



Strateška preobrazba izvedbe projektov: od modeliranja proizvodnje do javno-zasebnih partnerstev

Ivan Damnjanovic, profesor gradbeništva in okoljskega inženirstva



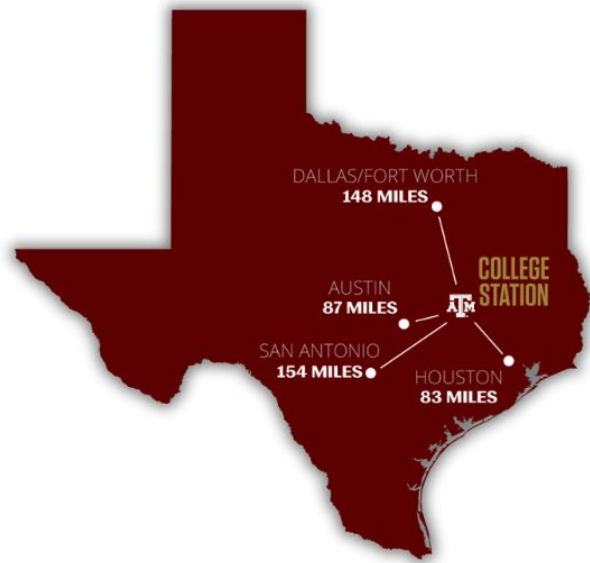
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O Texas A&M





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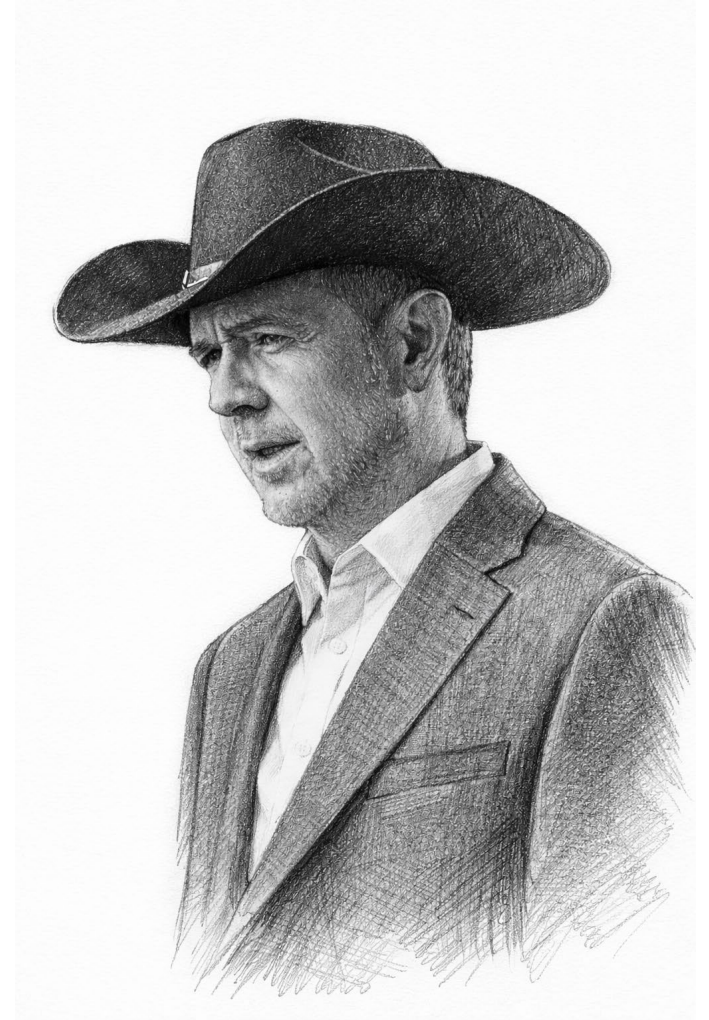
DEL A

**Projektno
vodenje
naslednje
generacije:
poudarek na
proizvodnji**

DEL B

**Javno-zasebna
partnerstva od
fizične do
digitalne
infrastrukture**

*Projektno vodenje
naslednje generacije:
poudarek na
proizvodnji*



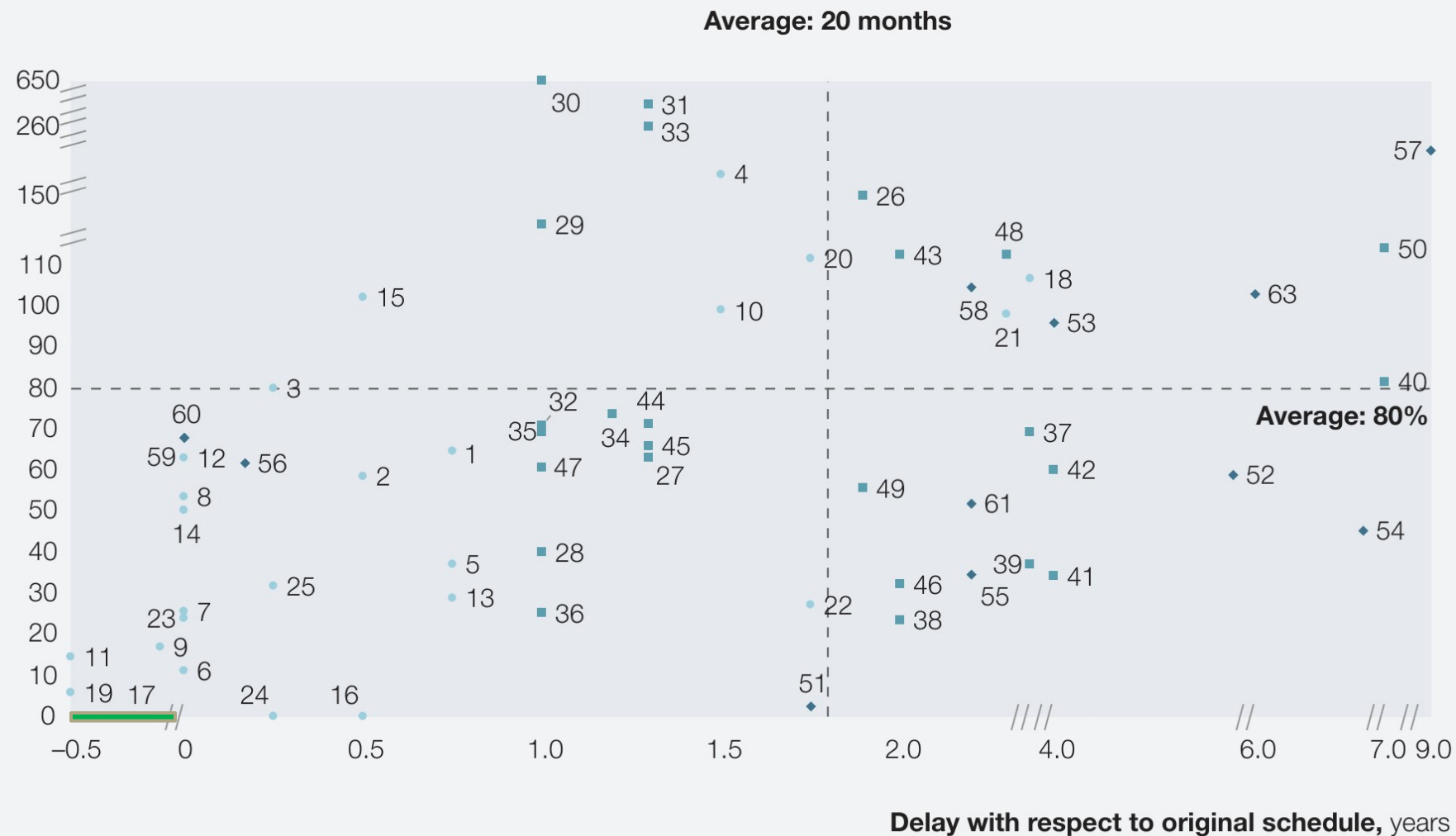
Zgodovinski pregled Nekaj podatkov...

Capital-expenditure overrun

(% of original quoted capital expenditure)

MEGA PROJEKTI

● Mining ■ Oil and gas ◆ Infrastructure



- **98% of projects** incur cost overruns or delays.
- The average **cost increase is 80%** of original value.
- The average **slippage is 20 months** behind original schedule.

Preseganje stroškov in zamude pri izvedbi Več podatkov....

McKinsey & Company (2016):

Skoraj 50 % velikih kapitalskih projektov je preseglo proračun, pri čemer je povprečno preseganje stroškov v višini 43 %.

Več kot 75 % velikih kapitalskih projektov je zaostajalo za časovnim načrtom.

Jergeas & Ruwanpura (2017):

64 % velikih naftnih in plinskih projektov je preseglo stroške.

73 % velikih naftnih in plinskih projektov je imelo zamude glede na

časovni načrt. Flyvbjerg et al. (2020):

66 % kapitalsko intenzivnih infrastrukturnih projektov je imelo presežke stroškov , pri čemer je povprečni presežek znašal 44 %.

61 % kapitalsko intenzivnih infrastrukturnih projektov je imelo zamude v časovnem načrtu.

Zakaj je to pomembno?

- Vsak projekt ima poslovni model
- Ekonomika projekta je zelo občutljiva na čas izvedbe in/ali stroške.

Počakajte ... ampak zakaj?

Izgubljena priložnost za zaslužek („Želim, da bi bil projekt končan že včeraj!“) Obresti na dolg (projekti so financirani do 90 %!!) Zakonski rok

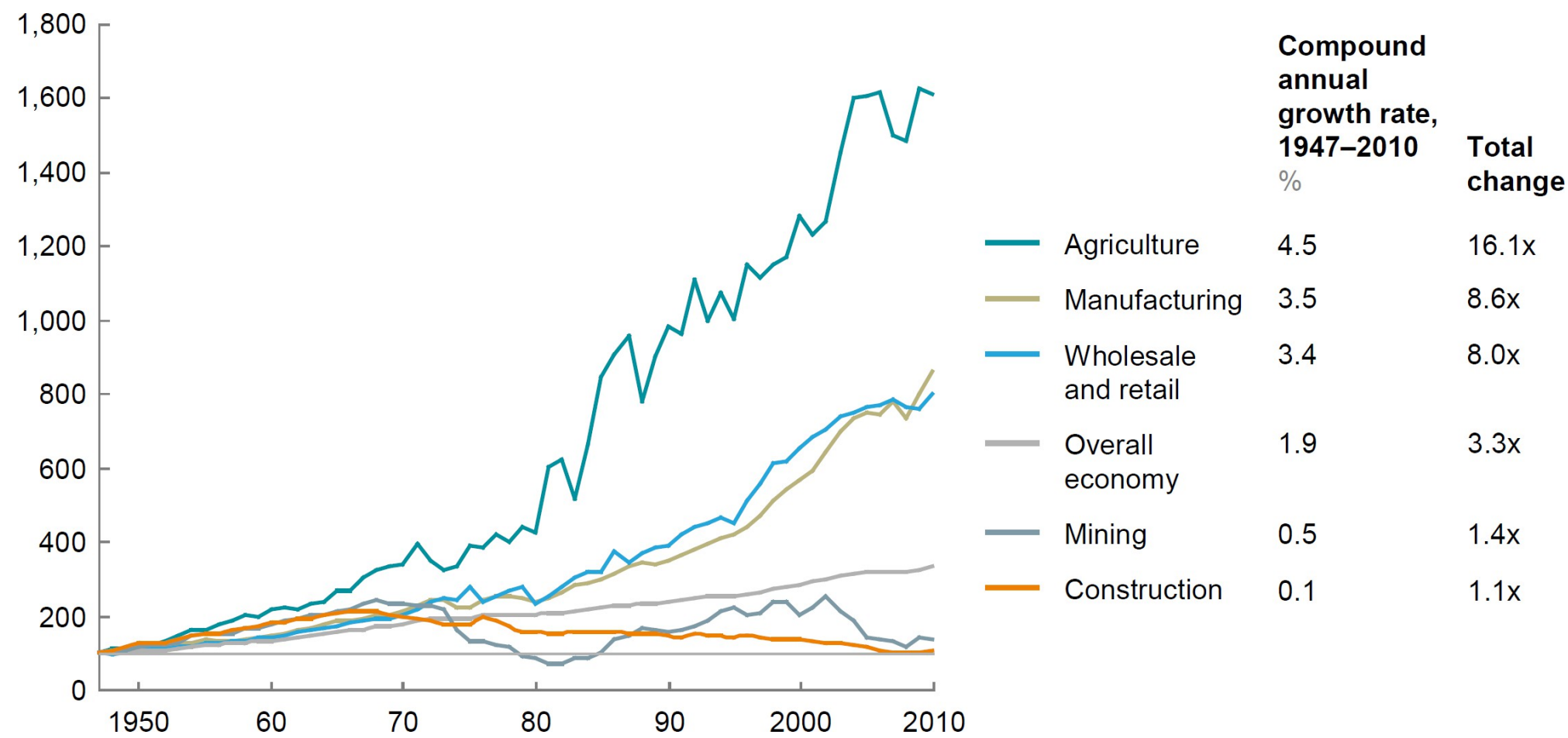
Povzetek

- Skorajda je norma, da projekti presežejo proračun in zamujajo (k temu prispeva več dejavnikov).
- Gospodarska stran projektov pa postaja vse bolj občutljiva na preseganje stroškov, zlasti na zamude v časovnem načrtu.
- Obstaja težnja, da se to tveganje prenese naprej.
- Vpliv je mogoče občutiti na deležnike v projektnih panogah: lastnike, izvajalce, podizvajalce, inženirska podjetja itd.



Kako smo prišli sem?

Zgodba o produktivnosti projekta

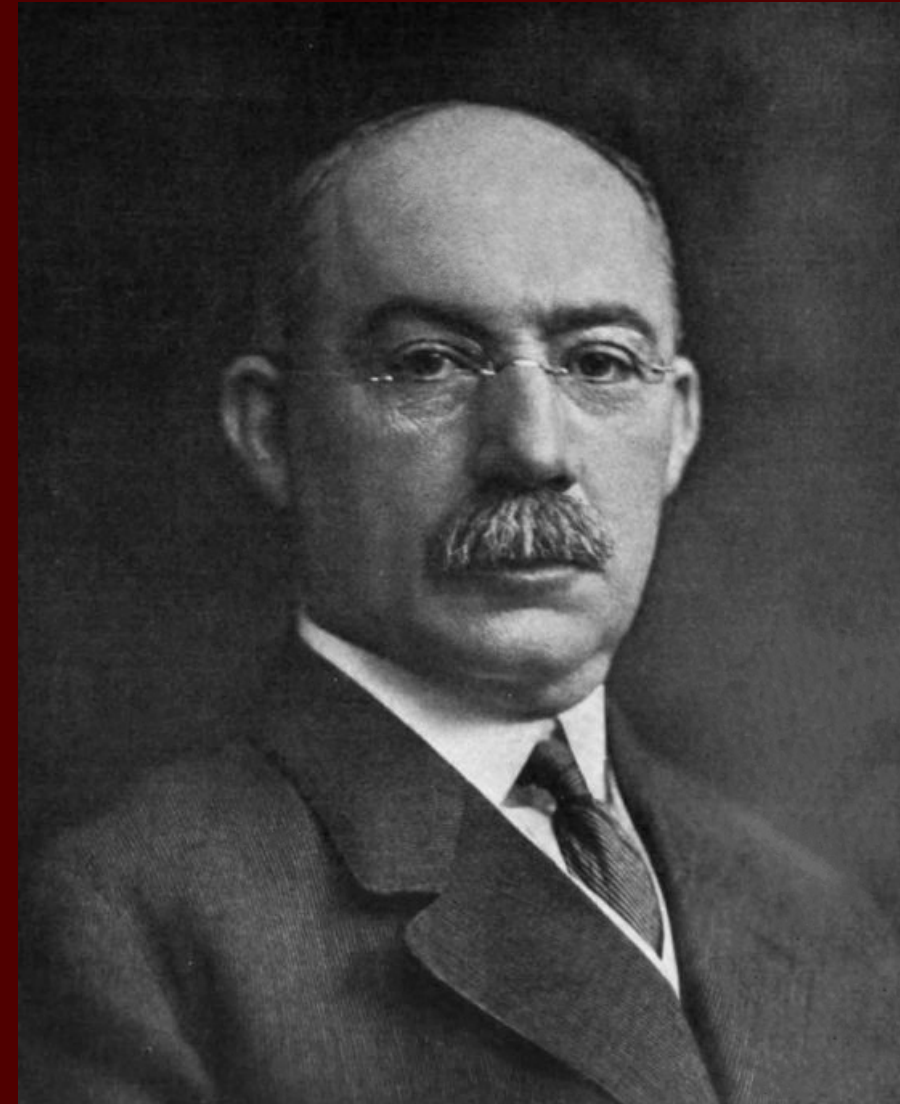


Frederick Taylor in Henry Gantt



FOKUS

- Študije časa in prostora
- Produktivnost nalog
- Ločitev načrtovanja od proizvodnje
- Načrtovanje urnika
- Učinek specializacije (fragmentacija)
- Motivacija delavcev in druge študije vedenja



CPM: James Kelly, Norman Walker in John Fondhal



Poudarek: CPM, PERT, EVM itd.



- Splošni prehod od produktivnosti nalog k predvidljivosti projektov, vendar se nadaljuje ločevanje načrtovanja od izvedbe dela.
- Vzpon projektne organizacije in vloga projektnih vodij pri lažšanju načrtovanja in plačil
 - Načrtovanje WBS in metoda CPM sta pomenila polni obseg velikosti serije in nobenih omejitev virov.
 - EVM, povezan z načrtovanim CPM, je postal računovodska metoda za plačila izvajalcem.
 - Ločitev izvajalcev od načrtovalcev!



„Le redki med tistimi, ki se imajo za „strokovnjake za CPM“, v celoti razumejo dejstvo, da se v časovnem načrtu z omejenimi viri koncept plavajočega časa in pogosto tudi koncept kritične poti sesuje. Ker so skoraj vsi gradbeni projekti vsaj do neke mere omejeni z viri, to postane glavni vir težav“ – John Fondahl



CPM

PERT

EVA

Načrtovanje delovne površine

Napredno orodje za pakiranje
dela Čas

Strategije sklepanja pogodb

Izdelava in montaža zunaj lokacije

Modularizacija Agile/Scrum/Sprint

Preglednice

Orodja za

proizvodnjo AI / ML

Last Planner (LPS) Lean

Integrirana izvedba projekta BIM

Oracle Primavera

Microsoft Project Six

Sigma Lean/Six

Sigma

Teorija omejitev Simulacije

Monte Carlo Predstavitve

WhatsApp / Klepeti Teams

/ zoom

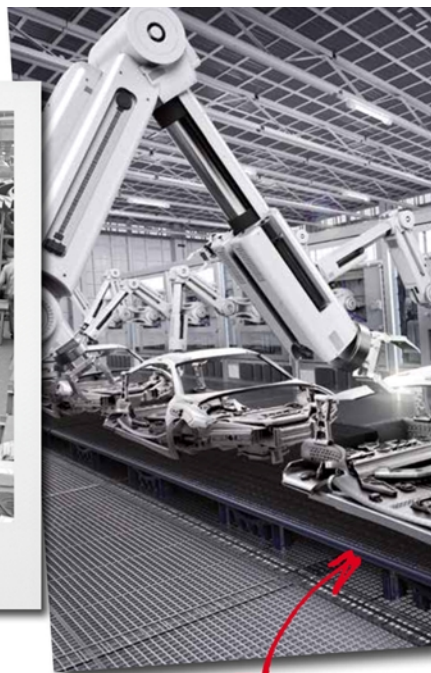
Povzetek



- Osredotočenost na produktivnost nalog je povzročila več problemov, kot jih je rešila.
- Osredotočenost na predvidljivost je privedla do urnikov, vezanih na nadomestila po metodi zaslužene vrednosti; to je ustvarilo veliko novih problemov in okrepilo druge.
- Specializacija je privedla do fragmentacije, ki je povzročila bolj zapletene projektne organizacije z več zainteresiranimi stranmi.
- Vse to je povzročilo povečanje birokracije in administracije projektov – projektni sodelavci, ki delajo ali celo ne vedo, kako se delo opravlja.
- Posredni stroški (stroški neproduktivnih dejavnosti) zdaj prevladujejo nad produktivnimi stroški!!! Koliko??
- Projekt v vrednosti več milijard dolarjev → **70 % !!!!!**



Workers building cars in a factory, 1930s.



From That to This:

Other Industries Have Perfected Modern Production. So, When Will Construction?

Like most other industries across the United States, the construction sector is becoming increasingly digitized as its leaders strive for success in the information age. And, although the engineering and construction (E&C) industry may have a long-standing reputation of being somewhat of a laggard in regard to innovation in comparison to other industries, the companies that lead the trend and choose to invest wisely in

digital innovation today, will absolutely have the competitive advantage tomorrow.

This desire for the construction industry to bring its best practices in line with the high-tech demands of the 21st century can be evidenced by the large – more than \$20 billion – amount of venture capital that has been entering the space over the last few years, accompanied by a rapid growth in

management, and collaboration. AWP provides a common language between owners, contractors, and suppliers around work packaging that can improve project effectiveness and efficiency.

“You could say that AWP acts as a valuable safety, alignment, and collaboration improvement approach,” says Jamie Gerbrecht, Construction Global Technology Sponsor with ExxonMobil. “It really brings a more enjoyable project experience that can motivate individuals and improve the project team’s overall morale. Ultimately, the framework and guidelines of AWP can help reduce confusion and unknowns during project execution and further equip the current and next generations for managing projects.”

Project Production Management

Operations science (OS) attempts to explain the behavior of different types of activities involved in the production of physical goods and services across many industries, such as agriculture, retail, logistics, and manufacturing. It

studies “production systems,” which are systems of interconnected tasks, human or automated, happening in sequence or in parallel, with each task transforming inputs, such as materials and information, into outputs, such as partly or completely finished products or services. Project Production Management (PPM) is the application of operations science to project delivery.

“We like to talk about operations science describing ‘the physics of how the work gets done,’” says Ram Shenoy, Executive Director of the Project Production Institute (PPI). PPI exists as the technical authority on PPM to inform, educate, and support research into leading PPM’s application to transform the project delivery performance of the E&C. “Other project management methodologies worry about the ‘What,’ the ‘Why,’ and the ‘When.’ They even explicitly exclude operations science from their scope. To our knowledge, we uniquely focus on the ‘How.’”

Understanding the underlying science and engineering foundation of different forms of production provides

greater insight into how to improve construction project delivery, compared with drawing simple qualitative analogies with factory manufacturing. All manufacturing systems are some form of production system, but not all production systems are manufacturing systems. By viewing all the activities in a construction project as a production system, PPM applies the governing equations of operations science to predict, control, and optimize project delivery, just as many industries outside the traditional E&C industry routinely apply operations science to optimize their operations. Understanding where data affects production system behavior allows PPM to be a platform for applying digital technologies to construction, including artificial intelligence, machine learning, robotics, and 4D visualization.

A recent survey by McKinsey & Company suggests that 98 percent of all major (>\$1 billion) capital projects either have budget overruns or schedule overruns or both. Those overruns tend to be substantial, with the average budget

continued on page 22



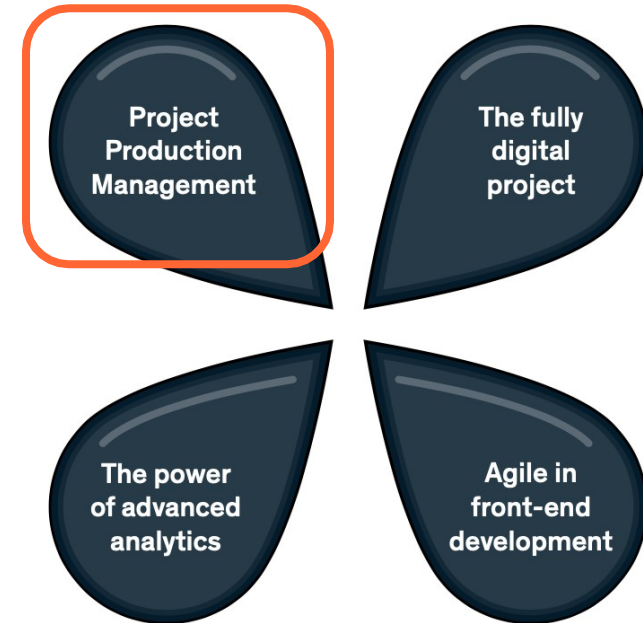
Oil & Gas Practice

How the oil and gas industry can improve capital-project performance

Management practices and digital technologies used by other industries can help oil and gas companies boost capital-project productivity.

by Alastair Hamilton, Jan Koeleman, and Koen Vermeltfoort

There are four main building blocks
for reshaping the oil and gas industry.

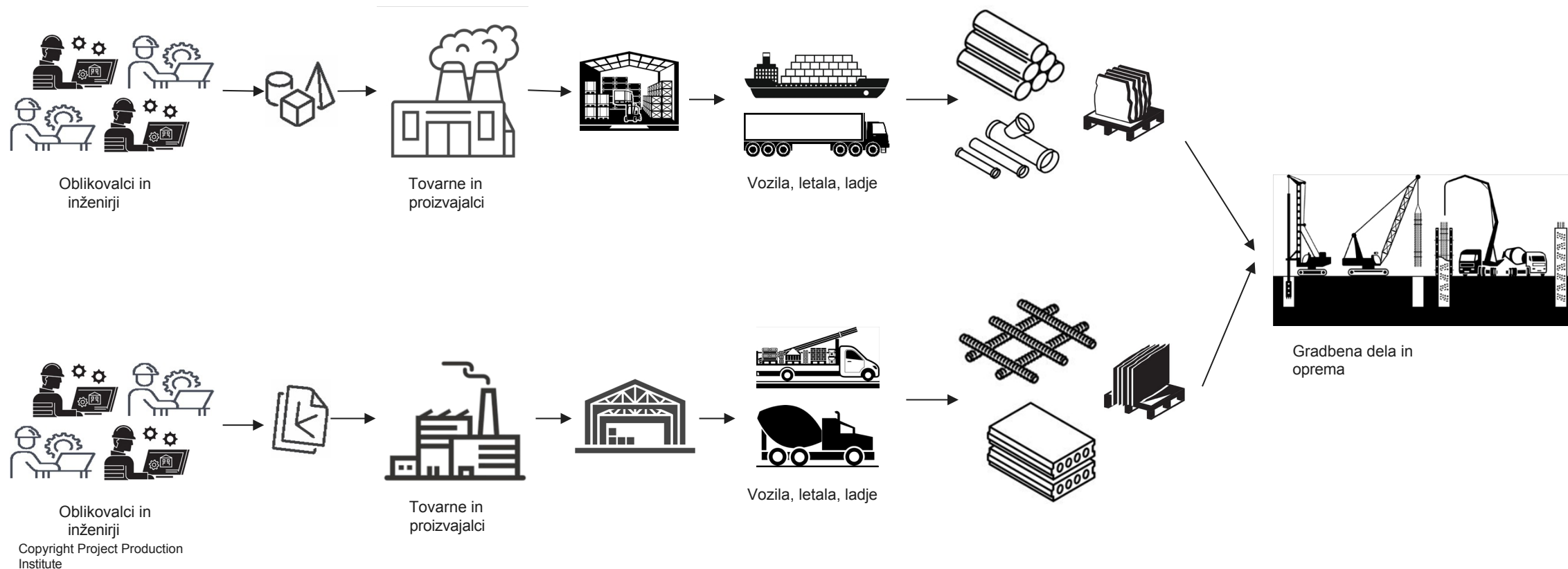


Source: McKinsey analysis



Projektno vodenje naslednje generacije

V gradbeništvu poteka delo skozi proizvodne sisteme

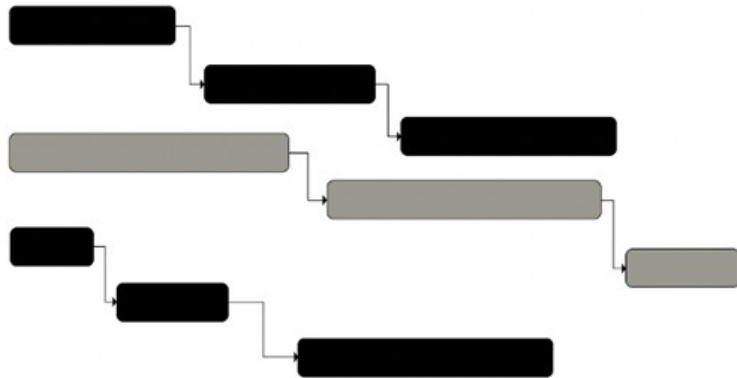




Način zasnove teh sistemov ima velik vpliv na izid projekta, tj. stroške, časovni načrt, denarna sredstva

ZAHTEV ZA PROIZVODNI SISTEM

Schedule = Should Happen



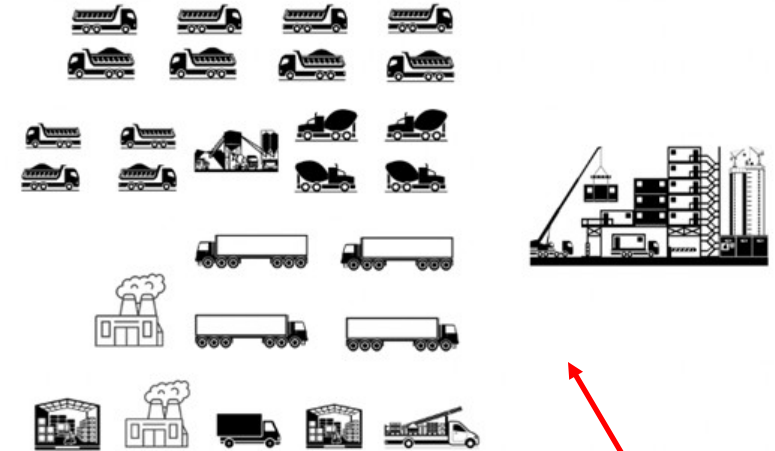
Dates & Progress

SIMPTOMI

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Za njihovo spremljanje porabimo veliko časa....

Production System = Can/Will Happen



Rates / Throughput

VZROKI

...brez razumevanja, kako delujejo



Operacijska znanost ureja delovanje projektnih proizvodnih sistemov



4 Verbs

5 Levers

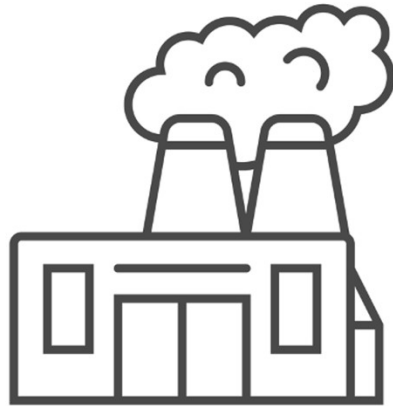
3 Curves

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4 Verbs



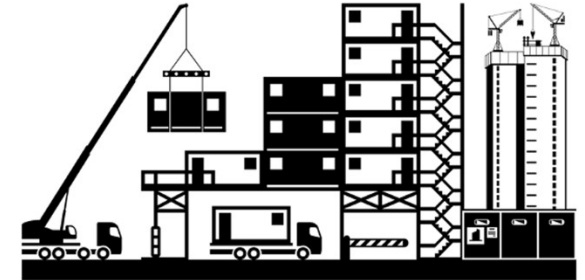
Design



Make

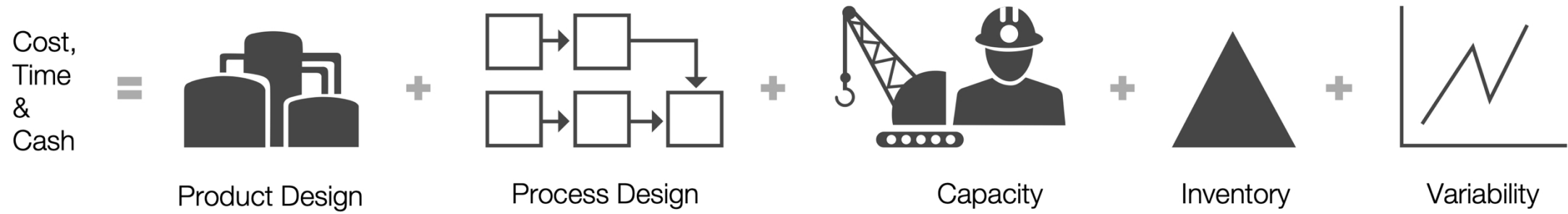


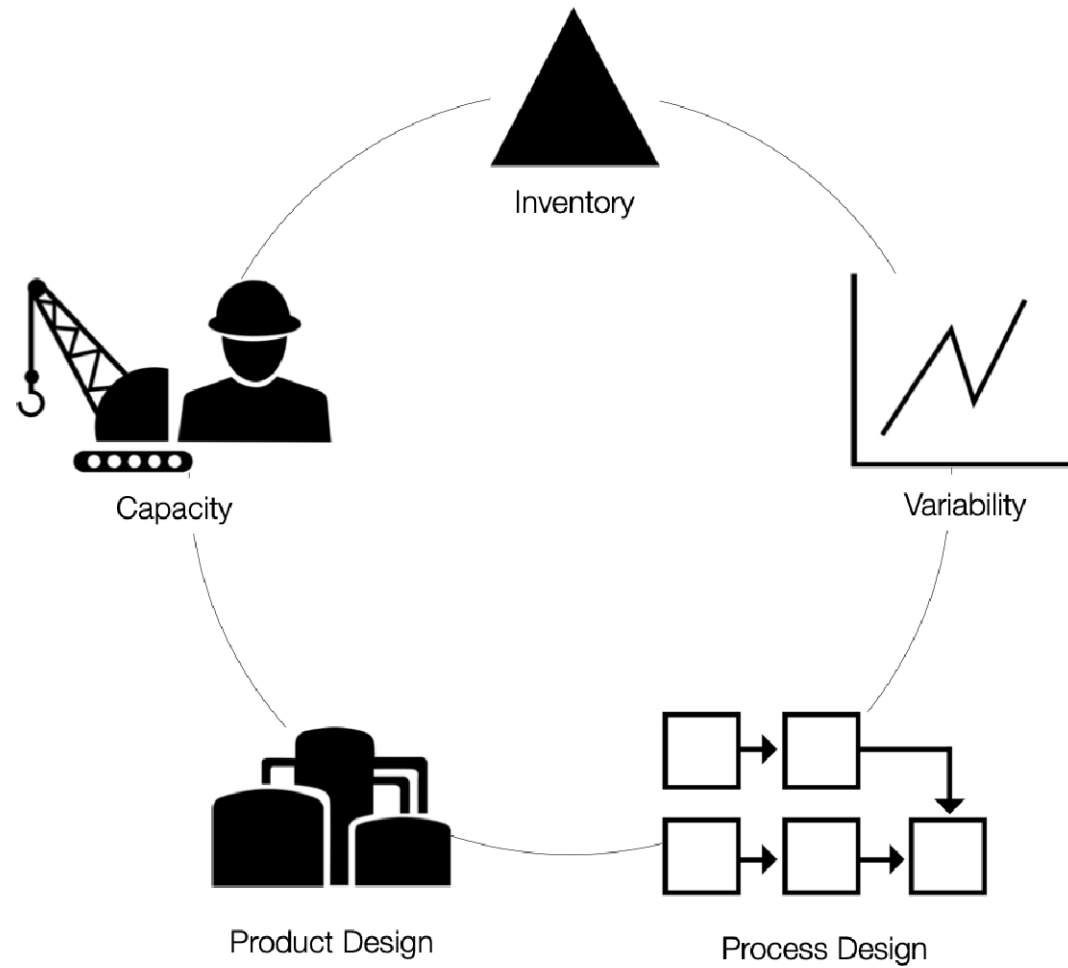
Transport



Build

5 Levers



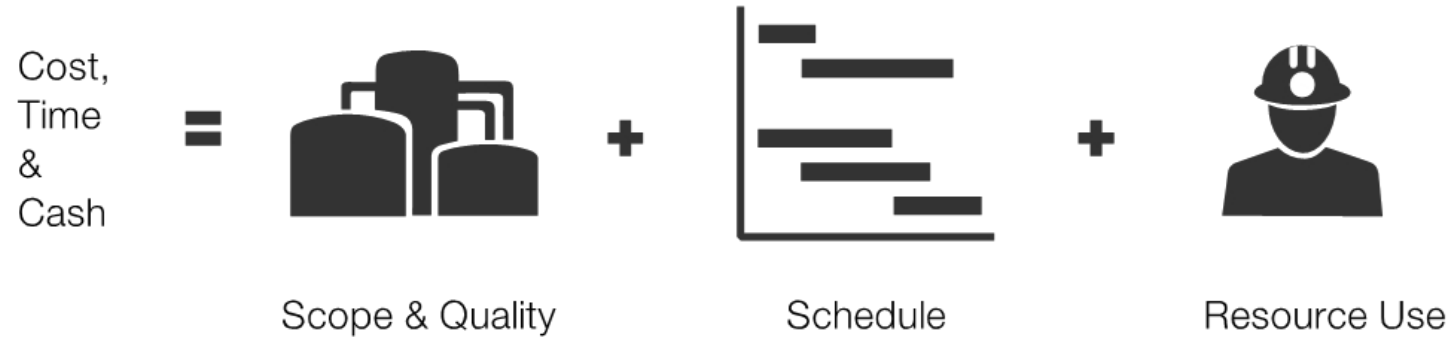


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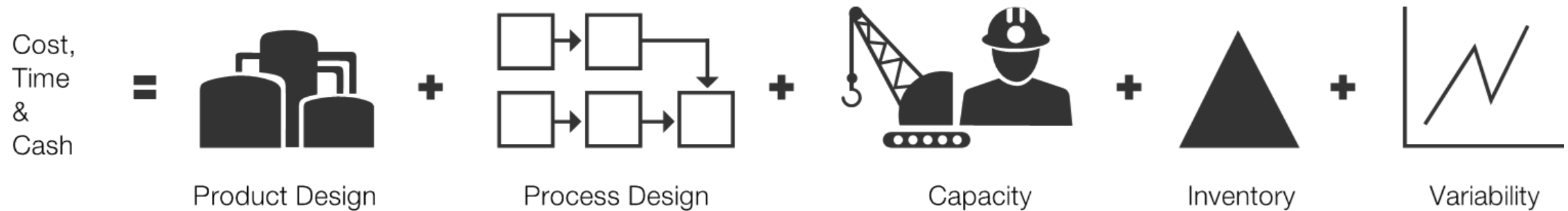
No Free Moves!

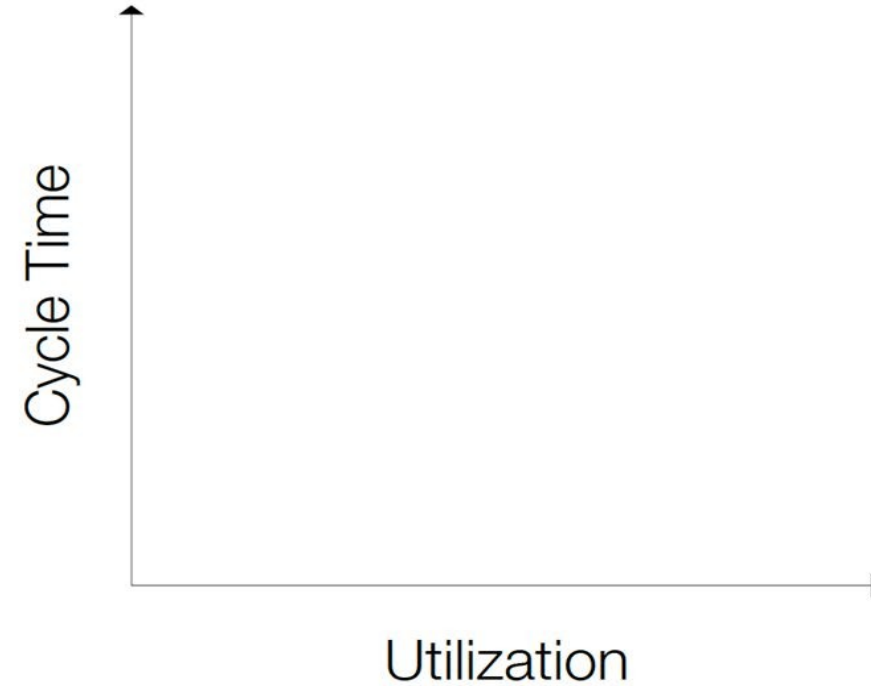
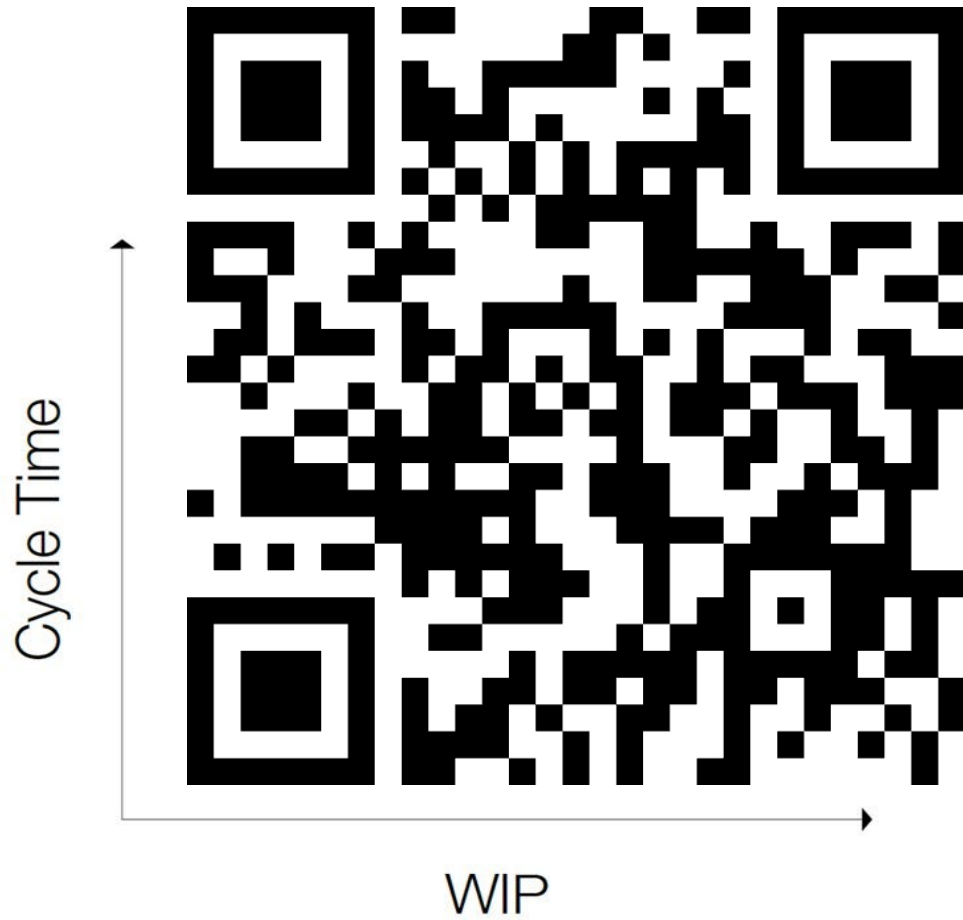


UPRAVLJANJE PROJEKTOV

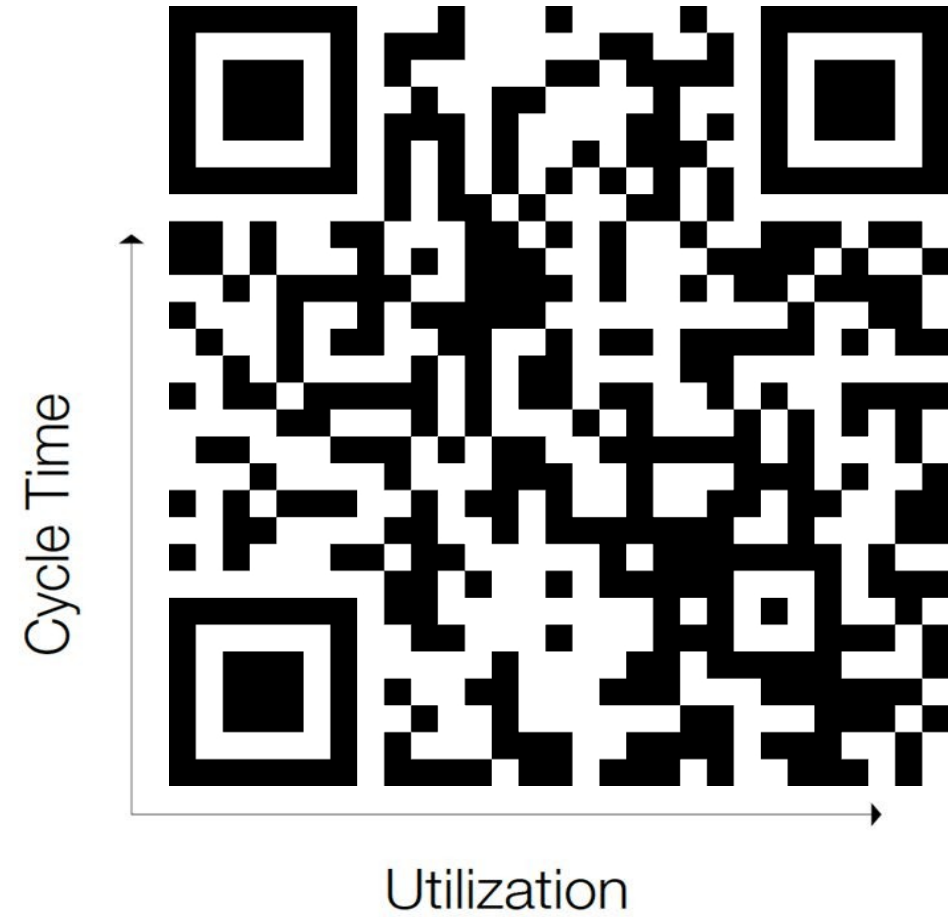


UPRAVLJANJE PROIZVODNJE PROJEKTOV

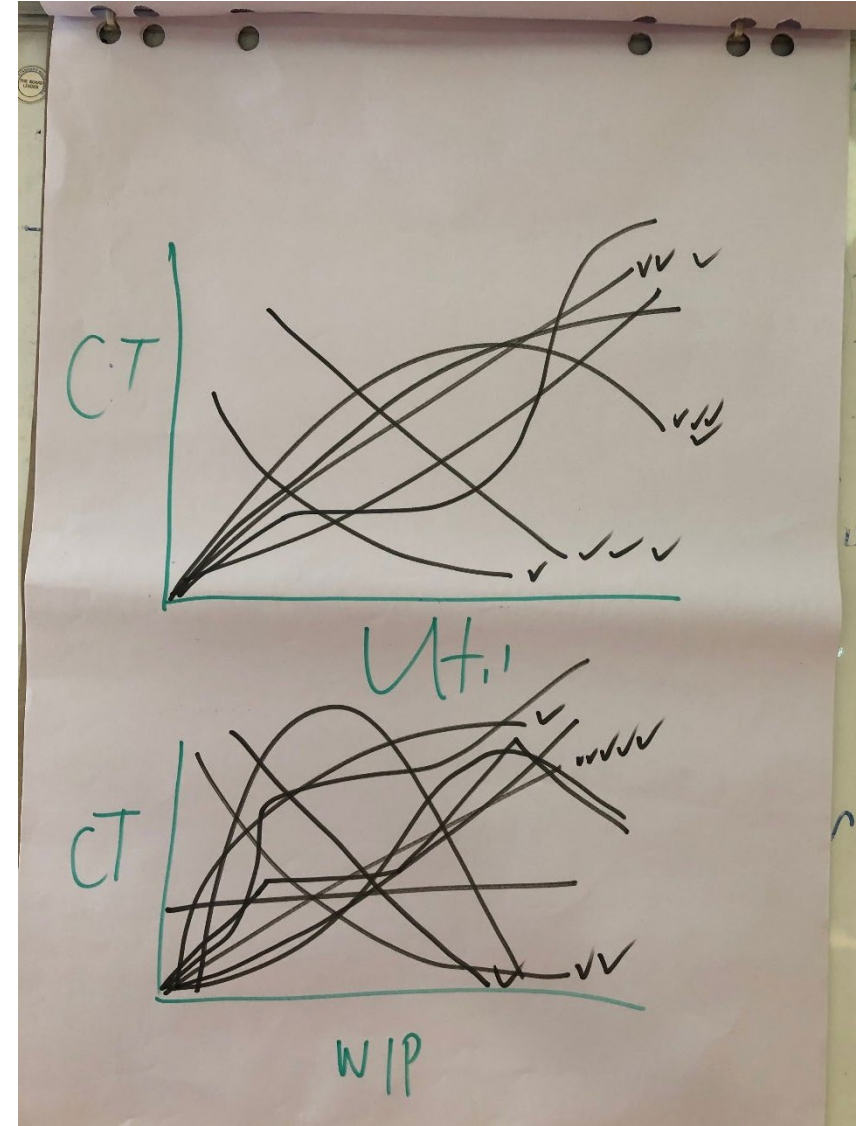
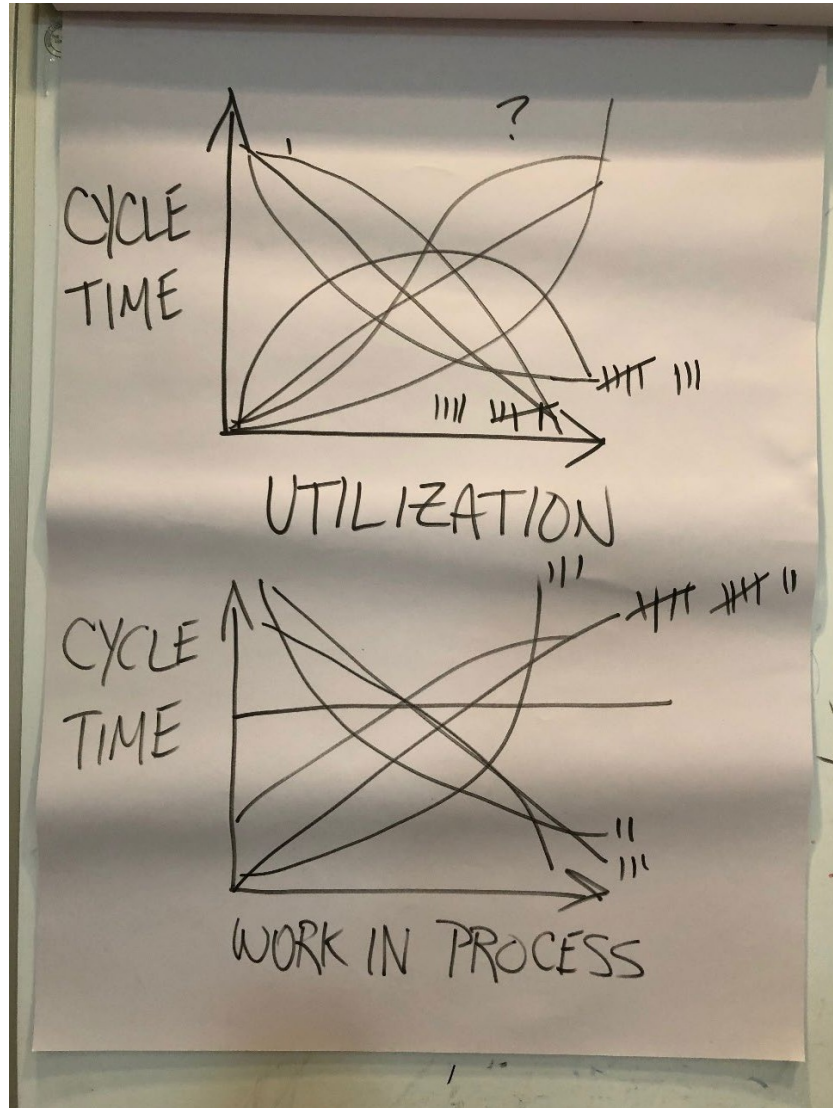




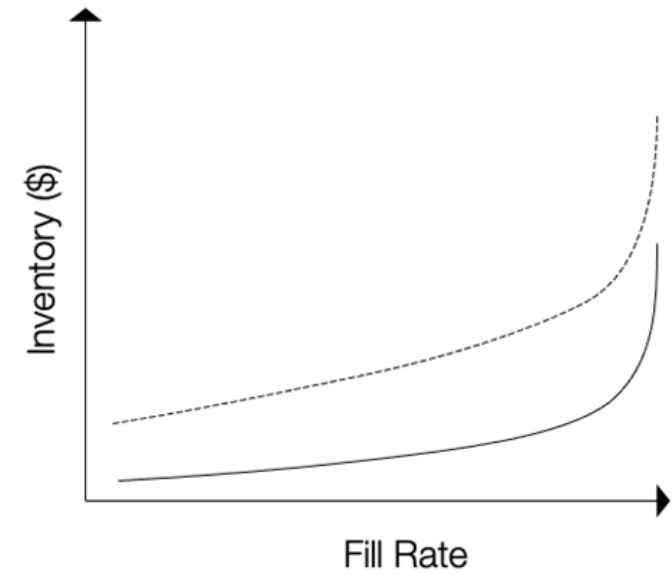
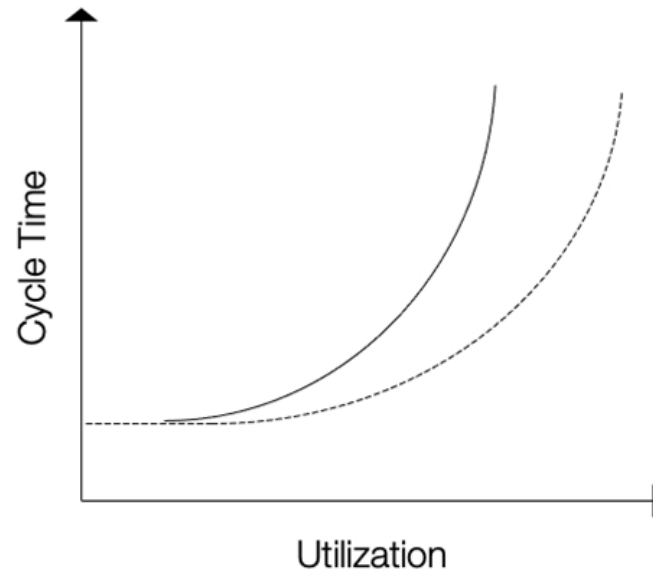
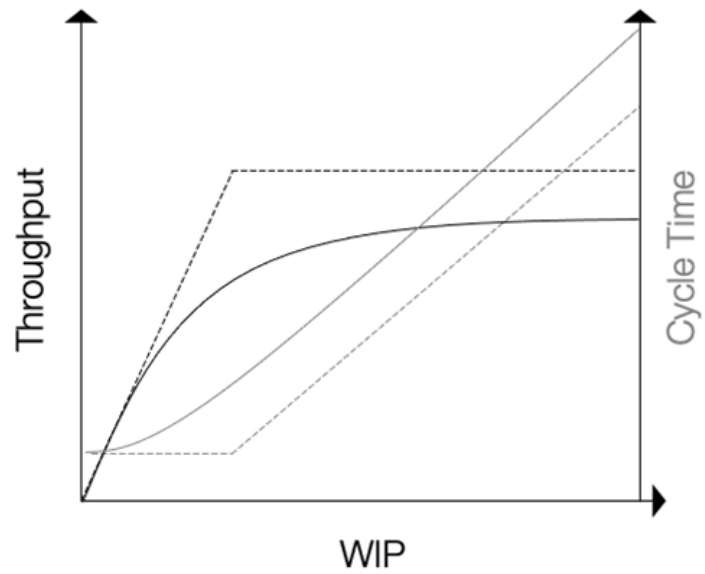
Kviz



Kviz



3 Curves



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Piloti – dejanski primer tega



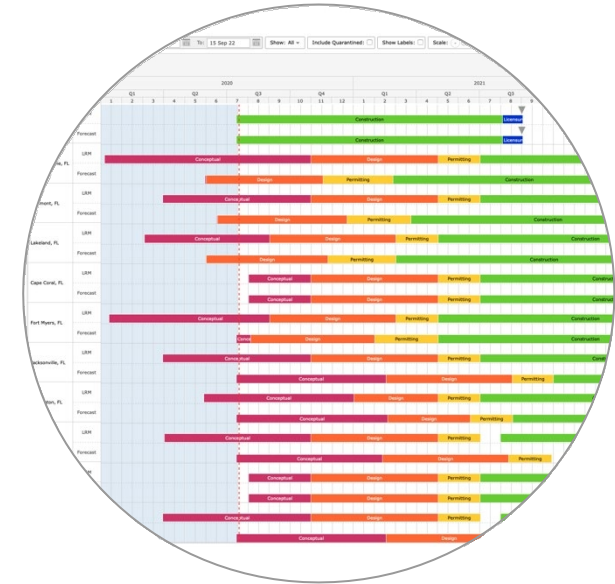
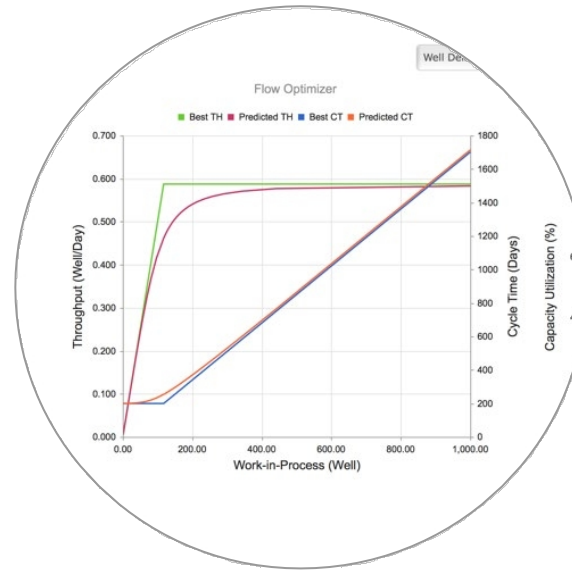
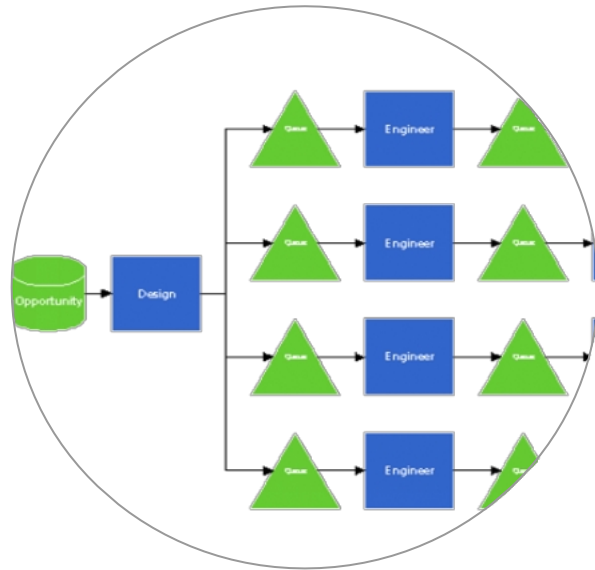
Podizvajalec za enotno ceno bo v prvih šestih mesecih gradnje v projekt vgradil 20.000 pilotov, dokončanje temeljev je načrtovano v dveh letih.

Najeti so bili odlični izvajalci pilingov, ki so opravili svoje delo – velik uspeh

Uspeh?



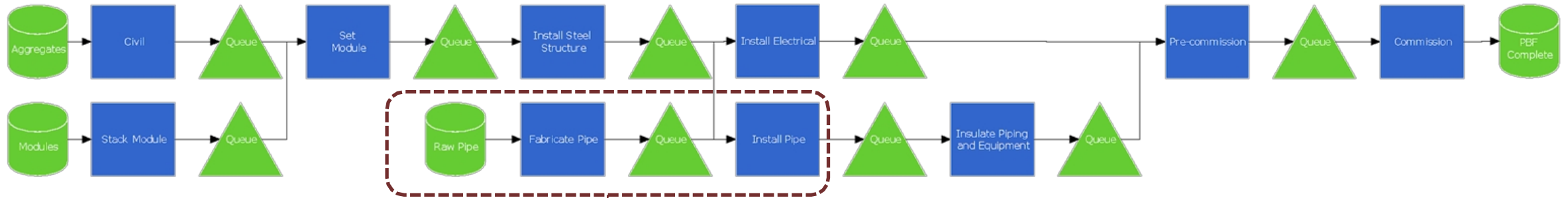
Zaključena vbijanje pilotov – čakanje na temelje



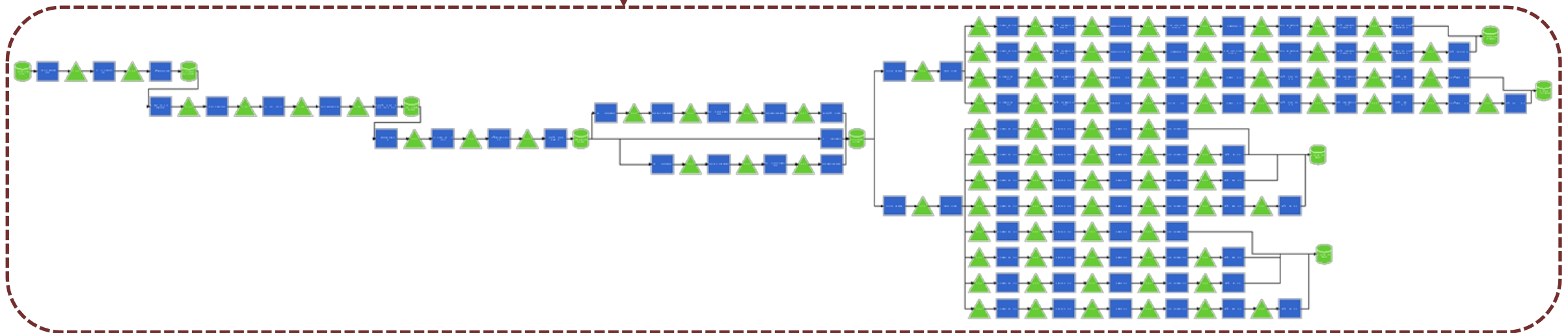
Tipični zemljevid proizvodnega sistema projekta



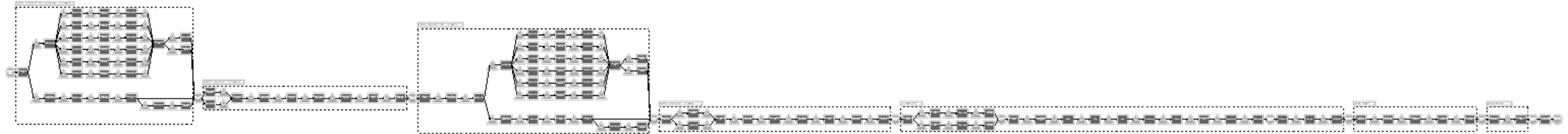
Zemljevid visoke ravni



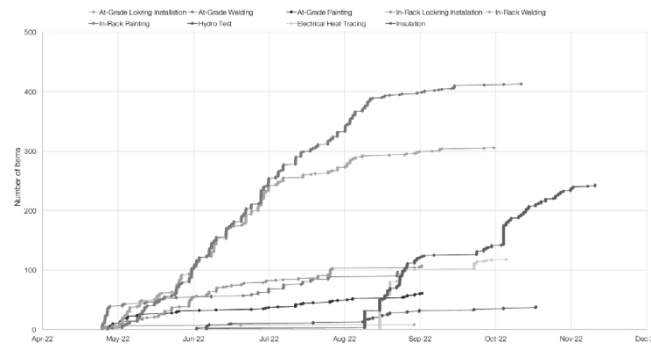
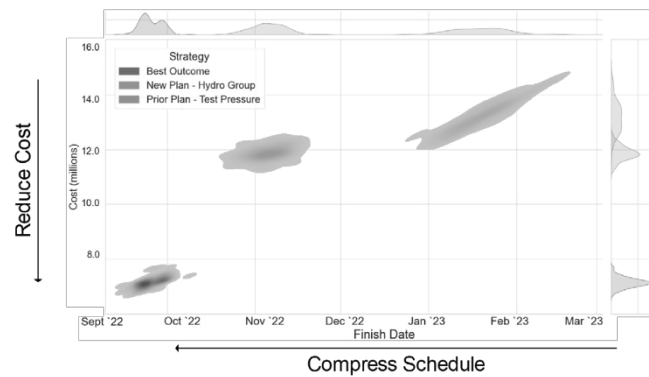
Podrobna karta



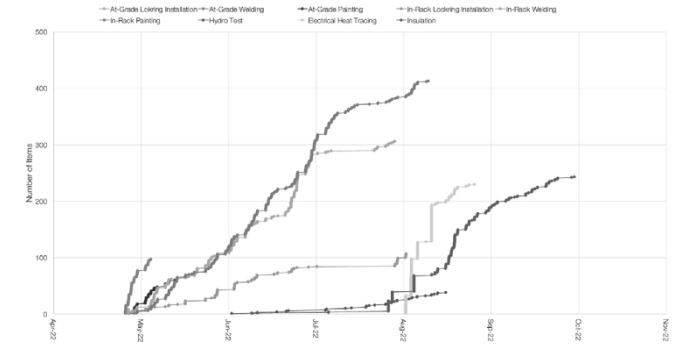
Projektni proizvodni sistem za cevovode in hidravlične preskuse



Omogoča SPS|PM Production Optimizer / Simulator

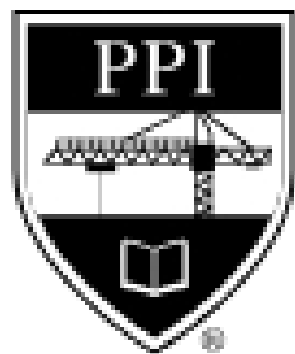


Trenutno



Predlagano

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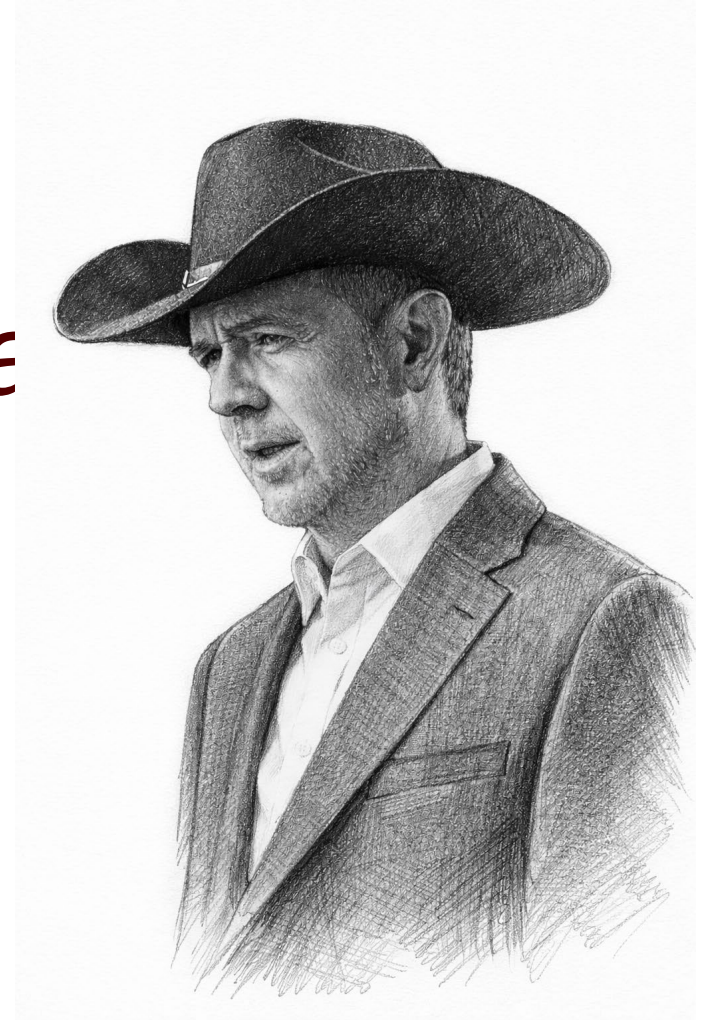
PROJECT PRODUCTION
INSTITUTE



Pridružite se skupnosti projektnih strokovnjakov



*Javno-zasebna
partnerstva: od fizičnega
do digitalnega
Infrastruktura*



Javno-zasebna partnerstva (PPP) in projektno financiranje



Vlade se ukvarjajo z izdatki (in zbiranjem (in najemanjem) sredstev).

Obseg naložb je omejen. Tudi pripravljenost na tveganje je omejena.

PPP omogočajo zasebnemu sektorju, da zagotavlja storitve, objekte ali spodbuja poslovno okolje.

- Financiranje s povečanjem davkov (PPP – SPV)
- Digitalna infrastruktura (PF – SPV)

Financiranje z davčnim povečanjem

Naložbe v projekte ustvarjajo vrednost, ki presega tisto, kar lahko razvijalci takoj internalizirajo.

To imenujemo zunanji učinki.

Zunanji učinki so lahko pozitivni (dostop, izboljšave zemljišč), pa tudi negativni (onesnaževanje, hrup itd.).



Hotel

Neposredni vir dohodka:
zasedenost sob

Zunanja vrednost: povečana
vrednost okoliških parcel

Avtocesta

Neposreden vir dohodka:
cestnine

Zunanja vrednost: povečana
vrednost okoliških parcel

Infrastruktura, ki omogoča razvoj
Sanacija lokacije
Brownfield C

Digitalna infrastruktura

Potreba po računalniški moči (ure GPU) eksponentno narašča

Podjetja na področju umetne inteligence so omejena in do neke mere ocenjena na podlagi računske moči.

Tehnologija se hitro razvija Projekti so tehnično zapleteni

SPV z nizkim tveganjem prihodkov, visokim tveganjem pri izvedbi



Stargate v Abeline, Teksas (april 2025)



STANDING TOGETHER
FOR A BIGGER IMPACT