

Measuring Performance with Digital Progress Management

Ingo Kocke, Senior Industry Consultant
Hexagon



Global leader in **digital reality solutions**
that are empowering an autonomous, sustainable future by putting data to work



Smart Digital Reality for Autonomous Industrial Facilities



SAFETY



QUALITY



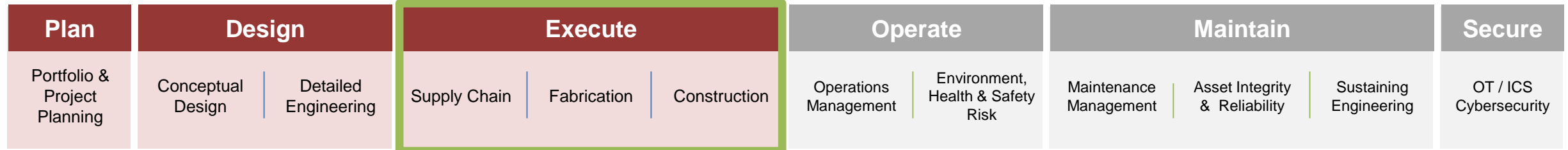
EFFICIENCY



PRODUCTIVITY

Digital Projects

Digital Assets



Single Pane Of Glass

Composable Services



Digital Backbone



Data Orchestration

SaaS Platform

Autonomy Enablers



What is the future of Execute?

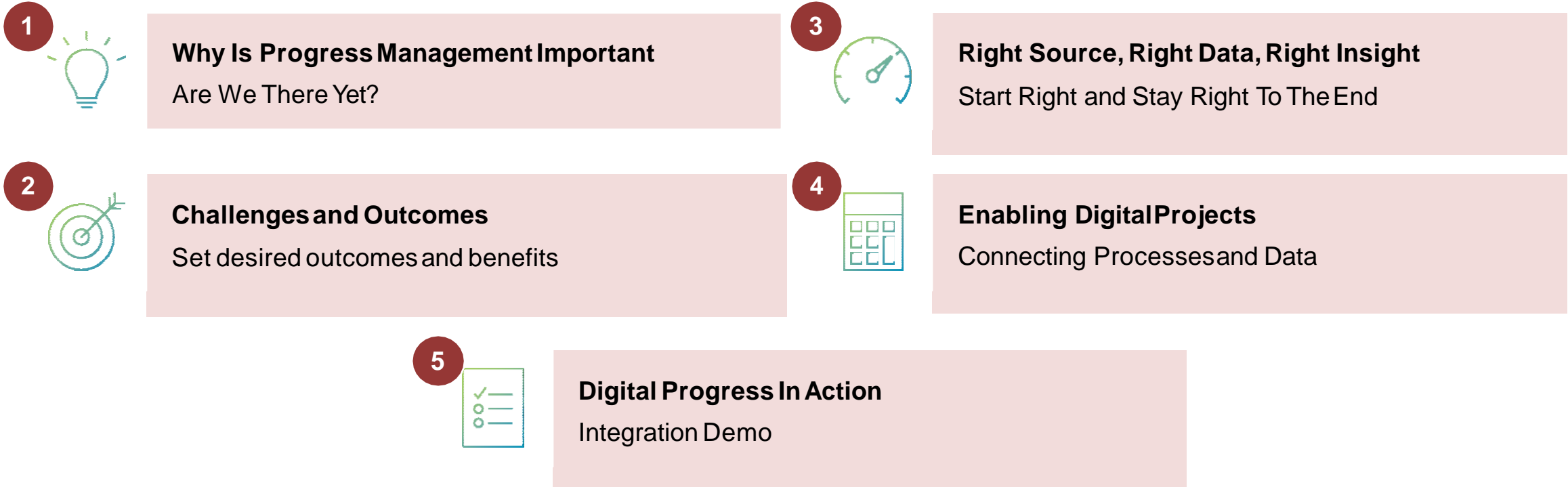


If you are still dealing with non-integrated systems and processes, you are missing a significant opportunity to minimize or even eliminate wastage during construction - whether that be time, money, material, or resources.

Why Is Progress Management Important

Identify Enterprise and Project Goals

Successfully executing projects hinges on many variables. Yet, the fundamental question that must be answered before any proactive or prescriptive measures can be implemented is this: Where are we today? Deceiving in its simplicity, this question often proves difficult to answer accurately. How can we make this easier?



Why Is Progress Management Important

Are We There Yet?

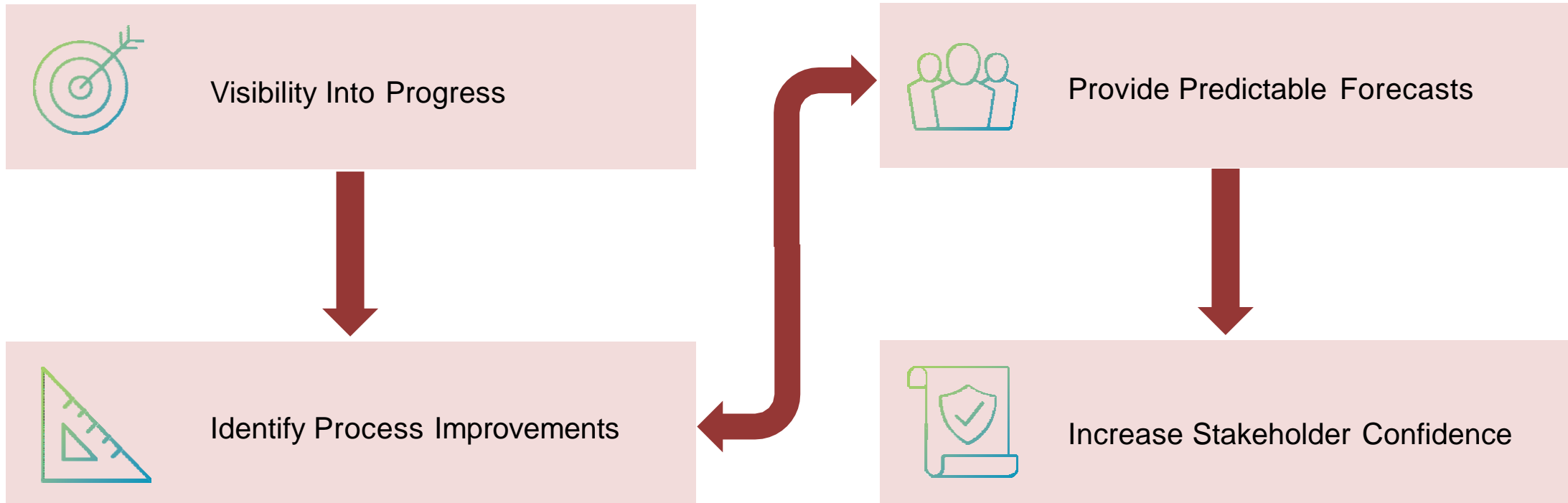


Why Is Progress Management Important

Are We There Yet?

Progress Measurement enables all stakeholders to understand the status of project tasks and activities. Accurate performance measurement is essential to know how the project aligns to planned cost, schedule and performance targets

Key Benefits of Accurate Progress Management



Challenges and Opportunities

From Poor Performance To Exceeding Expectations



Challenges and Opportunities

From Poor Performance To Exceeding Expectations

Poor productivity, tight profit margins, resource shortages and low technology adoption are all well documented challenges faced by the engineering and construction industry. Driving performance improvement through digital progress measurement and management will help alleviate the impact on successful project delivery

Current State



Historical Performance

- Projects Over Budget
- Projects Delivered Late
- Projects Failing To Deliver Planned Benefits
- Productivity Below Averages
- Too Much Time and Money Wasted
- Low Profit Margins Compared To Other Industries



Perception Versus Fact

- Limited Access To True Progress and Performance Data
- Status Based False Perceptions



Common Issues

- **Siloed and disconnected** processes and data management
- **Too subjective** and open to interpretation
- **Misalignment of delivery** completion with schedule
- **Lack of standardization** – No standard rules of credit
- **Inefficient** manual process with potential for error
- **Data intensive** – multiple sources requiring consolidation, manipulation and analysis
- **Difficult to validate** reliability and accuracy of information
- **Optimism Bias** – Reporting “inaccurate” progress especially early in project lifecycle

Automated Objectivity

Data Driven Decision Making

Provide accurate and timely progress information to allow all project stakeholders to focus on maximizing schedule and budget performance and delivering planned benefits and targets

Key Considerations



Speed



Accuracy



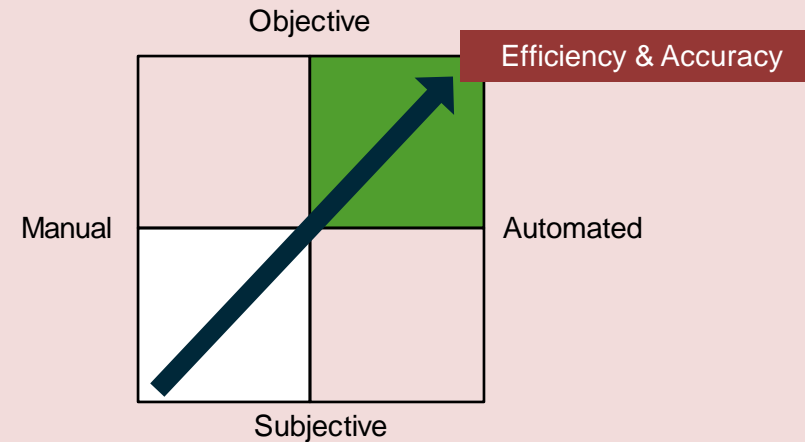
Completeness



Data Coverage



Scalability



- Remove Silos
- Shift from Manual based Data Management
- Automate Data Management
- Ability to drilldown into source data
- Auditable Progress Data
- System Driven Values

Getting It Right

5 Key Elements



Getting It Right

5 Key Elements

Any performance management system, whether digitized or not, requires the following 5 key elements to be successful.

- 1 Right Data**

The relevant performance data needs to be available as needed by stakeholders to effectively control and manage the project
- 2 Right Source**

The right performance data needs to come from the appropriate source, at the right level of detail and cadence
- 3 Right Time and Place**

Automated workflows within an integrated environment allows timely access to data
- 4 Right Person**

Notifying the right project team members and providing access to actionable insights improves decision making
- 5 Right Decision**

The correct course correcting decisions are communicated and carried out quickly with immediate impact on performance

Business Impact of Digital Progress Management

An Example

Project Performance Solution

1	Data	Framework established to capture progress at different project stages and details
2	Source	Siloed and disconnected tools require extensive data capture, preparation and consolidation
3	Time and Place	Progress analyzed after the fact with limited ability to eliminate or minimize performance issues
4	Person	Progress reported to right people to understand performance but without clear visibility into source data or ability to quickly identify problems
5	Decision	Performance issues identified and corrective actions taken but visibility into actions taken is difficult

Digital Project Progress Solution

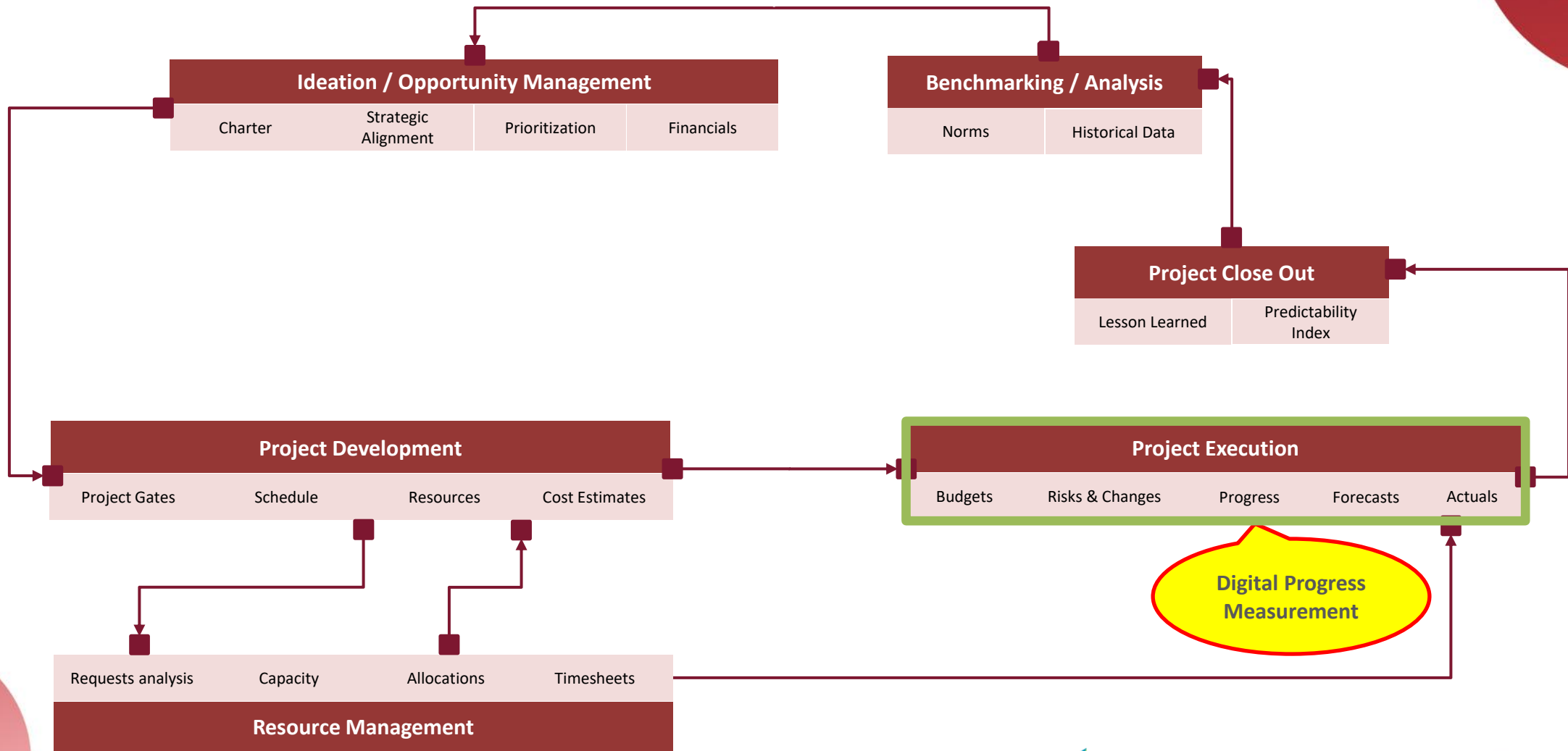
Both automated and manual processes established to capture timely progress from the right source
Instant access to accurate and timely performance data based on rule-based integrations
Immediate access to progress from the field or office.
Connected data provides visibility into performance at summary and detail level. KPI driven analysis supports easy identification of issues
Performance addressing actions integrated with cross-system change management processes

Enabling Digital Projects

Connecting Processes and Data



Managing the Entire Project Life Cycle



A Digital Reality

EPP – Delivering Digital Progress Management

Construction Management (Installed Quantities)



Intergraph Smart® Construction

- Work Package Progress
- EPP Solution Accelerator

Design Software (Engineering Deliverables)



Intergraph Smart® 3D

- Model Progress
- EPP Solution Accelerator

Completions and Commissioning (Package Progress)



Intergraph Smart® Completions

- Work Package Progress
- In Design / Roadmap

Digital Progress Management



Information Management (Deliverables Progress)



HxGN SDx™ Projects

- Drawings and Documents
- Productized Integration / Live Connector

Scheduling (Tasks and Activities)



- Activity and/or Step Progress
- EcoSys Connector / Solution Accelerator

ERP (Accruals and Actuals)



- Actuals and Milestone Progress
- EcoSys Connectors

Materials Management (Material Receipts)



Intergraph Smart® Materials

- PO Progress
- Smart Materials Driven Integration



Integrated Project Landscape

Schedule

ORACLE PRIMAVERA P6 | Project

WBS, Activities and Resources

Project Codes	WBS Details
Activity Details	Cost Accounts
Resources and Roles	

Schedule Progress

Activity Dates	Resource Assignments
Actuals	Forecasts
% Complete	

HEXAGON

Intergraph Smart® 3D	Intergraph Smart® Completions
Intergraph Smart® Construction	HxGN SDx® Projects
Intergraph Smart® Materials	HxGN Smart® Build
HxGN EAM®	

Enterprise Project Performance

HEXAGON | EcoSys™

Portfolios, Programs and Projects

Capital Plans	Funds
Resources	Strategic Objectives

Cost, Revenue, Hours and Quantities

Estimates	Budgets
Commitments, Actuals and Accruals	
Changes	Risks

Forecasts and Cashflows

Progress and Earned Value

Document Management and Collaboration

Multi-Currency	Workflows
Dashboards and Reports	

Enterprise Resource Planning

SAP | ORACLE E-BUSINESS SUITE | ORACLE JD EDWARDS

Project Objects

Project Codes	Code of Accounts
WBS, Networks and Activities	

Cost Control

Budgets	Commitments
Actuals	Accruals

Progress Management

WBS Status	Current Budgets
Forecasts	Cash Flows

Document Management

Bricsys® 24/7 | HxGN SDx® Projects Information Management

3rd Party Data Sources – Facilitators

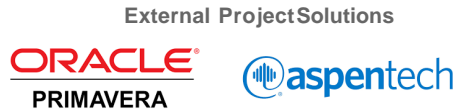
SQL | OData Open Data Protocol | API Application Programming Interface

Dashboards and Analytics


Power BI | Tableau | HEXAGON

Enabling Digital Projects

Connecting Processes and Data



Intergraph Smart® 3D
Intergraph Smart® P&ID
Intergraph Smart® Construction
Intergraph Smart® Materials

Intergraph Smart® Completions
HxGN SDx® Projects
HxGN Smart® Build
 **Bricsys® 24/7**



Supports ALL
EcoSys Integrations



Increased reliability and
simplified maintenance



Reduced implementation
time and cost



Improved performance



ERP Accruals & Actuals



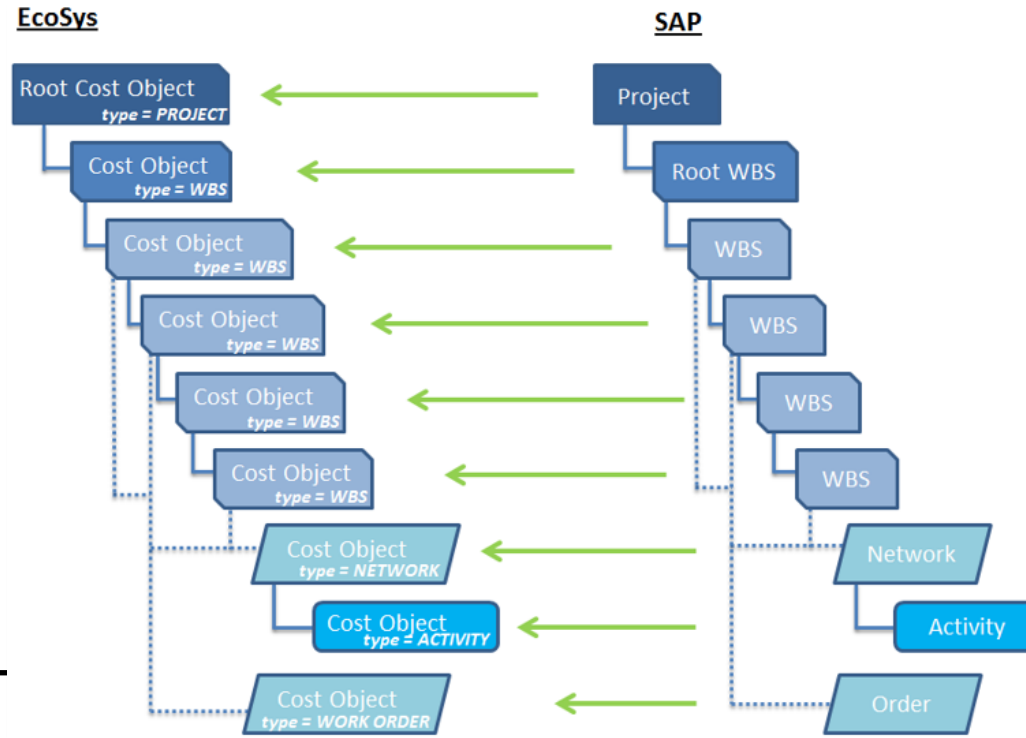
EcoSys SAP Integration

HxGN SAP Connector

HxGN SAP Connector

Key Features:

- Standard EcoSys integration product for SAP
- Full integration with SAP PS module
- S/4 HANA (ECC support available Q3 2023)
- SAP web services integration
- Cloud Compatible
- CBS to WBS Mapping
- EcoSys Workflow Automation
- Fully Configurable



Subject Areas - Imports to EcoSys:

- Project Structure Including WBS, Networks, and Work Order
- Actual Cost and Revenue
- Commitments
- Planned Costs and Revenue
- CATS Timesheets
- Budget Totals
- Enterprise Data

Subject Areas – Export To SAP:

- Project Structure Including WBS, Networks, and Activities
- Forecast Costs

CBS to WBS Mapping

- Ability to define mapping rules from SAP to EcoSys Cost Control Level
- Ability to preview costs before pushing data

Map SAP Structure to Projec...				Project Structure Element							
Hierarchy Path ID	Object Name	Link	Ma	Path ID	ID	Name	Type	Preview Project PO Cost	Preview Project Actual Cost	PO Costs	Actuals
										34,491,580	638,757,040
PRJ-000513	SAP Integration			PRJ-000513	PRJ-000513	SAP In Projects		Preview	Preview	0	0
PRJ-000513.02	Capital - Phase 1 Pad Dev	Link		PRJ-000513.1011A	1011A	1011A WBS				0	0
PRJ-000513.02.02-01	Engineering	Link		PRJ-000513.1011A.101A	101A	101A WBS				0	0
PRJ-000513.02.02-01.02-01-01	CS&S / DBM Engineering	Link		PRJ-000513.1011A.101A.FI	FI	FI WBS				0	0
PRJ-000513.02.02-01.02-01-01-99	Common	Link		PRJ-000513.1011A.101A.FI.CN	CN	CN WBS				0	0
PRJ-000513.02.02-01.02-01-01-99	[New]	Link		PRJ-000513.1011A.101A.FI.EL	EL	EL WBS				34,491,544	638,706,420
PRJ-000513.02.02-01.02-01-01-99	MR Phase 5B Pad Dev	Link		PRJ-000513.1011A.101A.FI.ER	ER	ER WBS				0	0
PRJ-000513.02.02-01.02-01-01-0	Legacy PCA	Link		PRJ-000513.1011A.101A.FI.IA	IA	IA WBS				36	50,620
PRJ-000513.02.02-01.02-01-01-02-0	Staffing	Link		PRJ-000513.1011A.101A.FI.ME	ME	ME WBS				0	0
PRJ-000513.02.02-01.02-01-01-02-01-0	Surplus Material - Asset Rv	Link		PRJ-000513.1011A.101A.FI.PI	PI	PI WBS				0	0
PRJ-000513.02.02-01.02-01-01-02-01-0	Staffing	Link		PRJ-000513.1011A.101A.FI.SS	SS	SS WBS				0	0

Schedule Integration



Schedule Integration

EcoSys Connect Overview

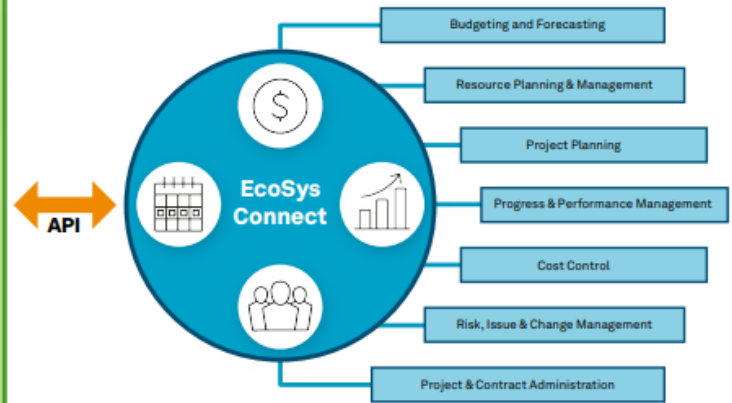
EcoSys Connect

Main Benefits

- Cloud-enabled platform purpose-built to support all EcoSys integrations
- Eliminates need for custom integration code
- Reduced implementation time and cost
- Increased reliability and simplified maintenance
- Improved performance

Main Features

- User Dashboard to monitor job status and audit log
- Job automation for scheduling and running on-demand executions (PATENT PENDING)
- Integration error handling (resend option in R2)
- Configurable field mapping and transformations



GENERAL STEPS SCHEDULE

Readers: Fixed, SOAP, No-op

Processors: Compound, Context Logger, Filter, SOAP, Hierarchy Builder, Iterator, Logger, No-op, P6 Join, Reducer, SOAP Join

Writers: SOAP, No-op

Read ProjectImportFilterProjectCodeName

- CompoundProcessor
 - IteratorProcessor
 - CompoundProcessor
 - Read ActivityImportFilter
 - CompoundProcessor
 - IteratorProcessor
 - CompoundProcessor
 - Read ProjectCodeValueActive
 - IteratorProcessor
 - CompoundProcessor
 - Read EcoSys Mapped Projects
 - P6 Join
 - Read P6 ProjectCodeAssignments
 - IteratorProcessor
 - CompoundProcessor
 - Read P6 Project
 - IteratorProcessor
 - CompoundProcessor
 - Read P6 WBS Activities
 - Write P6 WBS Activities to EcoSys
 - Read P6 WBS Activities
 - Write P6 WBS Activities to EcoSys

Basic: Name, Connector, Operation Name, Response Root Path

Advanced: Previous Step Output, Step Inputs

Step Inputs: ReadEcoSysConnectSettingsProperty, ecoSysConnectSettingsPropertyOptions, username, password, includeMetaData, logOutSession, logLevel, logTitle, logDebug, ecoSysConnectSettingsPropertyParameters, propertyID, P6Connector.Project, propertyValue

GENERAL STEPS SCHEDULE

Schedule Start Date: 08-Jun-2020, Schedule End Date: _____

Schedule Description: At 00:00, Every day

EVERY MONTH

| | | | |
|-----|-----|-----|-----|
| JAN | FEB | MAR | APR |
| MAY | JUN | JUL | AUG |
| SEP | OCT | NOV | DEC |

EVERY DAY

| | | | | | |
|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | | | | | |

EVERY HOUR

| | | | |
|-----|-----|-----|-----|
| SUN | MON | TUE | WED |
| THU | FRI | SAT | |

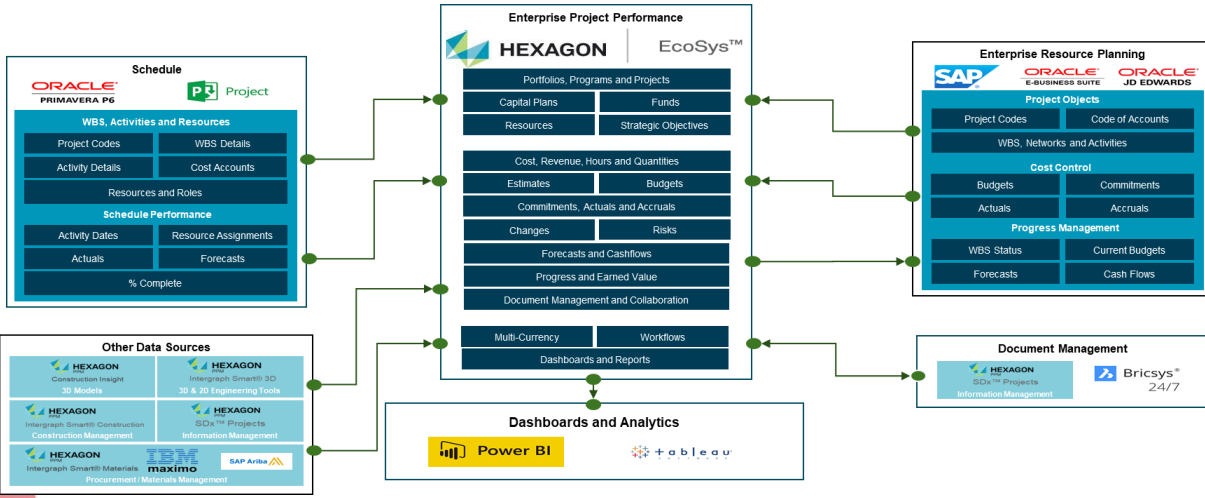
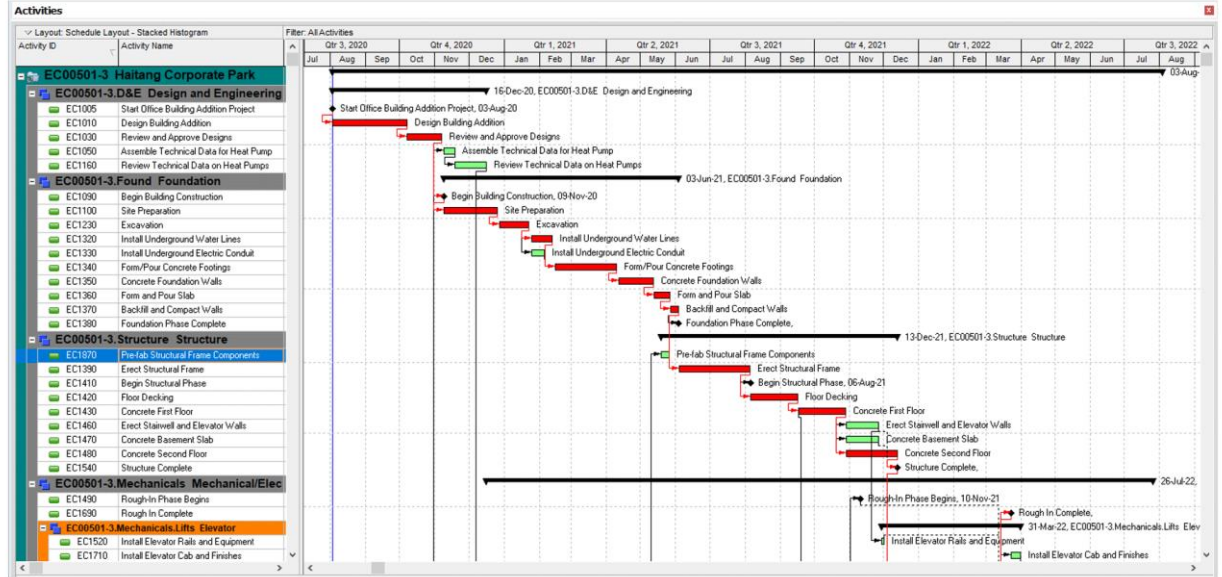
ADVANCED



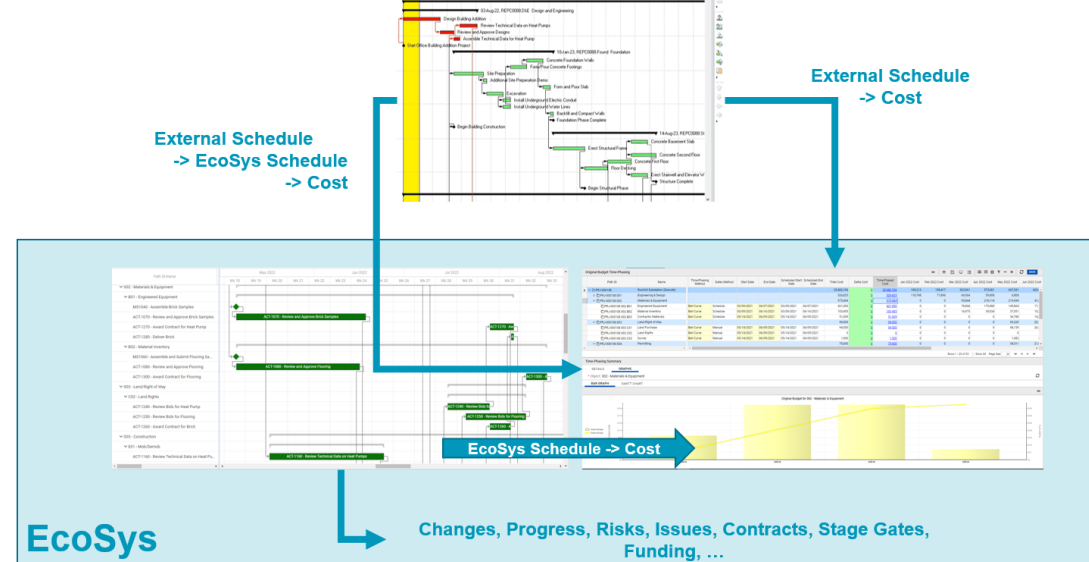
Schedule Integration

Primavera P6 / EcoSys P6 Connector

- ### Primavera P6 / EcoSys Connector
- Fully Cloud enabled integration platform
 - Simply integrate with MULTIPLE P6 instances
 - Import Activity Progress including Milestones
 - Import Activity Planned and Actual Start / End Dates to drive progress timeframe
 - Import Activity Progress to generate EVM metrics and support productivity analysis



External Schedule Integration



Engineering Progress Measurement

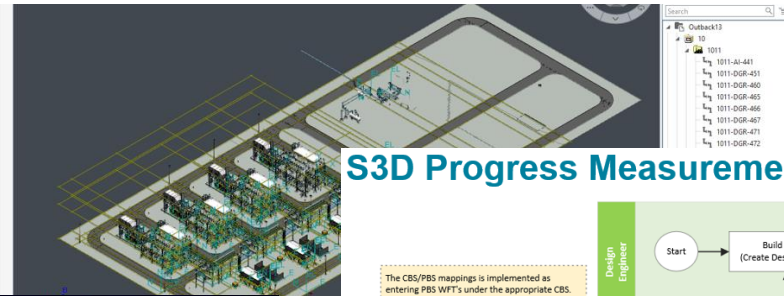
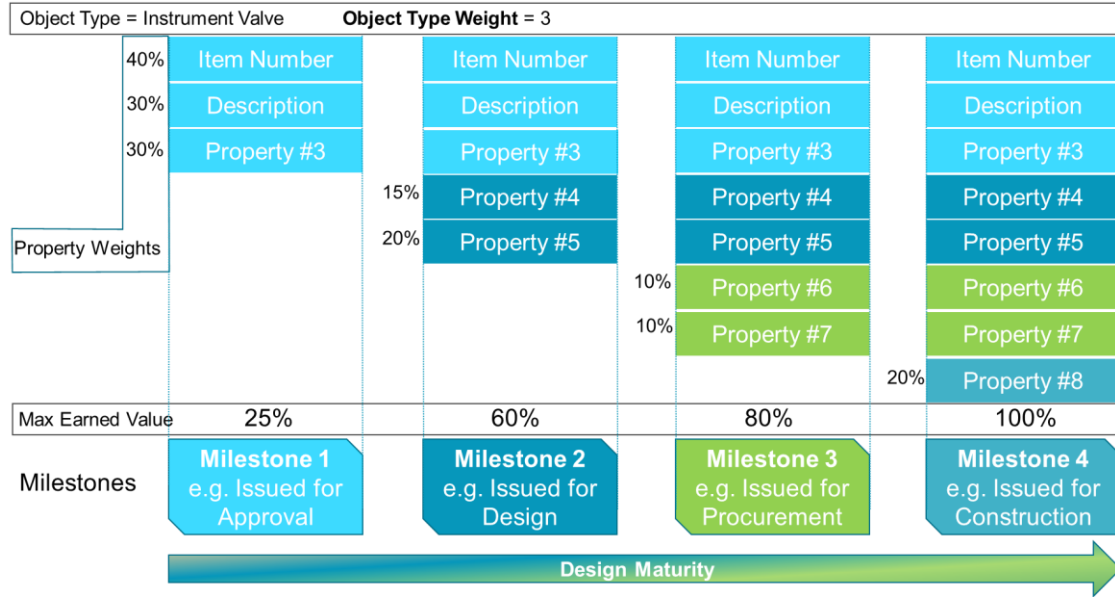


Engineering Progress Management

HxGN S3D

S3D

- Measures S3D Design Progress by Design Object Type based on approved design status
- Ability to Generate EV from S3D Design Object Progress
- Imports Design Quantities and Properties summarized by S3D Plant Breakdown Structure
 - PBS is typically: Plant / Site / Area / Unit / Discipline
- Design Progress is measured according to:
 - S3D Design Quantities compared to the EcoSys Quantity-based Budget
 - S3D Properties compared to EcoSys Stage of Design Milestones
- S3D PBS to EcoSys CBS Mapping
 - S3D PBS Structure is imported as EcoSys Transaction Categories
 - EcoSys User to do Manual Mapping of PBS to EcoSys CBS
- Solution will come with pre-configured S3D Filters on Design Object Type

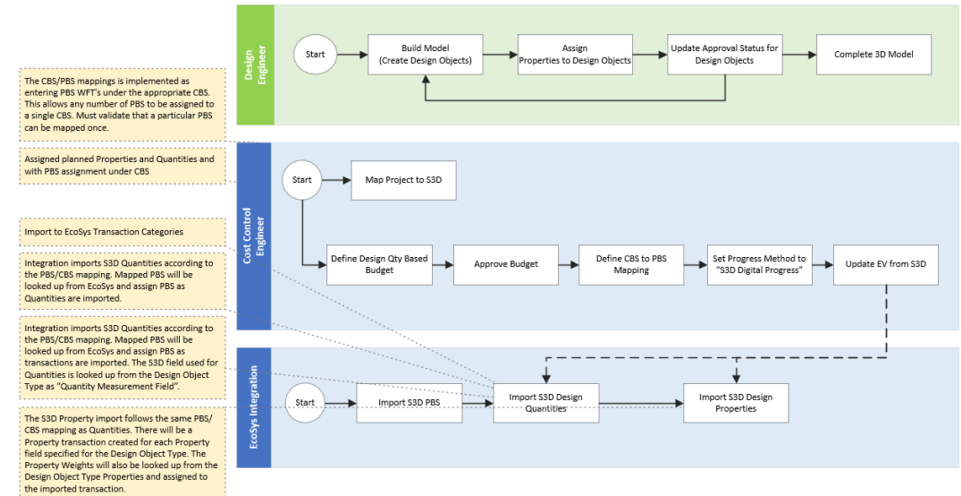


S3D Progress Measurement

Project: PRJ-000185 - 27th Jan Map to PBS Project Period: Jan 2022

| Path ID | Name | BAC Hours | BAC Cost | SAC | SV | TV | TV2 | ES | PAR | PV Cost | Progress Method | Physical % Complete | Preview % Complete | % Complete | Earned Ho. |
|-------------------|---------------------|-----------|----------|-----|----|----|-----|----|-----|---------|-----------------|---------------------|--------------------|------------|------------|
| PRJ-000185 | 27th Jan Map to PBS | 300 | 3,000 | 875 | 0 | 7 | 125 | | | 130 | | | | | |
| PRJ-000185 Demo 1 | Demo 1 | 100 | 1,000 | | | | | | | 42 | S3D Progress | | 0.0 | 0.0 | |
| PRJ-000185 Demo 2 | Demo 2 | 100 | 1,000 | | | | | | | 42 | S3D Progress | | 0.0 | 0.0 | |
| PRJ-000185 Demo 3 | Demo 3 | 100 | 1,000 | | | | | | | 42 | S3D Progress | | 115.6 | 0.0 | |

| Object Type ID | Budgeted Unit of Measure | S3D Primary UOM | Approved Budget Quantity | Approved Budget Cost | S3D Model Quantity | S3D % Quantity Modelled | S3D Rollup % Complete | S3D Budget Line EV Cost | S3D Design Object ID | Design Object % Complete | Model Quantity | S3D Design Weighted % Rollup |
|----------------|--------------------------|-----------------|--------------------------|----------------------|--------------------|-------------------------|-----------------------|-------------------------|----------------------|--------------------------|----------------|------------------------------|
| Outback | EACH | EACH | 100 | 1,000.00 | 334 | 33.4 | 115.58 | 1,156 | | | 334 | 115.58 |
| Slab-1-0702 | | | | | 15 | | | | | | 17 | 2.53 |
| Slab-1-0711 | | | | | 120 | | | | | | 62 | 74.88 |
| Slab-1-0031 | | | | | 15 | | | | | | 17 | 2.53 |
| Slab-1-0030 | | | | | 15 | | | | | | 17 | 2.53 |
| Slab-1-0041 | | | | | 15 | | | | | | 22 | 3.23 |



Information Management Integration



Information Management Integration

HxGN SDx Projects

SDx Projects

- Track Progress against Document and Drawing Deliverables in SDx
- Utilize Progress Rules of Credit aligned to Document Issue Status to determine % complete
- Bi-directional integration to transfer progress package details and package contents
- Utilize EcoSys Live Connector to view documents from within SDx
- Generate EV metrics based on planned actuals and progress in EcoSys
- Analyze productivity and performance in EcoSys

Project Management and Controls > Progress and Performance Management > Earned Value Analysis

Project: PRJ-000057 - Design and Engineering Delivery Project *Project Period: Apr 2021

| Path ID | Name | BAC Hours | BAC Cost | PV Hours | PV Cost | EV AC Hours | EV AC Cost | Progress Method | Physical % Complete | Review % Complete | Earned Hours | Earned Cost |
|------------------|---------------------------------------------------------------------------|-----------|----------|----------|---------|-------------|------------|------------------|---------------------|-------------------|--------------|-------------|
| PRJ-000057 | Design and Engineering Delivery Project | 2,800 | 224,000 | 2,800 | 224,000 | 2,107 | 188,560 | | 0.0 | 0.0 | 3,068 | |
| PRJ-000057.A | Process Design | 430 | 34,400 | 430 | 34,400 | 326 | 26,080 | | 0.0 | 0.0 | 166 | |
| PRJ-000057.A.A01 | Basics of Design | 60 | 4,800 | 60 | 4,800 | 46 | 3,680 | Progress Package | 0.0 | 48.3 | 0.0 | 24 |
| PRJ-000057.A.A02 | Process Flow Diagrams, Utility Flow Diagrams and Heat & Material Balances | 90 | 7,200 | 90 | 7,200 | 67 | 5,360 | Progress Package | 0.0 | 46.1 | 0.0 | 34 |
| PRJ-000057.A.A03 | Process & Operational Control Description | 90 | 7,200 | 90 | 7,200 | 69 | 5,520 | Progress Package | 0.0 | 30.0 | 0.0 | 27 |
| PRJ-000057.A.A04 | Process Equipment List | 80 | 6,400 | 80 | 6,400 | 61 | 4,880 | Progress Package | 0.0 | 30.0 | 0.0 | 24 |
| PRJ-000057.A.A05 | Process Data sheets for Main Equipment | 90 | 7,200 | 90 | 7,200 | 34 | 2,880 | Progress Package | 0.0 | 30.0 | 0.0 | 15 |
| PRJ-000057.A.A06 | Piping & Instrumentation Diagrams - P&ID's | 60 | 4,800 | 60 | 4,800 | 47 | 3,760 | Progress Package | 0.0 | 40.0 | 0.0 | 42 |
| PRJ-000057.B | Civil & Structural Design | 430 | 34,400 | 430 | 34,400 | 326 | 26,080 | | 0.0 | 0.0 | 565 | |
| PRJ-000057.B.B01 | Earthworks Specifications | 90 | 7,200 | 90 | 7,200 | 69 | 5,520 | Progress Package | 0.0 | 80.0 | 0.0 | 117 |
| PRJ-000057.B.B02 | Earthworks Grading Drawings Layouts | 80 | 6,400 | 80 | 6,400 | 61 | 4,880 | Progress Package | 0.0 | 40.0 | 0.0 | 96 |
| PRJ-000057.B.B03 | Piling Specification | 90 | 7,200 | 90 | 7,200 | 69 | 5,520 | Progress Package | 0.0 | 80.0 | 0.0 | 117 |

| Progress Item ID | Progress Item Name | Roc Set ID | Package Documents | Rules of Credit Action | Progress Item Delete | SDx Document Count | Allocated Hours | Roc Step Number ID | Roc Step Description | Progress Method ID | Document Status | Weight |
|------------------|--------------------|------------|-----------------------|------------------------|----------------------|--------------------|-----------------|--------------------|-------------------------------|--------------------|-------------------------|--------|
| A001 | Basics of Design | DRCat1 | PRJ-000057.A.A01.A002 | | | 3 | 60.0 | 01 | ASS - Assigned | Percent Complete | Not Assigned | 3.00 |
| | | | | | | | | 02 | PR - Preliminary | SDx | Preliminary | 25.00 |
| | | | | | | | | 03 | JPR - Issued For Review | SDx | Issued for Review | 10.00 |
| | | | | | | | | 04 | JPC - Issued For Design | SDx | Issued for Design | 10.00 |
| | | | | | | | | 05 | JPC - Issued For Construction | SDx | Issued for Construction | 10.00 |
| | | | | | | | | 06 | IAB - Issued For As-Built | SDx | Issued for As-Built | 20.00 |
| | | | | | | | | 07 | JFF - Issued For Final | SDx | Issued for Final | 20.00 |

Admin > Projects Admin > Progress Templates

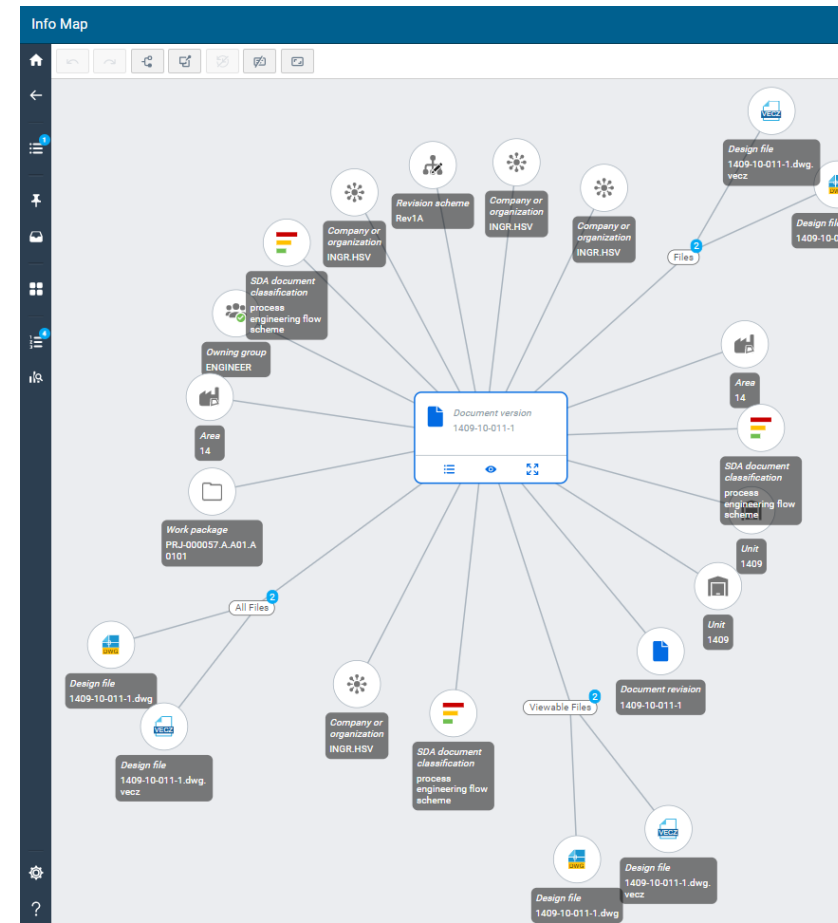
Milestone Templates Quantity Templates Deliverables Templates Package ROC Templates Package ROC Templates - Projects

Templates Import

Sets ID: Document Review Categories

| Sets ID | Name | Roc Set ID | Sets Path ID | Step ID Count |
|---------|-------------------------------------|------------|--------------|---------------|
| DRCat1 | Document Review Categories | DRCat1 | | 7 |
| DRCat2 | Document Review Categories - Manual | DRCat2 | | 7 |
| DRCat3 | Document Review Categories - 3 Site | DRCat3 | | 7 |

| Group Sets ID | Step ID | Roc Step Name | Progress Method ID | Weight | Doc Status | Sets ID |
|---------------|---------|-------------------------------|--------------------|--------|-------------------------|---------|
| | 01 | ASS - Assigned | Percent Complete | 5.00 | Not Assigned | DRCat1 |
| | 02 | PR - Preliminary | SDx | 25.00 | Preliminary | DRCat1 |
| | 03 | JPR - Issued For Review | SDx | 10.00 | Issued for Review | DRCat1 |
| | 04 | JPC - Issued For Design | SDx | 10.00 | Issued for Design | DRCat1 |
| | 05 | JPC - Issued For Construction | SDx | 10.00 | Issued for Construction | DRCat1 |
| | 06 | IAB - Issued For As-Built | SDx | 20.00 | Issued for As-Built | DRCat1 |
| | 07 | JFF - Issued For Final | SDx | 20.00 | Issued for Final | DRCat1 |



Procurement Progress Measurement

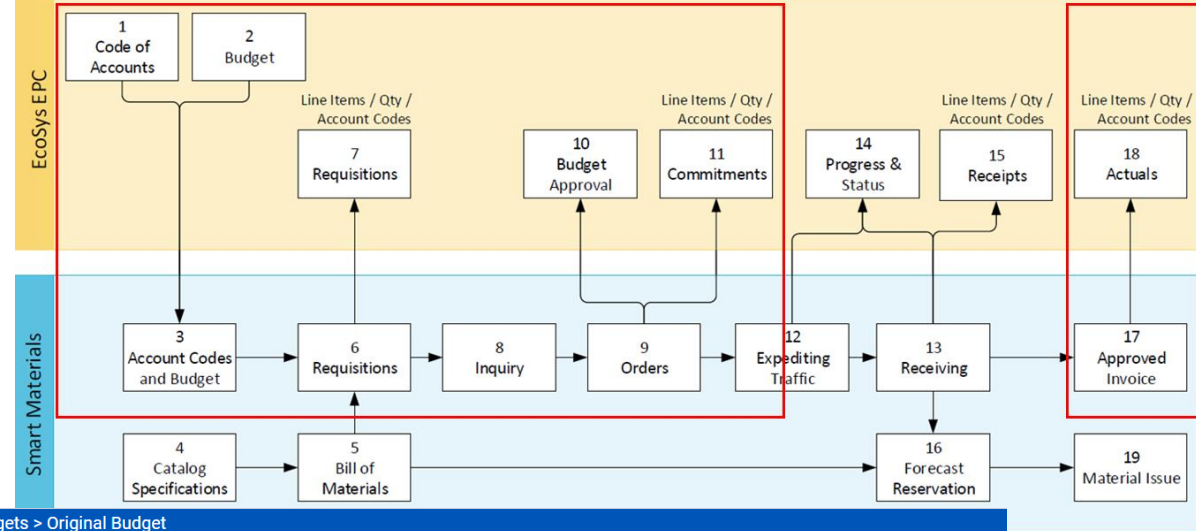


Procurement Progress Management

HxGN Smart Materials

HxGN Smart Materials

- WBS & budget info from EcoSys to Smart Materials
- Requisition, P.O. line item, Commitment from Smart Materials to EcoSys
- P.O. revisions and other costs are captured
- Quantities and Cost
- Inquiry through Delivery



J.10.01 Account Code Structures

Account Code Structures

Structure: ECOSYS, Short Desc: EcoSys, Description: EcoSys

Account Code Structure Details

| Order | Structure Type | Attribute Name | Hint Text | Node Type | Short Desc | Separator Text | Required | Length |
|-------|----------------|--------------------|------------------|-----------|------------|----------------|----------|--------|
| 1 | Attribute | WBSPATHID | WBSPatId | | | | ✓ | |
| 2 | Attribute | COSTACCOUNTID | CostAccountId | | | | ✓ | |
| 3 | Attribute | PROJECTCURRENCY | Projectcurrency | | | | ✓ | |
| 4 | Attribute | COSTINPROJECTCURRI | CostinProjectCur | | | | ✓ | |

Budgets > Original Budget

Portfolios Estimating Scheduling Projects Contracts Budgets Changes Progress Forecasts Reports User Asset Investment Planning Resource Management Configure E

* Project: TRG-01 - Power Plant Construction

ORIGINAL BUDGET TIME-PHASING ANALYSIS REGISTER IMPORT REPORTS

Original Budget Summary

| Path ID | Name | Type | Contingency Account Type | Unapproved Hours | Unapproved Cost | Approved Hours | Approved Cost |
|---------------|--------------------------|--------------|--------------------------|------------------|-----------------|----------------|---------------|
| TRG-01 | Power Plant Construction | Projects | | 0 | 0 | 1,459,882 | 399,900,390 |
| TRG-01.1 | Plant System Design | WBS | | 0 | 0 | 246,909 | 20,753,454 |
| TRG-01.1.1 | Business Requirements | WBS | | 0 | 0 | 63,783 | 5,685,526 |
| TRG-01.1.1.01 | Auxiliary Systems | Work Package | | 0 | 0 | 18,926 | 855,369.90 |
| TRG-01.1.1.02 | Civil Structures | Work Package | | 0 | 0 | 4,225 | 384,656 |
| TRG-01.1.1.03 | Control Systems | Work Package | | 0 | 0 | 2,783 | 377,860 |
| TRG-01.1.1.04 | Electrical Systems | Work Package | | 0 | 0 | 2,121 | 169,589 |

Approved Budget Details

APPROVED DETAILS

* Object: 01 - Auxiliary Systems

| Object Path ID | Cost Account ID | Resource ID | Resource Name | Material Item ID-Name | UOM ID | Quantity | Hours | Cost | Currency | Cost in Object Currency | Budget ID | Approval Date |
|----------------|-----------------|-------------|----------------|-----------------------|--------|----------|----------|------------|----------|-------------------------|------------|---------------|
| TRG-01.1.1.01 | ODC | CV-ENG | Civil Engineer | | LOT | 7.0 | 18,926.2 | 855,369.90 | USD | 855,369.90 | BGT-000001 | 01/13/2021 |
| 1.01 | LAB | | | | | 0.0 | 18,926.2 | 589,576.15 | USD | 589,576.15 | BGT-000001 | 01/13/2021 |

J.10.03 Account Codes

Account Codes

| Account Code | Account Code Structure | sc | Description | Currency | Planned Budget | Revised Budget |
|-----------------|------------------------|---------------|-----------------------|----------|----------------|----------------|
| TRG-01.2.03-LAB | ECOSYS | Systems | Control Systems | USD | 0,00 | 834,074,00 |
| TRG-01.2.03-MAT | ECOSYS | Systems | Control Systems | USD | 0,00 | 5,460,864,00 |
| TRG-01.2.04-LAB | ECOSYS | el Systems | Electrical Systems | USD | 0,00 | 510,501,00 |
| TRG-01.2.04-MAT | ECOSYS | el Systems | Electrical Systems | USD | 0,00 | 16,210,419,00 |
| TRG-01.2.05-LAB | ECOSYS | mental System | Environmental Systems | USD | 0,00 | 16,874,412,00 |
| TRG-01.2.05-MAT | ECOSYS | mental System | Environmental Systems | USD | 0,00 | 270,300,00 |
| TRG-01.2.06-LAB | ECOSYS | stems | Flow Systems | USD | 0,00 | 4,611,578,00 |
| TRG-01.2.06-MAT | ECOSYS | stems | Flow Systems | USD | 0,00 | 691,843,00 |
| TRG-01.2.07-LAB | ECOSYS | ical Systems | Mechanical Systems | USD | 0,00 | 638,223,00 |
| TRG-01.2.07-MAT | ECOSYS | ical Systems | Mechanical Systems | USD | 0,00 | 296,558,00 |
| TRG-01.2.08-LAB | ECOSYS | ystems | Safety Systems | USD | 0,00 | 1,406,691,00 |
| TRG-01.2.08-MAT | ECOSYS | ystems | Safety Systems | USD | 0,00 | 1,738,400,00 |

COMMITMENT REGISTER

Commitment Register

| Commitment ID | Commitment Name | Type | Hours | Committed Cost | Actual Cost | Open Commitment | Vendor Name |
|---------------|-----------------------------------|----------------|-------|----------------|-------------|-----------------|-------------|
| | | | 0 | 1,051,037 | 0 | 1,051,037 | |
| PO-000001 | Misc Bolts, Nuts and Washers | Purchase Order | | 1,051,037 | 0 | 1,051,037 | |
| PO-000002 | Equipment and Large Tools, Rental | Purchase Order | | 0 | 0 | 0 | |
| PO-000003 | Geotextile Xabric | Purchase Order | | 0 | 0 | 0 | |

Commitment Details

* Commitment: PO-000001 - Misc Bolts, Nuts and Washers

GENERAL COMMITMENT LINE ITEMS ACTUAL LINE ITEMS

| Object Path ID | Cost Account ID | Line ID | Description | Quantity | UOM | Hours | Cost | Currency | Cost in Object Currency | Date |
|----------------|-----------------|---------|-------------------------------|----------|-----|-------|--------------|----------|-------------------------|------------|
| | | | | | | 0.0 | 1,051,037.38 | USD | 1,051,037.38 | |
| TRG-01.2.07 | MAT | 7 | 1/4-20 21/2" HEX GRADE 5 ZINC | 50.0 | EA | | 4.00 | USD | 4.00 | 01/02/2017 |
| TRG-01.2.07 | MAT | 70 | M8 X 40 HEX 8.8 ZINC | 25.0 | EA | | 3.75 | USD | 3.75 | 01/02/2017 |
| TRG-01.2.02 | MAT | 99 | 1/2" Anchors | 50.0 | EA | | 40.00 | USD | 40.00 | 01/02/2017 |
| TRG-01.2.07 | MAT | 71 | M8 X 50 HEX 8.8 ZINC | 25.0 | EA | | 4.75 | USD | 4.75 | 01/02/2017 |

Construction Progress Measurement

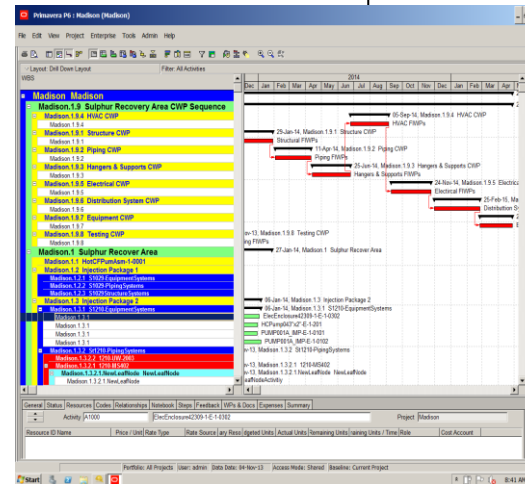


Construction Progress Management

HxGN Smart Construction

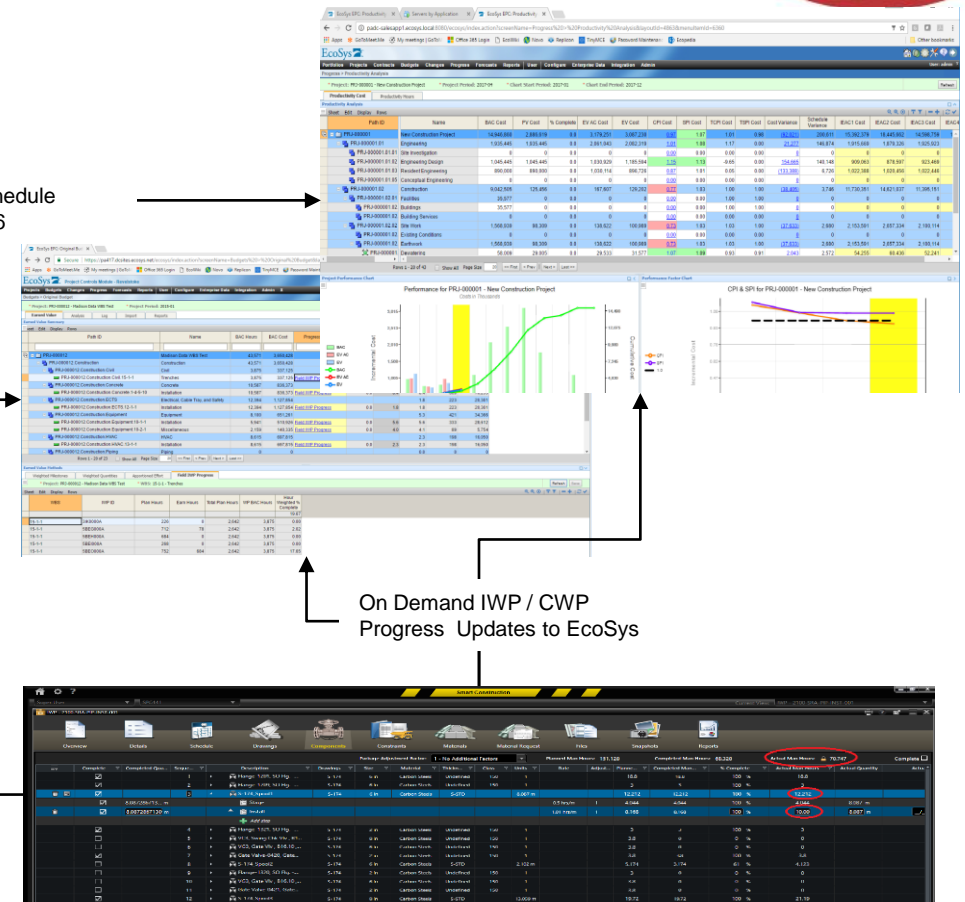
HxGN Smart Construction

- Scheduled or ad-hoc Field Construction Progress updates
- Update progress based on Installations Work Package (IWP) approval status
- Update progress based on Construction Work Package (CWP) modifications
- Identify progress/performance issues early
- Update EcoSys with following Work Package details
 - CWA Number
 - CWP Number (WBS Code)
 - IWP Number
 - Plant ID
 - Planned Manhours
 - Actual Manhours
 - Planned Start/Finish Date
 - Actual Start/Finish Date
 - Discipline
 - Purpose
 - Crew Size



Export Optimized Schedule at CWP Level to P6







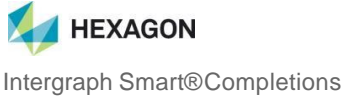

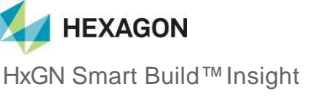

On Demand Schedule Updates from P6



Other Methods

Digital Options and Opportunities

Every project involves many sources of progress. We continue to build ways to integrate with other Hexagon solution and non-Hexagon products to provide access to the “right” source of progress data

| | | | |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
|  | <p>Schedule WBS, Activities, Relationships, Dates, Resource Assignment, and Progress</p> |  <p>Standard Product</p> | <p>EcoSys P6 Connector
MS Project Solution Accelerator</p> |
|  | <p>Structure and Classification Master Data, Project Commitments, Progress (Material Receipts), and Actuals (Invoices)</p> |  <p>Standard Product</p> | <p>Custom Integration developed by Smart Materials Product Team</p> |
|  | <p>Construction Work Package (CWP) and Installation Work Package (IWP) Progress</p> |  <p>Standard Product</p> | <p>Custom Integration Code developed by EcoSys Product Team</p> |
|  | <p>Construction Work Package Progress and Deliverable Completions</p> |  <p>Roadmap Integration (Configured With Services)</p> | <p>Customer Smart Completions API enabled via Services</p> |
|  | <p>Integrated HxGN 5D Vision; Budgeting, Progress, Change Management and EVA Enabled Forecasting</p> |  <p>Standard Product</p> | <p>Productized Integration Code developed by Smart Build Project Controls Product Team</p> |

Recording S3D

The Future Is Digital



Project Portfolio Management

Portfolio Planning
and Control

Fund
Management

Resource Planning
and Mgmt

Project and Contract
Planning

Scheduling

Estimating

Budgeting and
Forecasting

Cost Control

Progress and
Performance Mgmt

Risk, Issue, and
Change Mgmt

Project Management and Controls

Executives

Portfolio Managers

Project Managers

Project SMEs

Project Controls

Engineers

Contractors

Schedulers

Roles



Digital Progress



Summary

The Future Is Digital





THANK YOU