raw number of ideas without particular regard for quality.

Group brainstorming is usually considered a task of divergent thinking.

Brainstorming
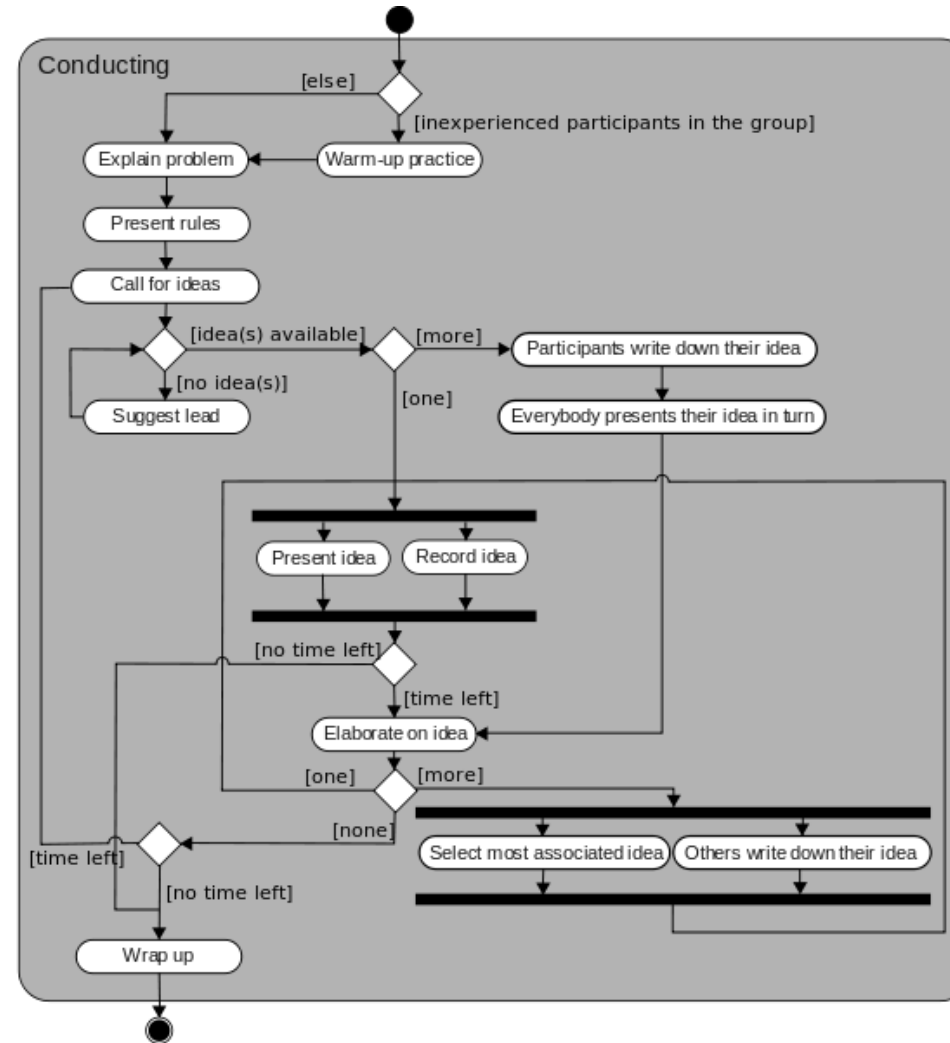
Brainstorm in teams

- Form a team of 2-4

- Use Teams to meet-up

- Pick a colour

Brainstorm in teams

- Brainstorm alternative products that could be made with a piece of metal string (**grey**) or wooden stick (**brown**)

- Mention the idea to the team and write down the idea in the chat function (5 mins)

- Discuss and sort the ideas (cluster, pipeline, etc) - (5 mins).

Brainstorming individually

- Brainstorm alternative products that could be made with the opposite object that you just selected as a team, which was a **piece of string** or **wooden stick**

- Write down your ideas in the team chat (keep to **5 mins**)

- Discus and sort the ideas (cluster, pipeline, etc) and take a picture (5 mins).

Recap

- Which technique did you prefer?

- How many ideas (n) did each team or summed individuals get?

See if $n_{team} = n_{individuals}$

Overview

- "Early in creative acts it's **important to diverge**, that is, to think about what you are doing in as many ways as possible. Later, you want to converge on a small number of paths to follow in more detail."

- "Many techniques use a structure like this. For example, in the 6-3-5 method, six people sit around a table and write down three ideas. They pass their stack of ideas to the person on their right, who builds on them. This passing is done five times, until everyone has had the chance to build on each of the ideas. Afterward, the group can get together to evaluate the ideas generated."

- "There are many variations of techniques like this. What they have in common is that they allow individual work during divergent phases of creativity and group work during convergent phases."

Group brain storming

- Literature has shown that groups produced **fewer ideas** than an equivalent number of individuals working alone (nominal groups).

- A meta-analysis, even found that **interacting groups usually produced poorer ideas in terms of quality** then nominal groups.

- Yet, group brainstorming was **perceived as more effective than individual brainstorming** by both interacting and nominal group members, a finding that extends the illusion of group productivity in brainstorming to tasks of convergent thinking. This might explain the popularity of it throughout industry.

- The effect between standard groups and nominal **groups reduces when brainstorming takes place later in the task** where there is a large amount of accumulated evidence to consider.

- Interestingly, **electronic brainstorming has been found to match that of nominal groups**.

Source: McGlynn et al 2014; Mullen et al. (1991); Gallupe et al (1991)

Electronic brainstorming

Use google docs/teams/e-mail/etc. to brainstorm on a "product" you want to develop and state for which year group.

1. (Anonymously) post you ideas (till 16th at 5pm)

2. Categorise ideas by keyword and eliminate redundant ideas (till 17th at 5pm)

3. Assess quality and rank them (till 18th at 5pm)

4. Select the best one (till 19th at 5pm)

Source: R. Brent Gallupe and William H. Cooper (1993)

Questions?

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