

University of Maryland

Project Management Symposium

NEXT SESSION

AI-Enhanced Project Estimating, Monitoring, and Forecasting

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PROJECT MANAGEMENT
CENTER FOR EXCELLENCE

A.J. CLARK SCHOOL OF ENGINEERING
Civil & Environmental Engineering Department

This session will be recorded.

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1. Setting the stage



Presentation slant and orientation

- Focus on estimating, monitoring, & forecasting is merely a means to an end
- End: How AI can transform PM as we know and love it
- Coverage applies to traditional and agile approaches
- Shaped by industry and consulting/training/teaching experience
- We will balance
 - Theory and practice
 - Tactical and strategic perspectives
 - Industry and academic considerations
 - Realism and futurism





The AI onslaught

- AI will reduce the need for human work: jobs could be lost!
- Sam Altman's one-person unicorn!
- AI could drastically reduce or decimate human work
- No crystal ball but the tea leaves are clearly visible

Could AI create a one-person unicorn? Sam Altman thinks so—and Silicon Valley sees the technology 'waiting for us'. (Sam Altman is the CEO of Open AI; a unicorn is a start-up that quickly reaches a market valuation of at least one billion US dollars.) ByteDance, SpaceX, and Stripe are some of the most highly-valued unicorns. (ByteDance valuation ~ US\$ 50 billion)



What do the tea leaves portend?

Goldman Sachs Predicts 300 Million Jobs Will Be Lost Or Degraded By Artificial Intelligence

25 million new project professionals are needed by 2030 (PMI 2021)

AI Won't Replace Humans — But Humans With AI Will Replace Humans Without AI (HBR)

Generative A.I. will upend the workforce, forcing 12 million job switches and automating away 30% of hours worked in the U.S. economy by 2030 (McKinsey)

Jobs with a high level of exposure to AI tend to be in higher-paying fields where a college education and analytical skills can be a plus. (Pew Research)

Robots would eliminate 200,000 jobs in the banking industry within the next 10 years (Wells Fargo study)

AI was responsible for 3,900, or roughly 5% of all jobs lost in May 2023 (Challenger, Gray & Christmas)

By 2030, 80 percent of the work of today's project management (PM) discipline will be eliminated as artificial intelligence (AI) takes on traditional PM functions (Gartner)

Kent Walker, Alphabet Inc.'s Top Lawyer: "AI automates tasks, not jobs. We now have more bank tellers than we've ever had before in the United States because ATMs made it cheaper to open up bank branches around the country. Tellers went from just handing out cash to helping customers with loans and other kinds of financial

Sun Tzu "Knows" "thine enemy"
(The Art of War)





Project Management Report Card

- Project failure and dysfunction rates remain alarmingly high
- Rates have not shown statistically significant upward trend
- Investment in projects is a large slice of global GDP (almost 50% according to some reports)
- Trillion-dollar question: Is project management doing its job well?
- Another trillion-dollar question: Could AI save project





Presentation Organization

- Organization:
 1. Setting the stage ✓
 2. Limitations and challenges of current PM estimating, monitoring, and forecasting tools
 3. Potential for AI to address these limitations and challenges
 4. Reading the tea leaves: How might AI warp the project management landscape, near-term and long-term? How might the long-term evolution unravel?



2. Limitations & Challenges of Existing PM Tools



Commonly used estimating, monitoring, & forecasting techniques

- Parametric estimation
- PERT
- Earned Value analysis
- Monte Carlo simulation

Automation and AI are not the same! For example, MS Project and EXCEL can automate some tasks, but they don't have "intelligence".





Technique Limitations*

Technique	Limitations	Perceptions created
Parametric estimation	Formula or function is often a quantitative idealization, so often clashes with practical considerations; “hidden” parameters are often not considered	<ul style="list-style-type: none"> ▪ Limited practical utility of the techniques/profession ▪ Stagnancy and short on thought leadership ▪ Lacking solid theoretical foundation ▪ Borrowed knowledge: inadequate originality
PERT	On shaky theoretical ground unless associated distributions are all normal, which impairs practical utility	
Earned Value Analysis (EVA)	EVA forecasting formulas can overlook trends, seasonality, work performance patterns, external influences, etc.	
Monte Carlo Analysis	Can be misleading if underlying probability distributions (and their parameters) do not reflect reality	

* Apply to traditional and agile approaches equally



Example 1: Regression

Installation Instance	Number of A fixtures	Number of B fixtures	Installation time (hrs)
1	3	4	17.4
2	5	2	16.7
3	4	4	20.5
4	5	7	30
5	6	5	25
6	3	4	16.8
7	5	3	19.8
8	6	4	22

*Regression Equation: Installation time = 1.79 * (# of A fixtures) + 2.58 * (# of B fixtures) + 2.14*

Hence, if one wants the (parametric) estimate for the time it would take to do a job that involved 7 A fixtures and 8 B fixtures, one will plug these numbers into the above equation to get

Estimate: 1.79(7) + 2.58(8) + 2.14 = 35.31 hours

But how reliable is this estimate? Limited pattern recognition.





Example 2: Earned Value Analysis

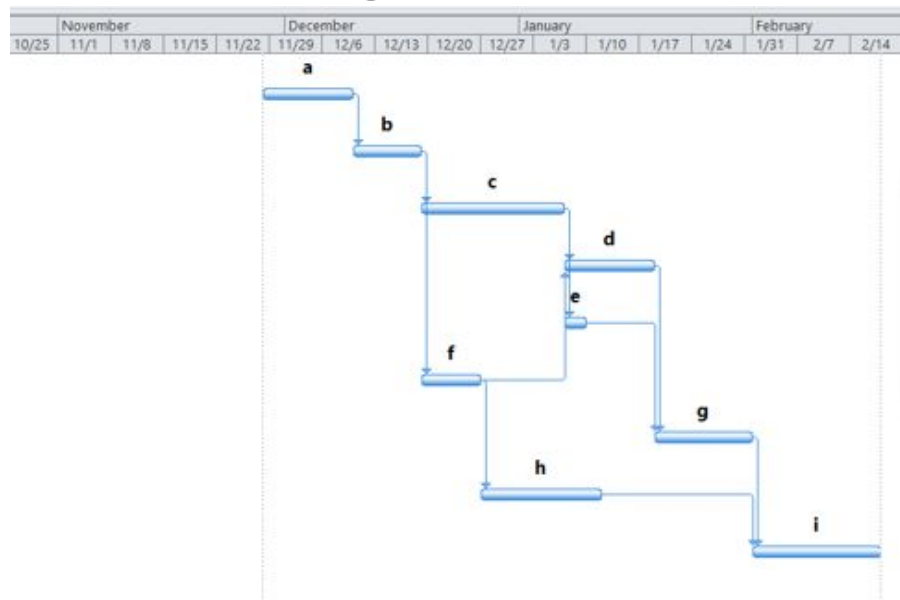


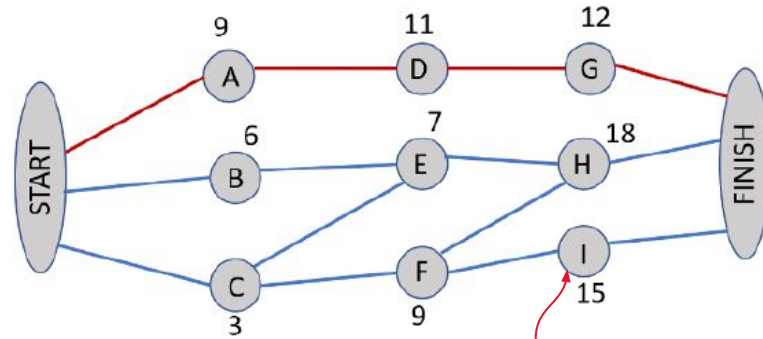
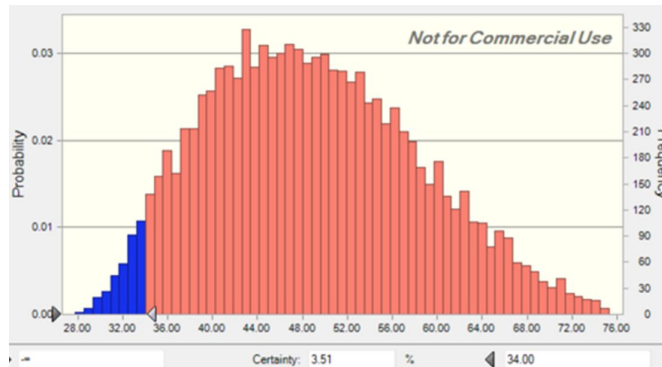
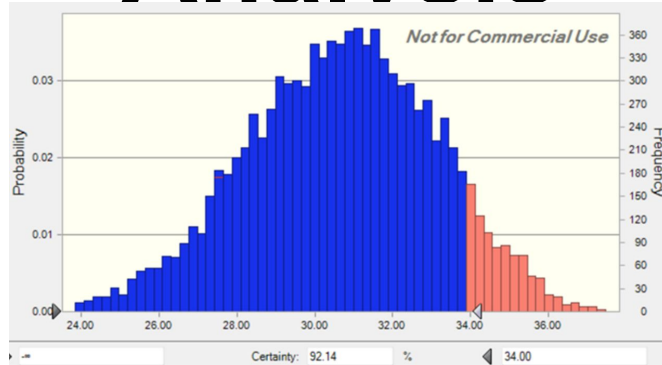
Chart reflects risk-adjusted plan. Suppose SPI in early January is 1.2 (and suppose CPI = 1), so project is ahead of schedule and on budget. Hence, forecast completion date shows early completion.

Why could this forecast be misleading? Again, other variables could confound the forecast, so various influences and hard-to-decipher patterns could be overlooked, seasonality for example.





Example 3: Monte Carlo Analysis



A	D	G	32
B	E	H	31
C	E	H	28
C	F	H	30
C	F	I	27

Duration distributions can have outsized effects on the distribution of the forecast parameter. In this case, the distribution for activity I can drastically alter schedule outcomes. Once again, influences are not captured.



A decorative graphic consisting of three overlapping chevron shapes pointing to the right, colored red, yellow, and black from top to bottom.

Summary of limitations and challenges

- Formulas are limited by the underlying assumptions
- Not all influencing variables and factors are captured
- Resulting computations result in weak approximations
- Margin of error could result in misleading conclusions

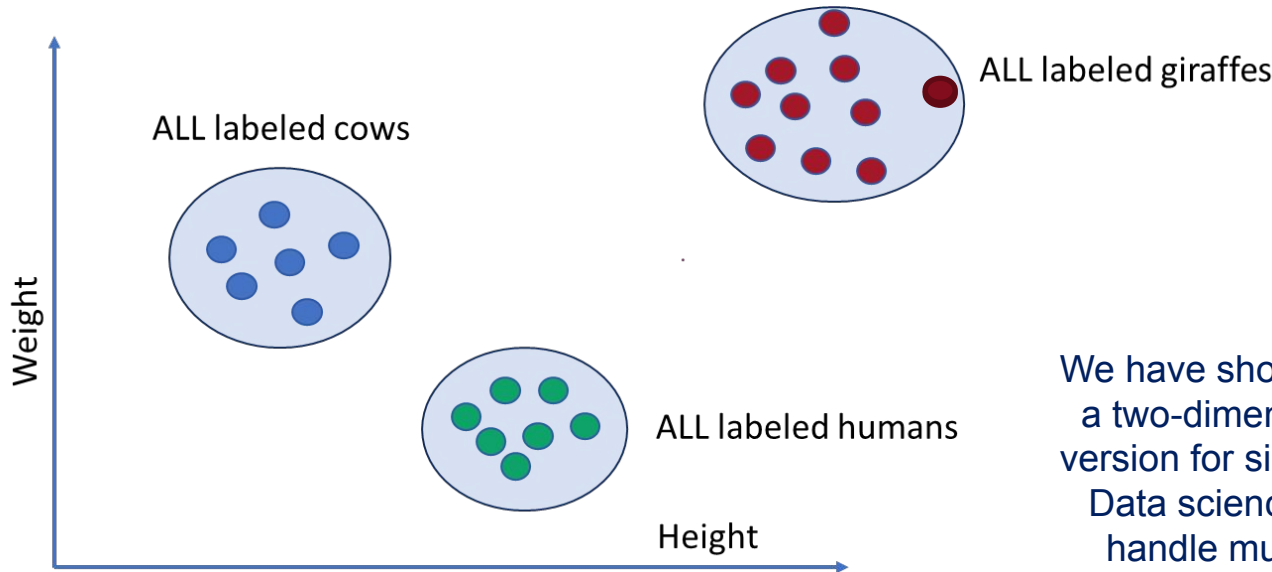
Could these limitations/challenges account for the prevalent project issues, dysfunctions, and lackluster outcomes?



3. Potential for AI to address limitations and challenges



Supervised learning

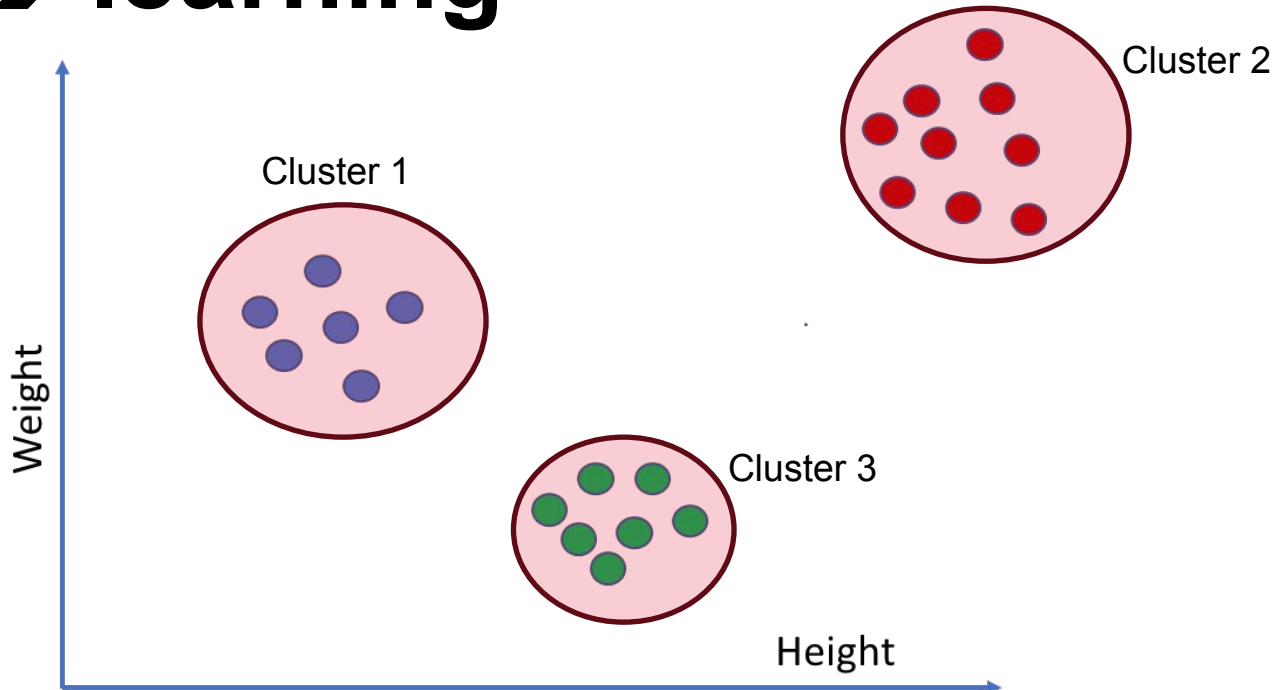


Neural nets are examples of supervised learning. Regression is also a form of supervised learning.

We have shown only a two-dimensional version for simplicity. Data science can handle multiple dimensions.



Unsupervised learning

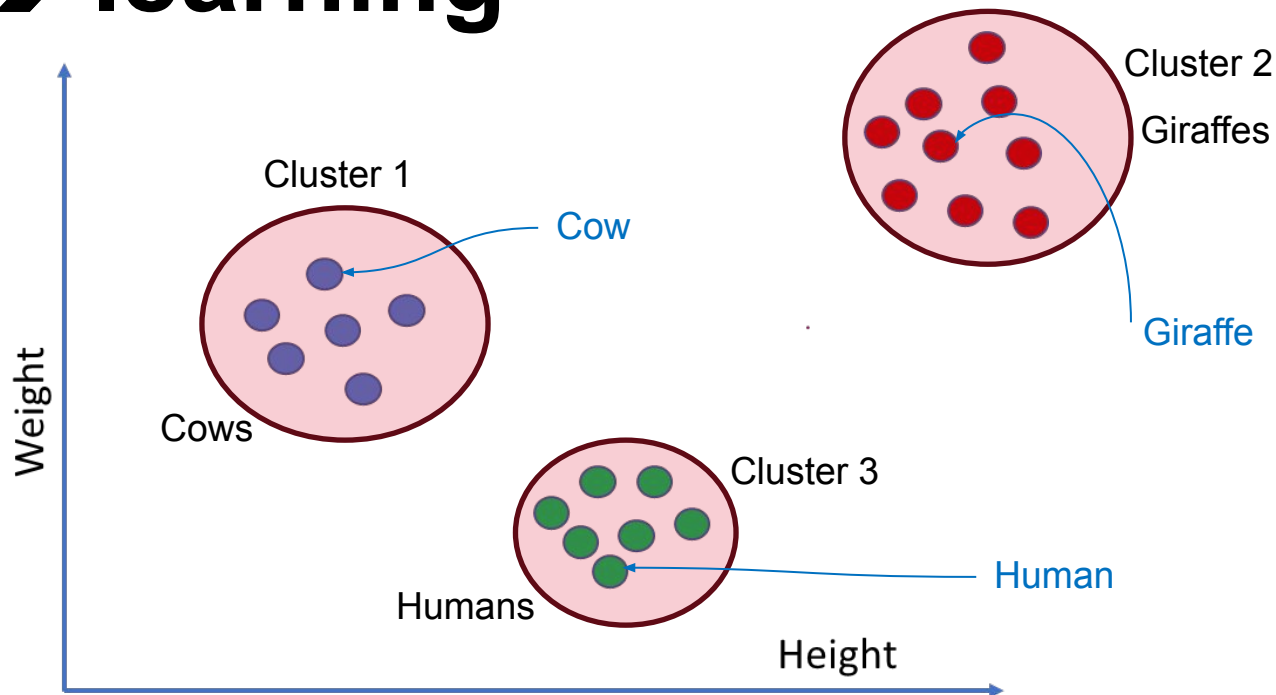


Unsupervised learning includes clustering, anomaly detection, PCA/dimensionality reduction, association rules/recommender systems





Semi-supervised learning

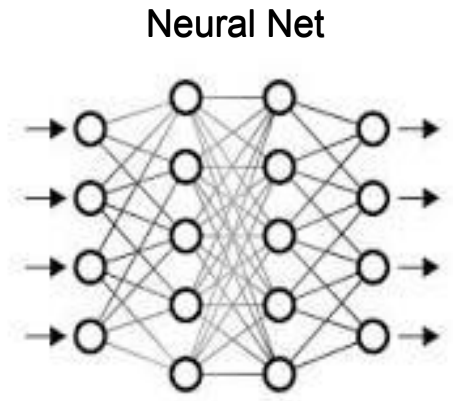
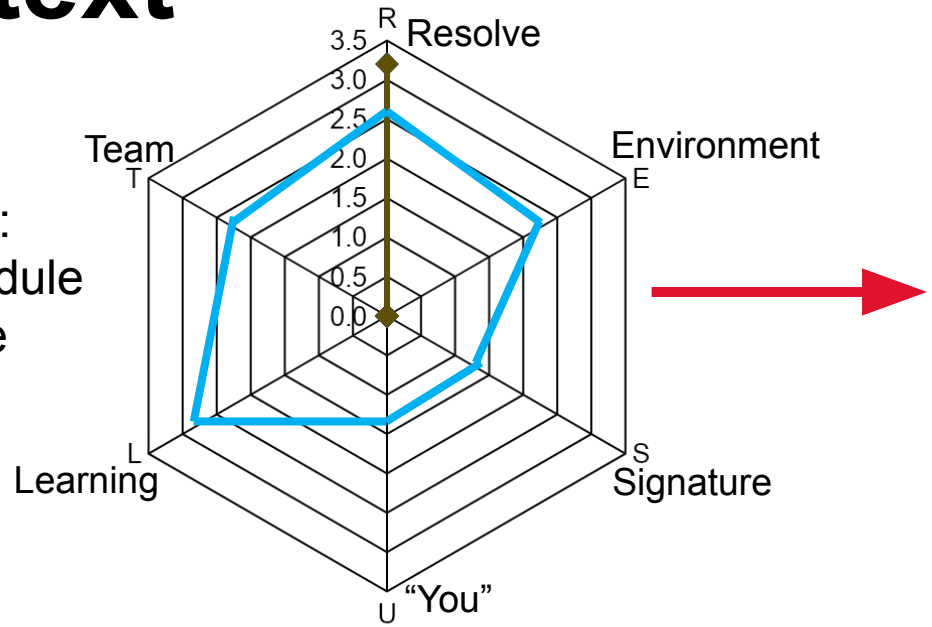


Semi-supervised learning includes fraud detection, content classification, audio and image analysis



Supervised learning – PM Context

EXAMPLE-1:
Predicting Schedule
Performance



Schedule Performance Vector

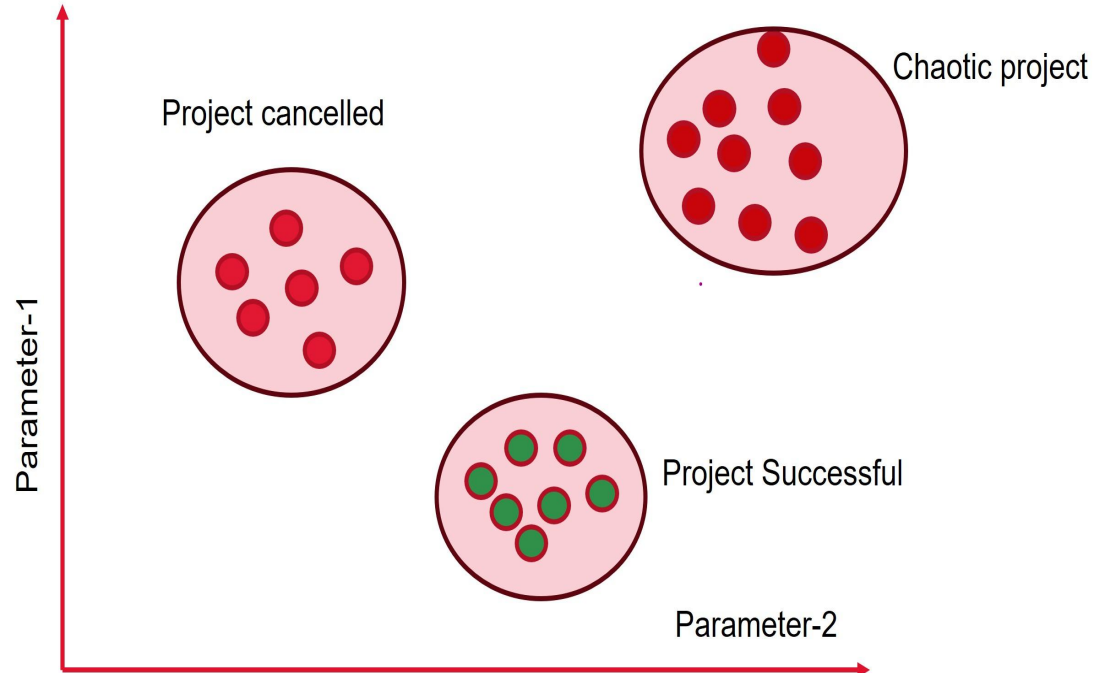
RESULT™ Model for Organizational Transformation





Supervised learning – PM Context*

EXAMPLE-2:
Project classification*

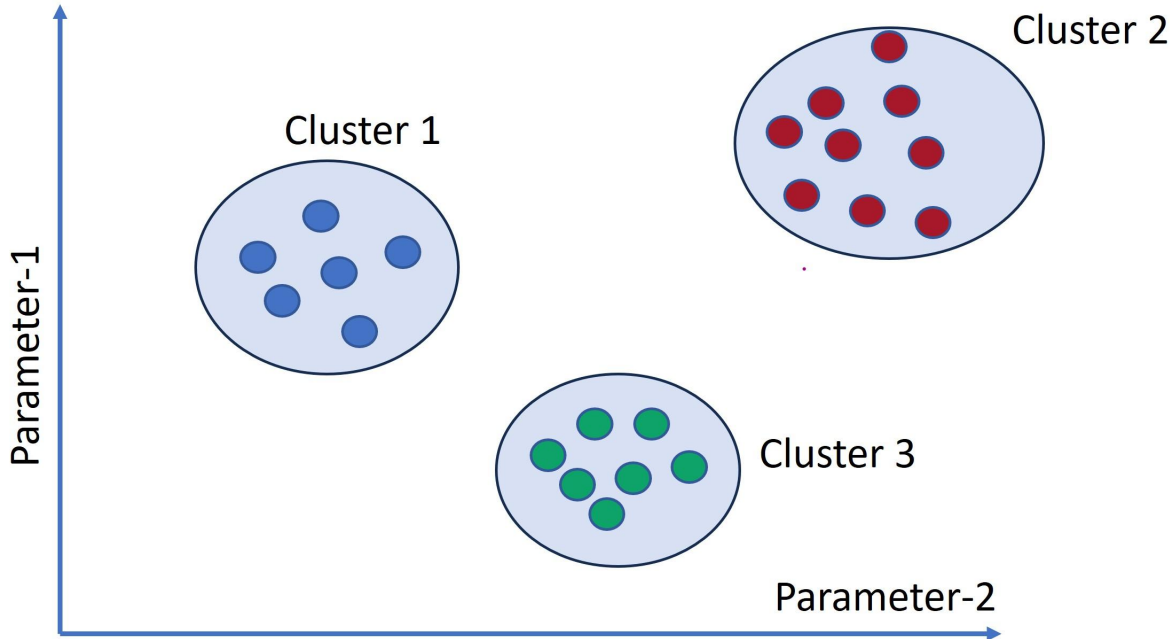


* Can be adapted for stakeholder classification





Unsupervised learning – PM Context




**Characteristics-based
project segmentation**

**More than two parameters
can be handled**

**Semi-supervised learning
is also applicable to PM as
is anomaly detection**



A decorative graphic consisting of three overlapping arrows pointing to the right, colored red, yellow, and black.

Key section conclusions

- AI-based approaches can handle several parameters – hard and soft – unlike current PM tools. Hence realism and applicability are higher.
- AI can enhance existing PM estimating, monitoring, and forecasting tools – as well as other PM tools – to facilitate improved project outcomes
- AI-based approaches could make organizational work more efficient and effective – thereby facilitating organizational transformation
- AI could elevate the PM discipline to incorporate more “*science*” vs. “*craft*”. This science could address broader work challenges



4. Reading the tea leaves: How might AI warp the project management landscape

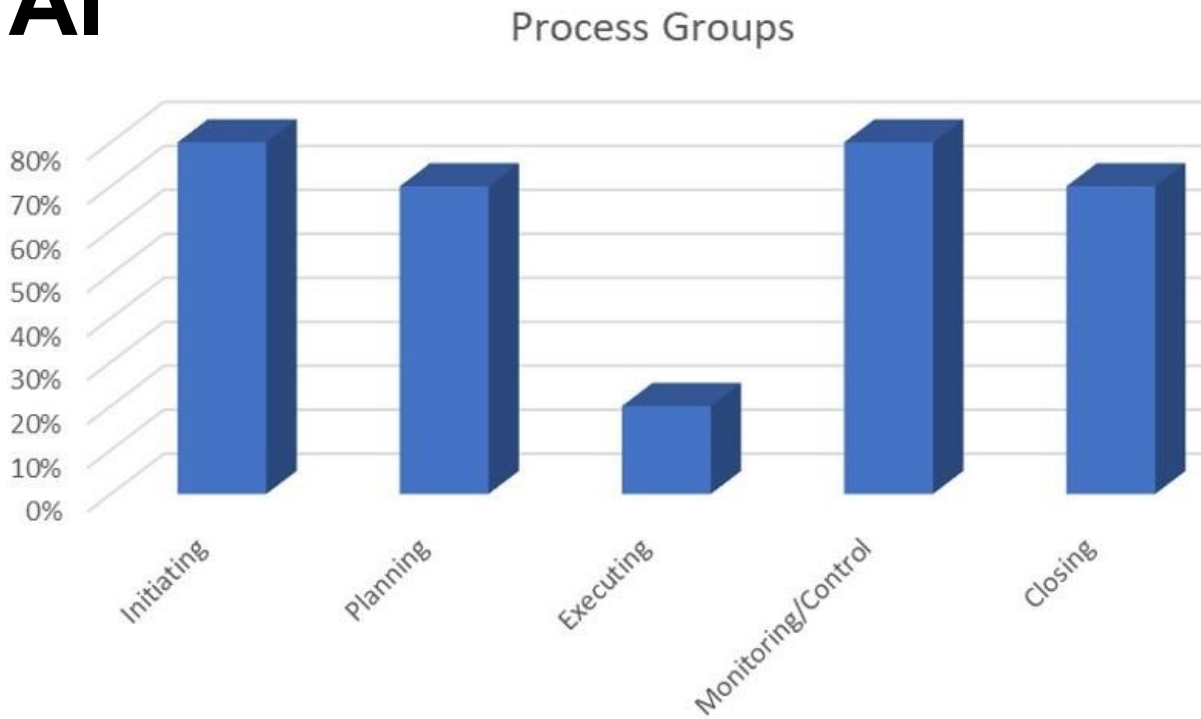


How might AI transform PM?

- Initiating and closing could yield to generative AI
- Parts of planning could also be handled by generative AI
- Use of Retrieval-Augmented Generation (RAG) will grow
- Other AI tools will perform monitoring/control and parts of planning
- Execution will probably hold out against AI the longest, but Robotics/RAG are likely to gradually erode that space as well

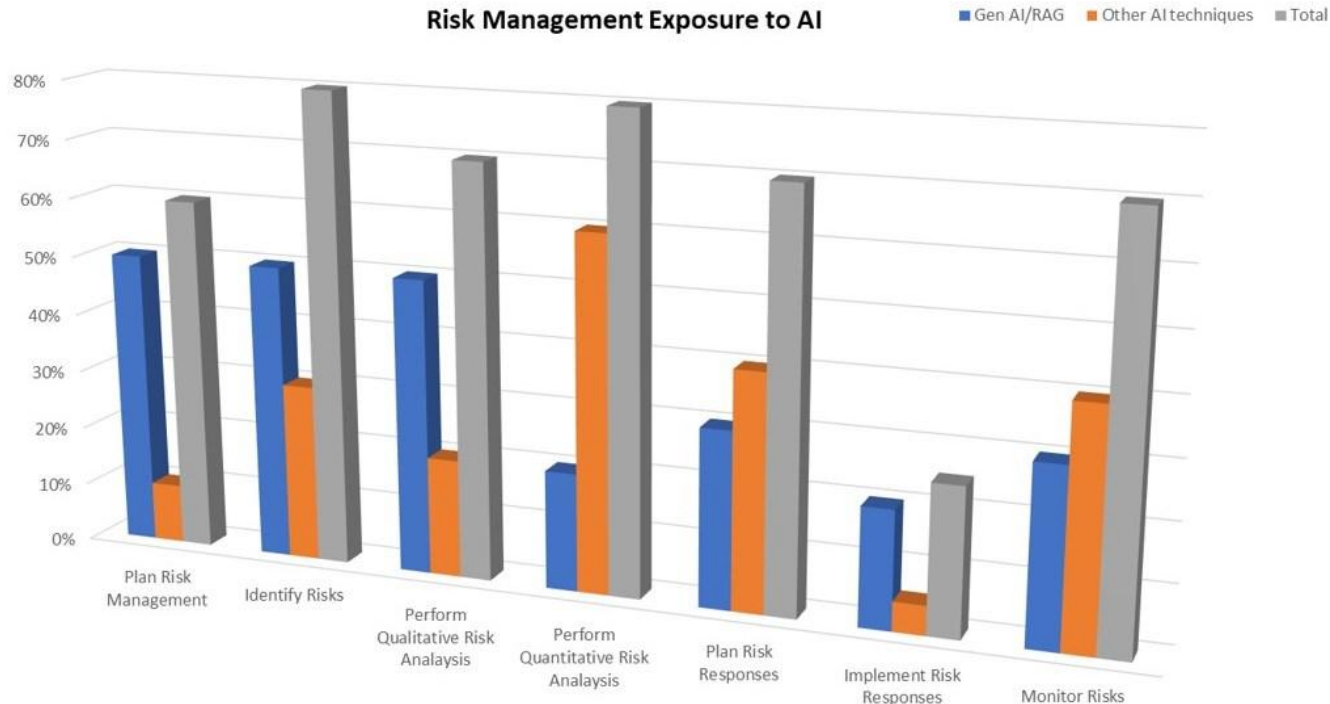


Process Groups exposure to AI





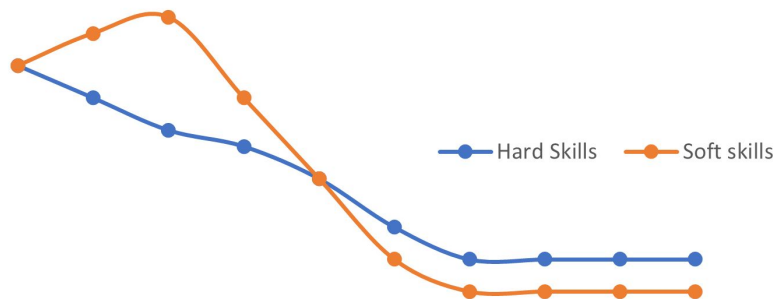
Risk Management exposure to AI





AI Implications for Hard vs. Soft Skills

Need for Hard & Soft **PM** Skills



TIME →

Need for Hard & Soft **ORGANIZATIONAL WORK MANAGEMENT** Skills



TIME →



A decorative graphic consisting of three overlapping, stylized arrow shapes pointing to the right. The top arrow is yellow, the middle is red, and the bottom is black.

Implications for jobs and project managers

- Large proportion of PM job tasks will gradually cede to AI
- PM job reductions likely but not certain over the course of time
- PMs with AI/data science skills are more likely to survive job loss
- PM jobs that remain will create greater value and impact
- PM will permeate work and PMs will be organizational "*work solutionists*"
- PMs more likely to facilitate organizational work transformation than manage individual projects – so their title might change
- New PM role/title will be elevated and salaries higher

Implications for standards and teaching

- PM skillset evolution will necessitate curriculum changes & PM faculty will need reskilling
- Industry will not wait for academia – we need relevant research!
- Partner and co-lead with industry in redesigning curriculum, identifying critical new skills, and creating work solutions
- Develop PM thought leadership (example: have University alliance?)
- Be a catalyst in creating equitable access to high-quality education
- Don't only follow standards but create/influence them as well!
- Get business schools on board and evangelize executives on PM



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3. *Narrowing the Talent Gap*, PMI and PwC Report, 2021
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THANK YOU!

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Questions?





Evaluate Session

