34th Annual INCOSE international symposium

hybrid event

Dublin, Ireland
July 2 - 6, 2024

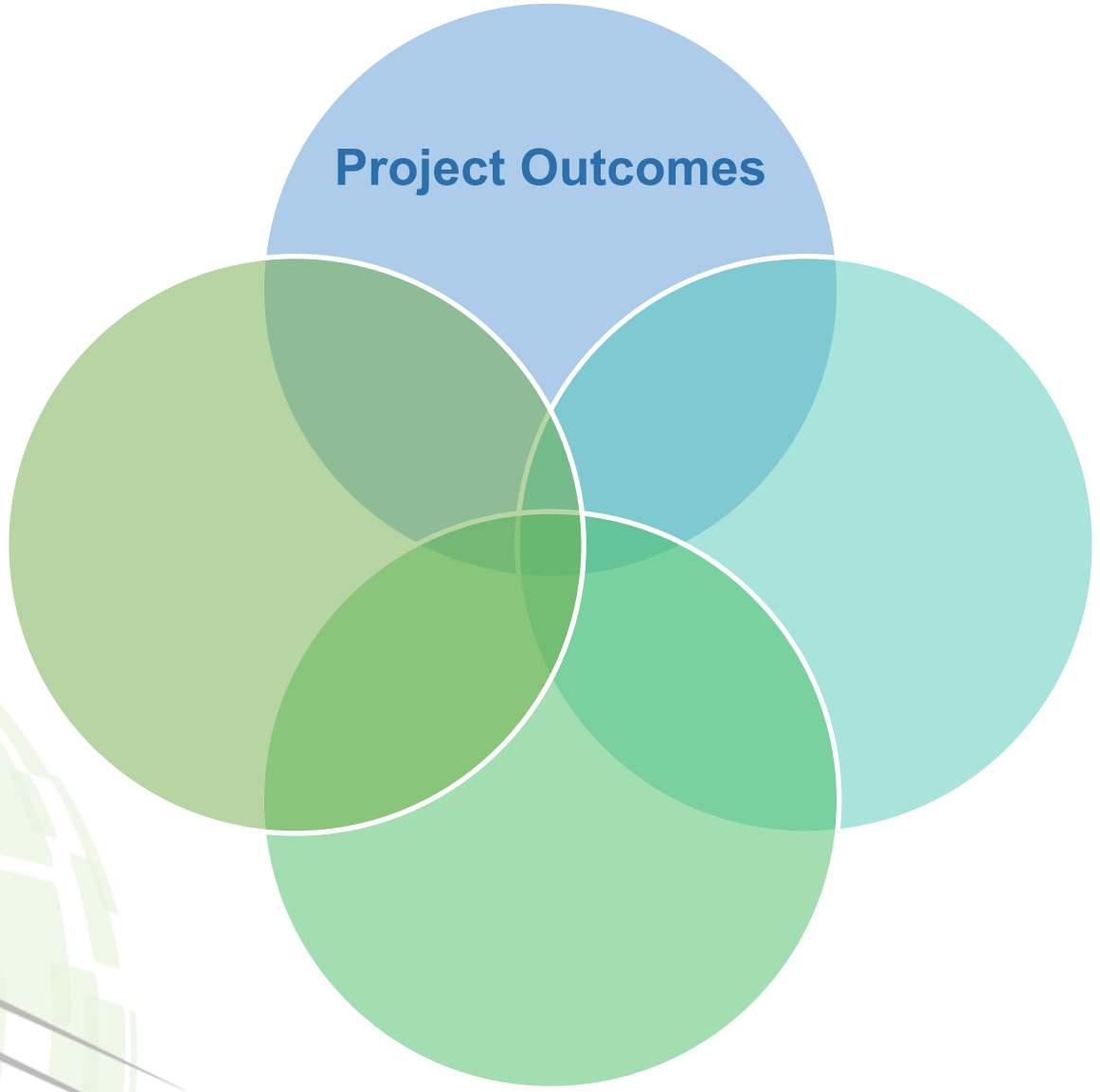
Barry Hawkey and Dr. Marie Vans

Real to Real: Deriving Software Development Practices from Film Production Principles

Theoretical Background

Software Development: Four Interrelated Problems

Software Development: Four Interrelated Problems



Project Outcomes

- McKinsey and the University of Oxford study of 5,600 IT projects found that software projects were, on average *(Bloch et al., 2012)*:
  - 66% over budget
  - 33% over schedule
  - 17% less value than predicted
  - Of all IT projects, software projects have the highest risk of cost and schedule overrun

- Another study of 1,355 public-sector IT project projects found that *(Budzier & Flyvbjerg 2012)*:
  - 18% of custom software development projects
  - 26% of software implementation projects
  - 41% of data management projects
  - …finished more than 25% over budget.

- A more recent study of 617 software development projects found that 36% of projects were unsuccessful *(Khoza, 2020)*.

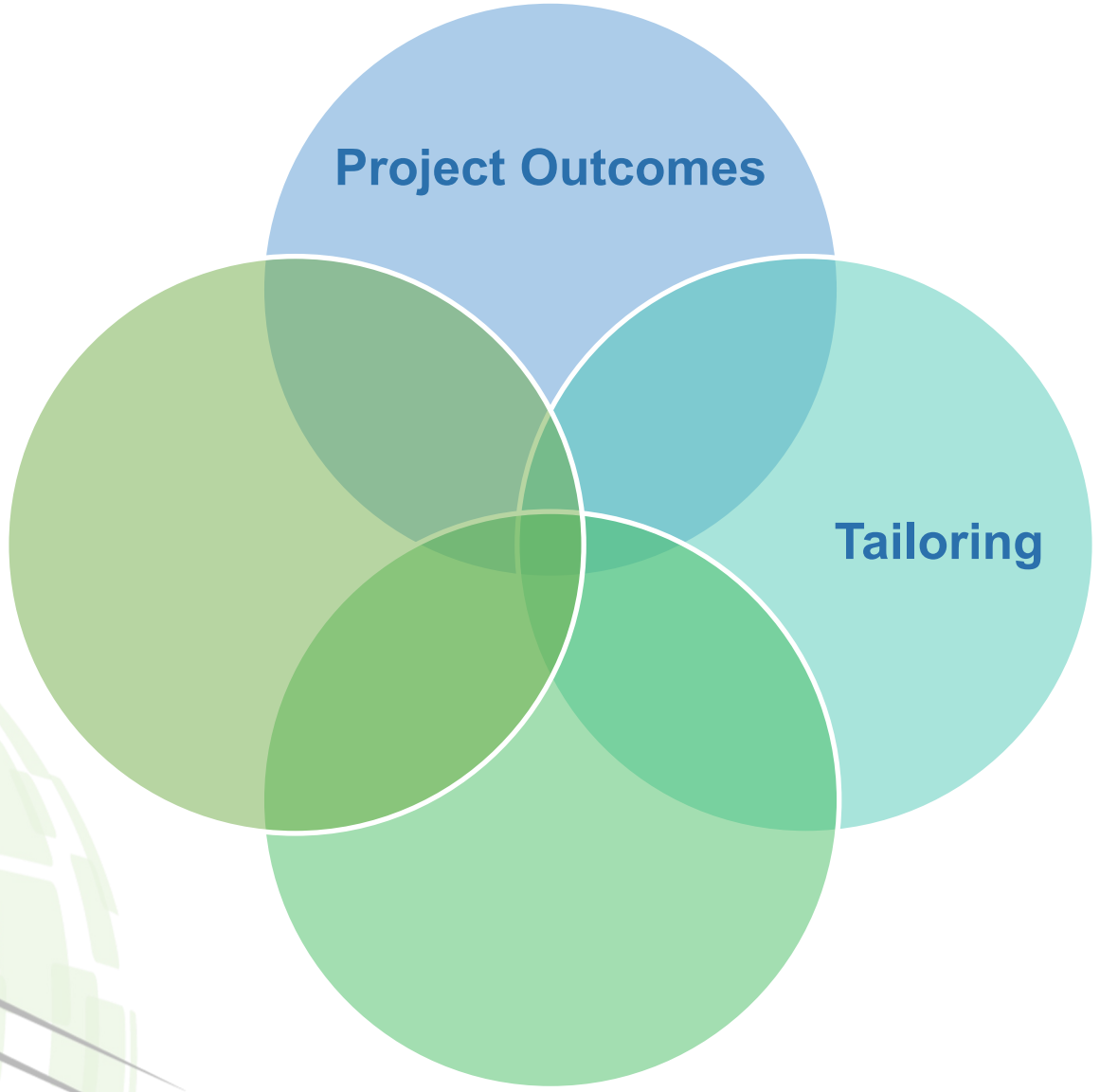
Little Evidence of Improvement Over Time

- An analysis of 5,392 IT projects between 2002 and 2014 found that the size of IT project cost overruns did not vary significantly during that time *(Flyvbjerg et al. 2022)*
  - Agile Manifesto was published in 2001!

- An analysis of 4,227 IT projects found that adaptive methodologies may reduce the risk of schedule overruns, but do not reduce the risk of cost overruns or benefits shortfalls *(Budzier & Flyvbjerg, 2013)*

- Software project success rates have stagnated for the last decade *(Khoza, 2020)*

Software Development: Four Interrelated Problems



Tailoring

- *Predictive* → *Adaptive* → *Hybrid* and *Bespoke*

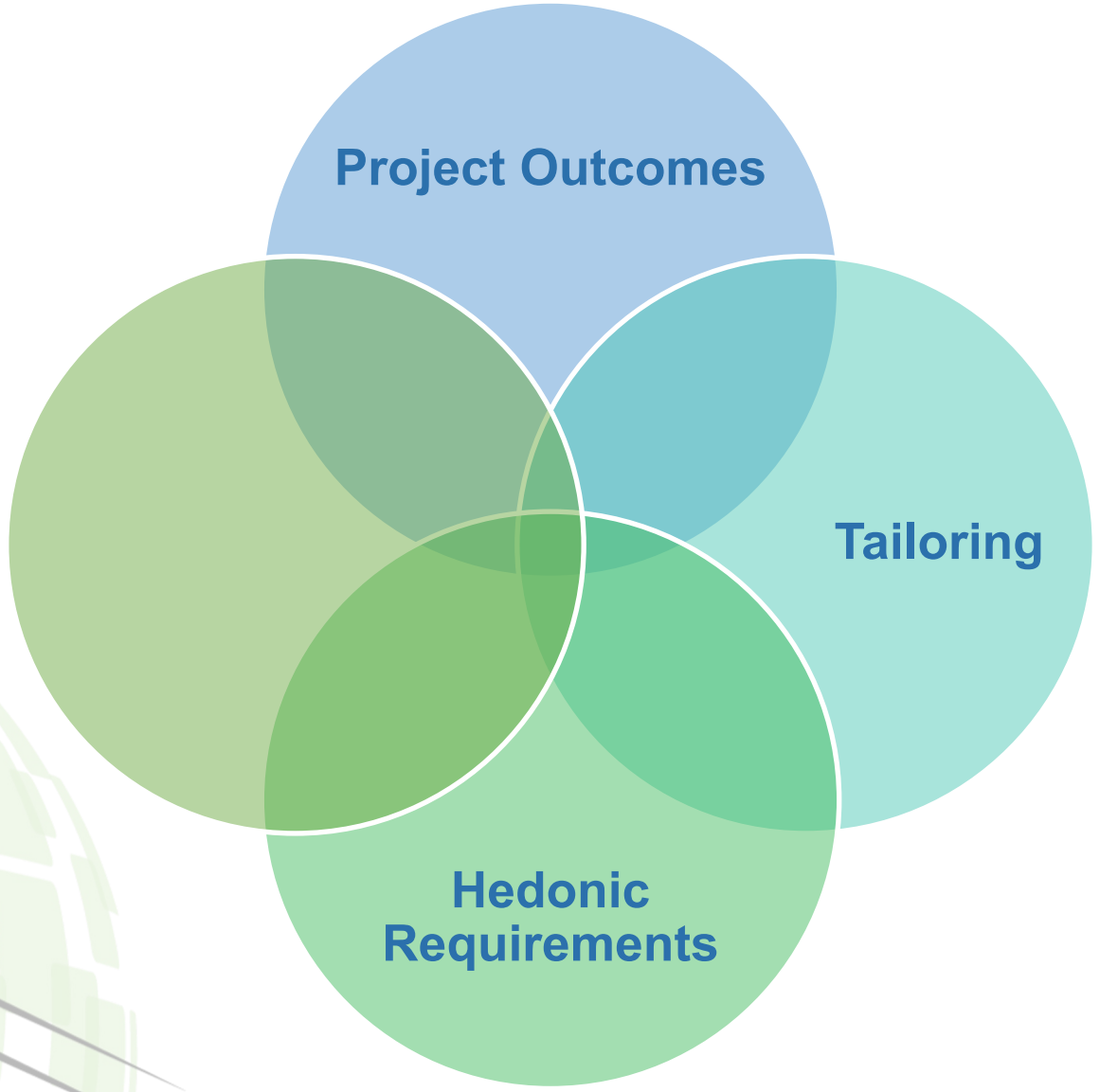
- Better suit the needs of individual projects
- Tailor project methods, artifacts, governance, templates, and more.
  - *(Obeng 1996; Shenhar 2001; PMI 2021)*

- PMI process and guidance is industry-agnostic

Tailoring

- Lack of practical heuristic guidelines for tailoring
- How to match project characteristics to appropriate management practices
- Allow teams to quickly adapt their methods to support current project needs
- “If *this*, then *that*.”
- If your project has *X* characteristics, make sure to spend time on *Y*.

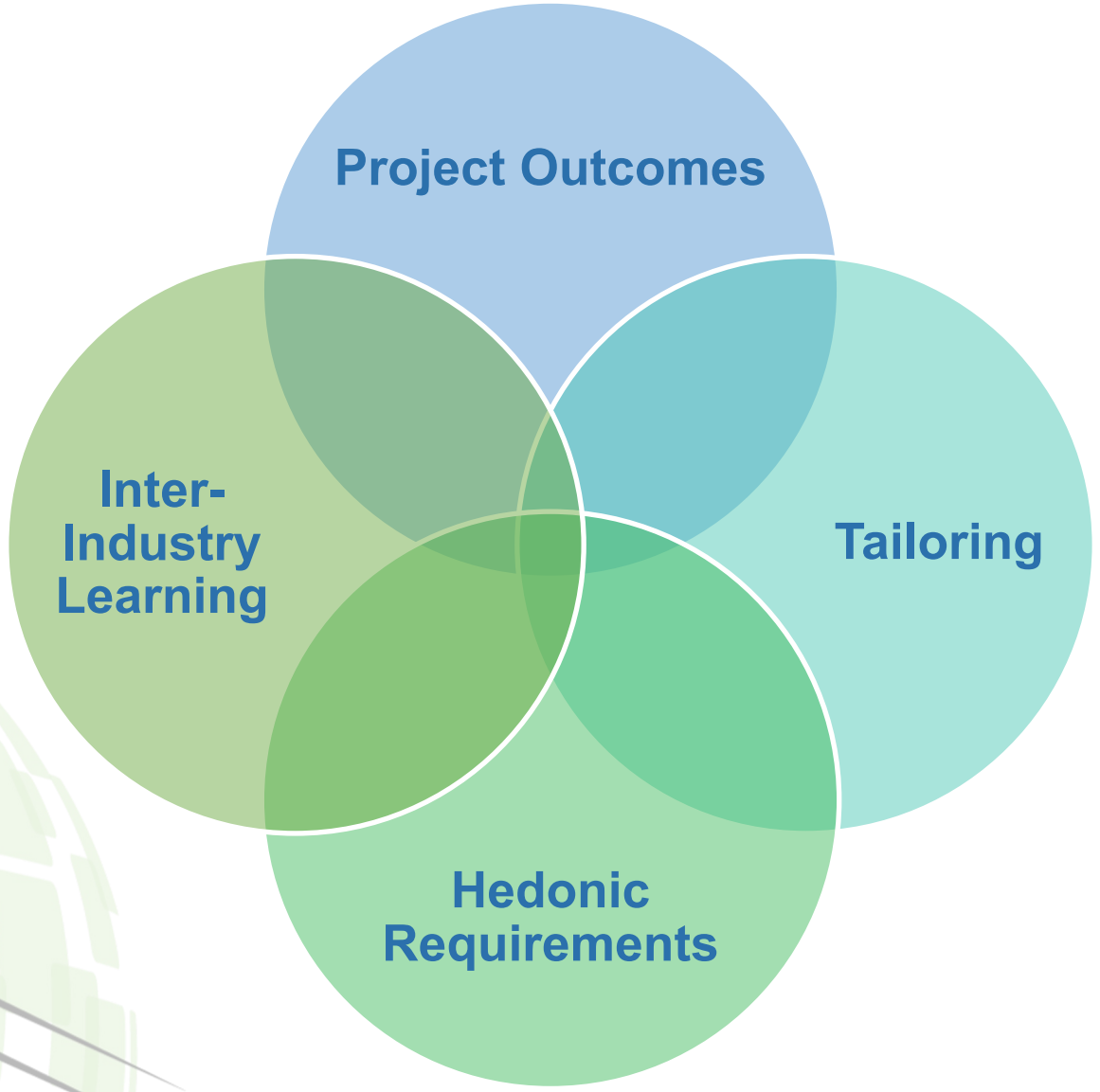
Software Development: Four Interrelated Problems



Hedonic Requirements

- A type of non-functional requirement
- Specify the **intended emotional response** of the user *(Hassenzahl et al. 2001)*
- Subjective and inherently challenging to identify and communicate *(Callele et al. 2006)*
- No established techniques for eliciting hedonic requirements (*Callele et al. 2005)*
- Many software development projects never capture them in any official manner *(Callele et al. 2005)*

Software Development: Four Interrelated Problems



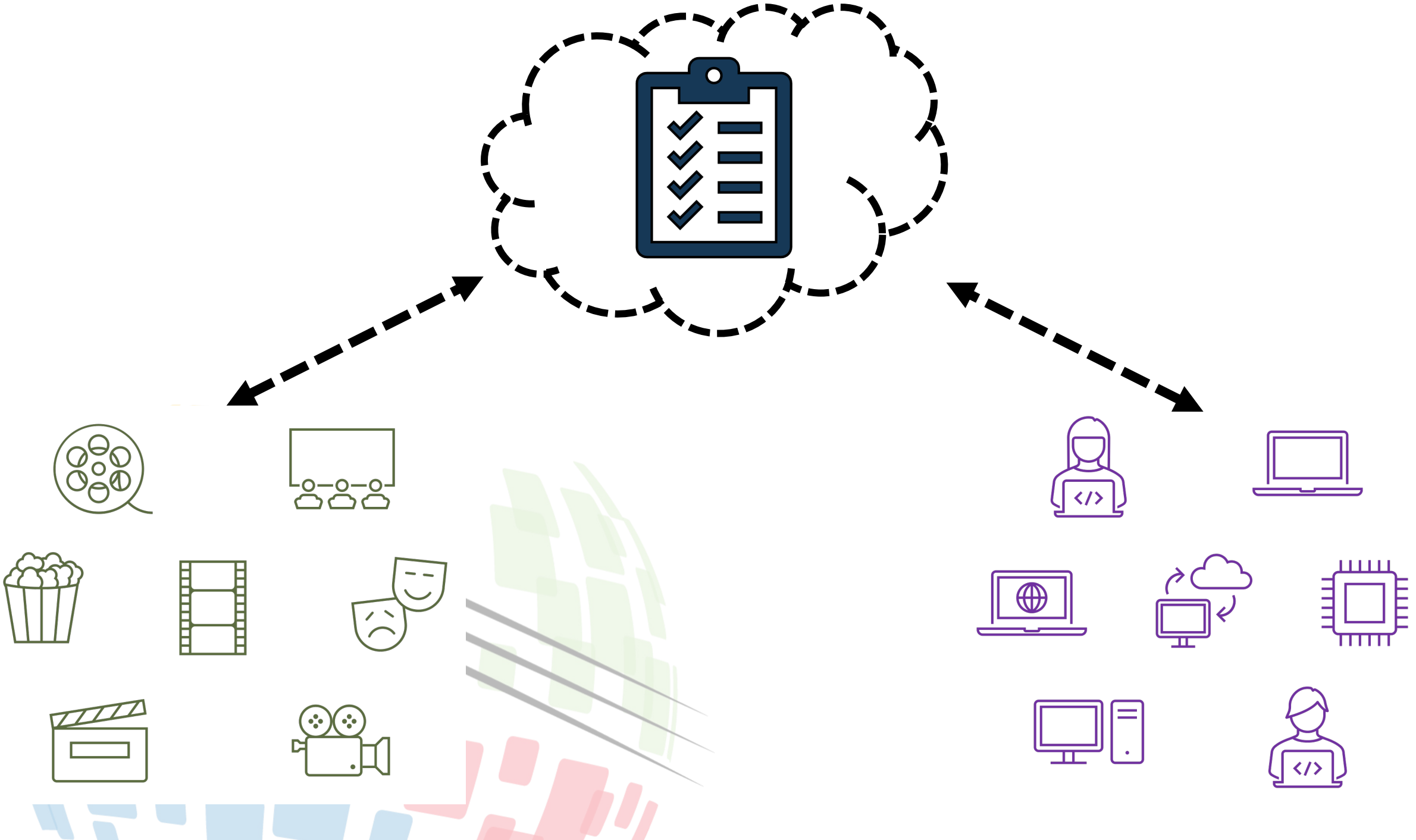
Inter-Industry Learning

- **Inter-Project** Learning:
  - ‘Postmortems’
  - Audits
  - Project Management Office / Center of Excellence
  - Coaching / Mentoring
- **Intra-Industry** Learning
  - Conferences / Journals
  - Trade Shows
- **Inter-Industry** Learning
  - No formal process
  - No process in widespread use
  - Knowledge is ‘siloed’ across multiple projectized industries

Inter-Industry Learning

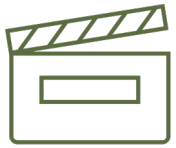
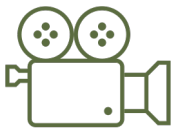
- **From Live Theater Production to Product Development**
  - The Staging Model: The Contribution of Classical Theater Directors to Project Management in Development Contexts (Lehner, 2009)
- **From Software Development to Product Development**
  - Agile-Stage-Gate for Manufacturers (Cooper and Sommer, 2018)
- **From Oil and Gas to Construction**
  - Use of Project Execution Models and Building Information Modeling (BIM) in Oil and Gas Projects – Searching for Relevant Improvements to Construction (Mejlænder-Larsen, 2019)
- **From Manufacturing to Construction**
  - Lean Construction: Fundamentals and Principles (Abdelhamid, El-Gafy, and Salem 2008)

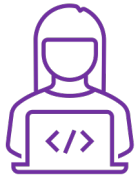

When filming on location, plan for the weather!



Don’t forget your team’s biological needs!

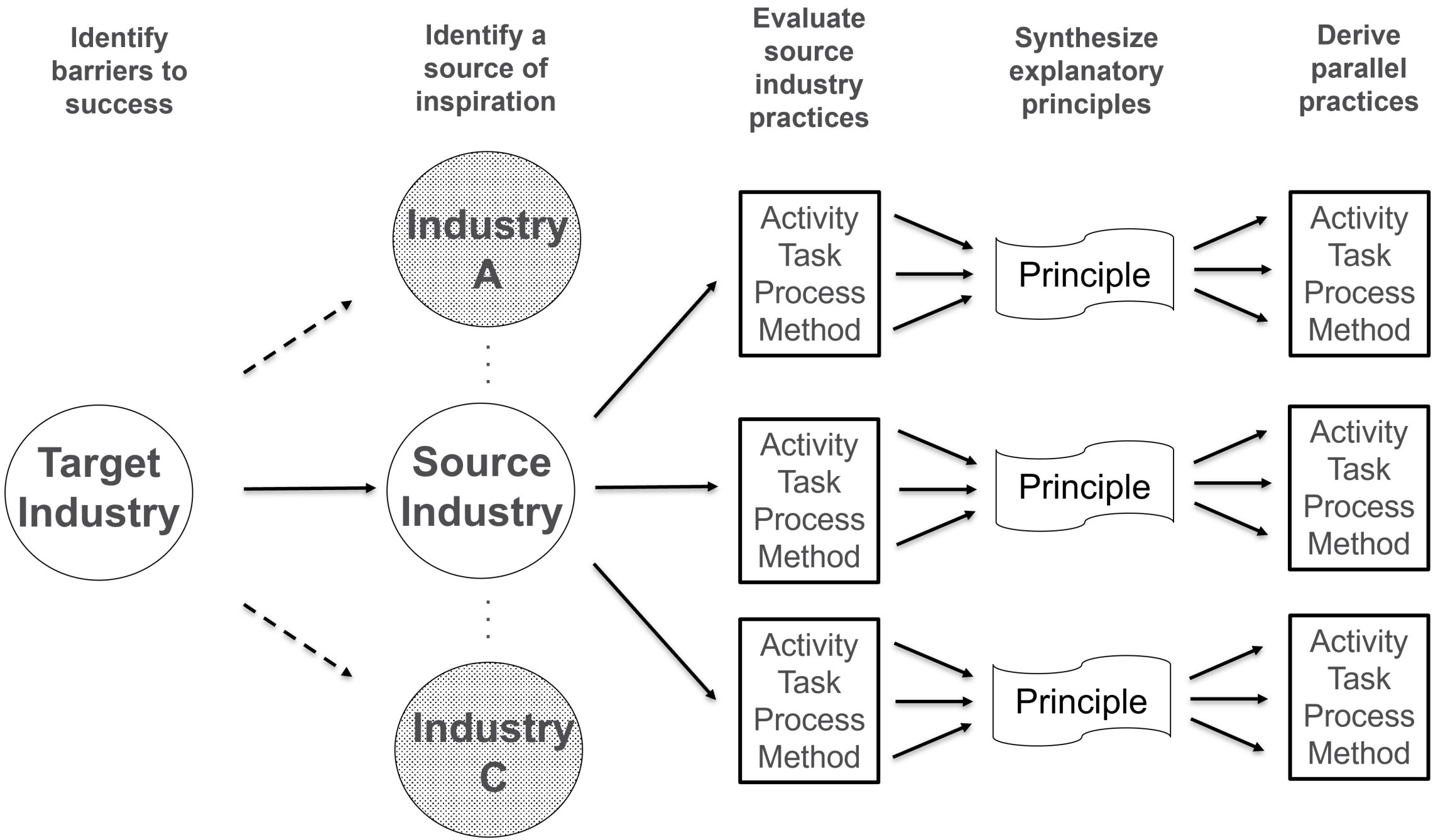

1. Feed crew every 6 hours.
2. Penalties for not feeding crew.
3. Formal process to skip meals.
4. Good catering = happy crew.




1. Ergonomic workstations
2. Regular breaks
3. Make water and snacks available


The Real-to-Real Method



The Real-to-Real Method

1	Asses potential barriers to project success within a **target** industry
2	Identify, as a **source** of inspiration, another industry that has developed different approaches to similar challenges
3	Holistically evaluate project management practices used in that source industry
4	Synthesize a set of explanatory, guiding principles those practices evidently support
5	Identify or develop practices suitable for the target industry which would also adhere to or support these principles

Step One:
Identify Potential Barriers to Success Within a Target Industry

Potential Barriers to Success for Software Development Projects

1. **Software development project outcomes are not improving over time**
2. **We lack practical, heuristic guidelines on tailoring our management practices to fit project needs**
3. **Hedonic requirements are not well addressed by current methodologies**

- **To improve project outcomes, use the Real-to-Real method to look outside of the industry for inspiration on how to tailor existing management practices to better support hedonic requirements.**

Step Two:
Identify, as a source of inspiration, another industry that has developed different approaches to similar challenges

Similarities between Film and Software Projects

- Both develop intangible, experiential products.
- Both intend to address a business need before a fixed and often immoveable deadline.
- Both often require significant investment.
- Both often experience a high degree of change to requirements after development begins.
- Both require collaboration between specialized teams.
- Both require the integration of multiple workstreams.
- Both require careful analysis prior to the start of development.
- Both must be delivered to their target audience in a planned and managed release.

Adapted from Persse, 2008

Step Three:
Holistically evaluate project management practices used in that source industry

Step Four:
Synthesize a set of explanatory, guiding principles those practices evidently support

Literature Review: Film Production

- 93 Total Sources
  - Predicting box office results (22)
  - Exhibition strategies for complete films (17)
  - Project planning (11)
  - Risk management (8)
  - Greenlighting (8)
- Textbooks on film production (4)
  - Film Production Management: How to Budget, Organize, and Successfully Shoot Your Film (Clevé 2006)
  - Film Production Project Management 101, 2nd Edition (Patz 2010)
  - The Complete Film Production Handbook, 4th Edition (Honthaner 2013)
  - Producer to Producer: A Step-By-Step Guide to Low Budget Independent Film Making (Ryan 2017)
- Directly comparing Film Production and Software Development (16)

Film Industry Practices	Principle
Independent film projects often use the same job titles and assigned duties as union film projects.	
The financer, producer, and director formally commit to a film project in writing, with their key responsibilities and schedule clearly defined.	
Apart from unexpected changes, cast duties, expectations, requirements, and schedule are clearly spelled out before they formally join the project.	
Producer; Production Unions and guilds, such as SAG-AFTRA, provide detailed descriptions of job roles and duties.	

Expectation Clarity

Film Industry Practices	Principle
Independent film projects often use the same job titles and assigned duties as union film projects.	**Enable team members to understand their own and other's responsibilities, select suitable projects, and commit to roles in which they will excel.**
The financer, producer, and director formally commit to a film project in writing, with their key responsibilities and schedule clearly defined.	
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Film Industry Practices	Principle
The ‘greenlighting’ decision approves a proposed film project for production.	
Greenlighting calls for detailed cost and benefit analysis.	
Many proposed films are never greenlit for production.	
Very few individuals in each organization have the authority to greenlight a proposed project.	

Rigorous Project Approval

Film Industry Practices	Principle
The ‘greenlighting’ decision approves a proposed film project for production.	**Ensure the use of formal project approval decisions, based on detailed analysis, to authorize project proposals for full development.**
Greenlighting calls for detailed cost and benefit analysis.	
Many proposed films are never greenlit for production.	
Very few individuals in each organization have the authority to greenlight a proposed project.	

Film Industry Practices	Principle
During production, progress and expenses are reported daily or weekly.	
Box office results and industry awards are widely reported in the media.	
Going over budget or over schedule is noticed quickly, and causes discussion and changes to the plan.	
Projects end with a financial audit by a third party.	

Benefits Management

Film Industry Practices	Principle
During production, progress and expenses are reported daily or weekly.	**Estimate, track, and report actual progress, spending, and outcomes.**
Box office results and industry awards are widely reported in the media.	
Going over budget or over schedule is noticed quickly, and causes discussion and changes to the plan.	
Projects end with a financial audit by a third party.	

Film Industry Practices	Principle
The script breakdown turns the script into call sheets, shooting schedules, location lists, and others.	
Changes to the script are printed on new colors of paper.	
Scripts all use the same formatting.	
All film projects use a set of documents that are familiar to the cast and crew, such as call sheets, shooting schedules, production reports, etc.	

Linked Boundary Objects

Film Industry Practices	Principle
The script breakdown turns the script into call sheets, shooting schedules, location lists, and others.	**Improve communication and collaboration by using a set of standardized documents and by tracking revisions.**
Changes to the script are printed on new colors of paper.	
Scripts all use the same formatting.	
All film projects use a set of documents that are familiar to the cast and crew, such as call sheets, shooting schedules, production reports, etc.	

Verification:
Interview Series #1 - Film Producers

Interview Goals

1. Verify our understanding of each practice
2. Verify the near-universal use of each practice in the film industry
3. Confirm the relationship between each practice and the principle that it best supports.
4. Confirm that the principles, as we have defined them, accurately synthesize each set of practices

Film Producer Interviews

#	Title	Years of Experience	Duration (h:mm)
1	Production Supervisor	15	0:53
2	Producer	15	1:45
3	Production Supervisor	15	0:46
4	Producer; Production Manager	23	1:20
5	Production Supervisor; Production Coordinator	13	0:40
		81	**5:40**

Film Producer Interviews

- Average of 16 years of experience
- Minimum of 13 years

- Three participants have held production roles on one or more Oscar-winning films
- One participant was currently producing a film at a ‘major’ Hollywood studio
- One participant’s career included production roles on films which earned >$10B in total box office returns

Film Producer Interviews

Principle	% Matching
Expectation Clarity	100%
Benefits Management	100%
Rigorous Project Approval	95%
Linked Boundary Objects	98%
Average	**98%**

Step Five:
Identify or develop practices suitable for the target industry which would also adhere to or support these principles

Expectation Clarity

Principle	Software Development Industry Practices
Enable team members to understand their own and other's responsibilities, select suitable projects, and commit to roles in which they will excel.	Use standardized roles, titles, and responsibilities.
	Define and document roles and responsibilities.
	Provide access to role and project details before hiring or assigning team members.

Expectation Clarity

- Participation in selecting project goals and strategy has been found to significantly improve performance *(Locke and Latham, 2002)*
- Mandated goals can result in reduced enthusiasm on the project team *(Bryson, 1993)*
- Higher levels of team member commitment are associated with project success *(Ehrhardt et al. 2014; Buvik and Tvedt, 2017)*
- Affective Commitment: A greater acceptance and belief in project goals, and a greater willingness to engage with the project (*Buvik and Tvedt, 2017).*

Rigorous Project Approval

Principle	Software Development Industry Practices
Ensure the use of formal project approval decisions, based on detailed analysis, to authorize project proposals for full development.	Project approval (Go / No-Go) decision is a competitive and highly selective filter.
	Limit funding and staffing before project approval (Go / No-Go decision)
	Use a formal project approval (Go / No-Go decision) process.
	Centralize project approval (Go / No-Go decision) authority in a few key decision-makers.
	Conduct a detailed ROI analysis before project approval (Go / No-Go decision).

Rigorous Project Approval

- Risk Management: A competitive filter, attempting to ensure only projects with the highest potential for success are approved
- Clarity on which projects have been approved limits risks of team members ‘working ahead’
- Careful estimation of project costs, risks, and benefits
- Each year, over 15,000 screenplays are registered in the US, but only 700 are approved for production, a rate of less than 5% *(Eliashberg, 2007)*
- Every film producer’s office accumulates project proposals that failed the greenlighting decision, but all major studies archive enter “floors full *(Persse, 2008)*.”

Benefits Management

Principle	Software Development Industry Practices
Estimate, track, and report actual progress, spending, and outcomes.	Define overage thresholds that trigger corrective action when a project goes over budget or schedule.
	Report progress and expenses frequently.
	Conduct and publish a final accounting of expenses and delivered scope.
	Measure and report actual delivered benefits.

Benefits Management

- Value creation, benefits management, business value, and benefits realization all have overlapping definitions and have been used interchangeably in the literature *(Laursen and Svejvig, 2016; PMI, 2021).*

- Planning, measuring, and reporting the project's *actual achieved value*.

Benefits Management

- IT Projects using Benefits Management are less likely to experience cost and schedule overruns.

	Percent of Total Projects	Average Budget Overrun	Average Schedule Overrun	Percent with Catastrophic Overruns
IT projects that tracked benefits	**44%**	**6%**	**51%**	**14%**
IT projects that did NOT track benefits	**56%**	**36%**	**119%**	**41%**

Analysis of project success rates for Software Development projects which did and did not track financial benefits. Adapted from Budzier and Flyvbjerg, 2013.

Benefits Management

- Box office results and industry awards
- Wide publication of project costs and delivered value

- A film team begins every project understanding that the results of their efforts will be known or easily discoverable by potential future teammates and employers.

- Normative Commitment: The felt obligation.
- Continuance Commitment: The risk of potential losses.
  - *(Buvik and Tvedt, 2017)*

Linked Boundary Objects

Principle	Software Development Industry Practices
Improve communication and collaboration by using a set of standardized documents and by tracking revisions.	Use formal change control for key project artifacts.
	Use standardized project templates.
	Follow a defined process to propagate changes approved to one artifact to other artifacts.
	Facilitate collaboration by deriving supporting artifacts, such as mockups, from a detailed scope statement.

Linked Boundary Objects

- Collective creativity requires seeking help, giving help, and quickly reframing relevant information *(adapted from Hargadon, 2006)*
- In many organizations, there is a perceived social cost to asking for help *(Hargadon, 2006)*
- Creative workers are likely to resist coordination mechanisms that engineers readily accept *(Edrissat, 2016).*
- Boundary Objects are flexible artifacts that support and satisfy the information requirements of multiple knowledge domains *(adapted from Bechky, 2003 and Star and Griesemer, 1989)*.
- Boundary Objects can encourage cross-boundary collaboration and learning *(Bechky, 2003 and Hargadon, 2006)*

Interview Series #2: IT Project Managers

Interview Goals

1. Confirm the relationship between each practice and the principle that it best supports.
2. Affirm the potential value of each principle and practice within their professional domain

Software Project Manager Interviews

#	Title (Certification)	Years of Experience	Duration (h:mm)
6	IT Project Manager (CSM)	25	0:34
7	Technical Program Manager (SAFe)	17	0:20
8	Principle Software Solutions Engineer (LSS)	18	0:39
9	Program Director (MAPM)	27	1:00
10	IT Project Manager II (PMP)	5	0:42
11	Technical Program Manager (None)	24	0:41
		116	**3:56**

Software Project Manager Interviews

Principle	% Matching
Expectation Clarity	100%
Benefits Management	96%
Rigorous Project Approval	87%
Linked Boundary Objects	92%
Average	**94%**

Discussion

Construct Definitions

- Short definitions are necessarily reductive
- **Principle**: Benefits Management
  - "Estimate, track, and report actual progress, spending, and outcomes."
- **Practice**: Report progress and expenses frequently
- Must refer to film production practices to understand:
  - Level of detail
  - Frequency
  - Recency
  - Organizational distance
  - Severity and immediacy of corrective actions

Novelty

- If the practices identified through the ‘real to real’ process are the key to managing hedonic requirements, they are *non-obvious* solutions to that challenge
- None directly address ‘emotional requirements’
- All are recommended by various sources…
- ….but are not paired with managing hedonic requirements in the existing literature
- List of ‘all recommended tasks’ is extensive

Value and Future Research

Empirical Validation

- Survey of IT Project Managers
- *“Please recall a recent project that you managed from start to finish, which involved developing or configuring software. You may select a project with any final outcome, whether it was successful, faced challenges, or did not meet its goals.* ***How well do each of the following statements describe management of that project?”***
- Measures project outcomes, the level of hedonic requirements, and use of the 16 practices translated from the film industry.

Value

- We intend to verify the benefit of the identified principles and practices to software engineering
- We aim to provide software engineering teams with straightforward, heuristic guidelines on tailoring their management to better support project needs.
- Software engineering projects with differing levels of hedonic requirements may benefit from adherence to different management principles and the use of differing practices supporting those principles.
- **We also seek to validate the ‘real to real’ process of inter-industry learning in general, potentially allowing for the translation of beneficial practices between other industries and knowledge domains.**

Future Research

- Potential benefits of these principles and practices to MBSE
- Potential benefits of these principles and practices to the technical management process
- Translating software engineering practices to film production
- From construction project management to software engineering projects with low levels of hedonic requirements?
- Event management?
- Emergency response?

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