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Project Production Control

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The Gorgon Experience

PPI Symposium November 30, 2016

The Industry Situation



Global Failure of Major Capital Projects. Source - Ernst and Young



The Construction Industry Challenge

Ineffective Control of Work Execution



Notes:

Over 300 projects since year 2000

Over 300,000 data points on reasons for Non-Completion of Work



Project Delivery Gap – Production System





Gorgon – Status of Project (1Q 2015)





Gorgon – Status of Project (1Q 2015)



"It was virtually impossible to know the *truth* of the project schedule. Even when operating from a monthly look-ahead schedule, key project milestones were slipping as much as a week per month." - Gorgon Productivity Manager



Physical evidence of increased cycle time?

MEIC Storage (1 of 8 storage areas)

Area - 30 Hectares









PROJECT MANAGEMENT



PRODUCTION MANAGEMENT





The Construction Industry Findings (Craft Work)

CIFE Findings No Formal Process to Manage Variability

- Foremen / Supervisors lack formal methods for managing variability and estimating it's impact
- Rely on intuition and their past experience managing variability
- "This is how it has always been done"
- "You hire good people who take care of business"

Production Control proposes a scientific approach to variability management



Understanding the PPC Solution

Production Control Principles

- Plan in greater detail as you get closer to doing the work.
- Produce plans collaboratively with those who will do the work.
- Reveal and remove constraints on planned tasks as a team.
- Make and secure reliable promises.
- Learn from breakdowns.

Objective is to:

(1) improve workflow and

(2) improve plan reliability and predictability

Excerpts from Production Control Principles, Ballard, Hammond, Nickerson



Applying the Solution





The Solution – Application to Construction Execution





The Solution – Production Scheduling

Production Scheduling Making 'One Team' operational



One Target + Multiple Disciplines, Functions and Companies planning work execution



The Solution – Daily Production Planning

Daily Production Planning Supporting and systematizing operation discipline at the workface



Daily Production Planning





Execute Work

Daily Production Plan

Daily Production Planning Cycle

Cross-discipline / functional / company team updates the status of today's work (last 24 hrs.) and commits tasks for tomorrow (next 24 hrs.) including resource allocation and integration of field and support tasks



Insights from Gorgon

1 - Commitment Reliability (CR):



Doing <u>what</u> you say you will do...

- Greater visibility on what work needs to get done
- Clear ownership and accountability who is responsible to get the work done
- Synchronized execution of tasks across multi-trade work flows

With PPC Gorgon achieved > Greater than 85% of daily commitments on Train 2 versus industry average of 53%



Insights from Gorgon

2 - Improved Planning Predictability



Train 2 and Commons MM 13-22

Doing it when you said you would...

- Increased confidence on achieving project milestones
- Greater control of causes of variability at the work front
- Seamless integration of systems completion tasks into planning and execution cycle

Train 2 Gorgon achieved 82% of 1 month forecast with a +/- 7 day window with PPC (versus 14% without PPC)



Insights from Gorgon

3 - Reduced Project Cycle Time



Doing it <u>better</u> every time...

- Measurable cycle time reduction
- Sustainable schedule compression
- Improved capability to achieve project schedule and cost targets

Cycle time reduction between T1 & T2 scopes of work at Gorgon ranged from 13% to 52%



Towards Predictive Control of Project Delivery

SULTS **M** РРС

85 %

Deliver the Plan – Gorgon site commitment reliability, (delivering what you promised you would do) improved from industry ~50% to over 80% with key areas delivering over 90%.

82 %

Predictability of project milestones improved from 14% without PPC to over 80% in areas with PPC

14-50 %

Do more with less - 14-50% reductions in cycle time with associated cost and required cash reductions are possible with PPC



Appendix



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PPC Provides the Processes and Tools for Site Supervision to Effectively Manage Work



"DNA" of work execution elements



Complexity of coordination of work across multiple work fronts

WFP delivers information / materials to site...although not necessarily explicit, foremen are actually expected to be directly responsible for the following tasks:

- · Study and interpret the scope on each IWP
- Explode each IWP into individual tasks (all tasks are the same discipline)
- · Design detailed operations as to how work will occur
- · Further develop bill of materials into daily chunks
- Integrate and coordinate / negotiate the work with other trades
- Adjust detailed operations based on integration with other trades requirements
- · Ensure availability of equipment capacity and temporary elements
- Identify and allocate the necessary labor capacity to execute their own work
- Coordinate the marshaling of capacity and inventory to the point of installation
- Orchestrate and monitor the execution of work including reporting of progress



The 'Operations' are considered by Project Controls, but Flow and the effects to WIP (Inventory) are not



It is critical in the new era to view the project as a Production System



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The impact of WIP (inventory) and Cycle Time can be understood and controlled by treating the Project as a Production System

Little's Law:

TH = WIP / CT

Cycle Time Formula:

CT = BT + MT + ST + PT + QT

BT = (Waiting for Batch) + (Waiting in Batch) + (Waiting for Match)

VUT Equation: $CT_q \approx V \times U \times t$ $\approx \left(\frac{c_a^2 + c_e^2}{2}\right) \left(\frac{u}{1 - u}\right) t_e$



Establishing a Solution Framework

Distinctions between Project Controls & Project Production Control

Project Controls

- Reliance on the functional aspects of project management
 - Planning
 - Buying
 - Contracting
 - Forecasting
 - Reporting
- Reliance on Accounting and on project scope and status measures e.g.:
 - Cost & Schedule Variances
 - Earned Value Measures
 - Estimate to complete etc...
- Benefit Vital statistics during the life of the project; autopsy measures after completion.

Project Production Control

- Investment in the management of production or execution of work:
 - Designing
 - Engineering
 - Making
 - Installing
 - Commissioning
- Reliance on Operations Science and on work process measures e.g.:
 - Throughput (TH) = Work-inprocess/Cycle-Time (Little's Law)
 - Cycle time = Process Time + Batch Time + Move Time + Set-up Time + Queue Time (understand relationship between capacity, time and variability).
- Benefit model, optimize, control and improve how knowledge work and craft work is executed.



Aligning Service Provider to the Type of Solution

Mapping the types of Project Delivery Optimization Approaches



Optimization Methodology



Optimization Focus