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Emirates Arsenal Stadium, London

Cleopatra Enterprise Metrics & KPIs in Project Cost Management

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Cleopatra Enterprise



**Project Controls
EXPO**
London, UK

About the Speaker



Stefan Bakker

VP Business – Europe, Americas

- Bachelor & Master degrees in Business Economics & Marketing
- Various courses in Cost Estimating & Cost Management
- 10 years of commercial consulting experience for various technical industries

Presentation topics

- Company introduction
- What are Metrics & KPIs and when to use?
- Why are Metrics & KPIs important?
- Examples of Metrics & KPIs in various phases
- How to find Metrics & KPIs by benchmarking?
- How to use benchmarking intelligence?
- Project Metrics & KPIs vs business objectives
- Conclusions

Introduction



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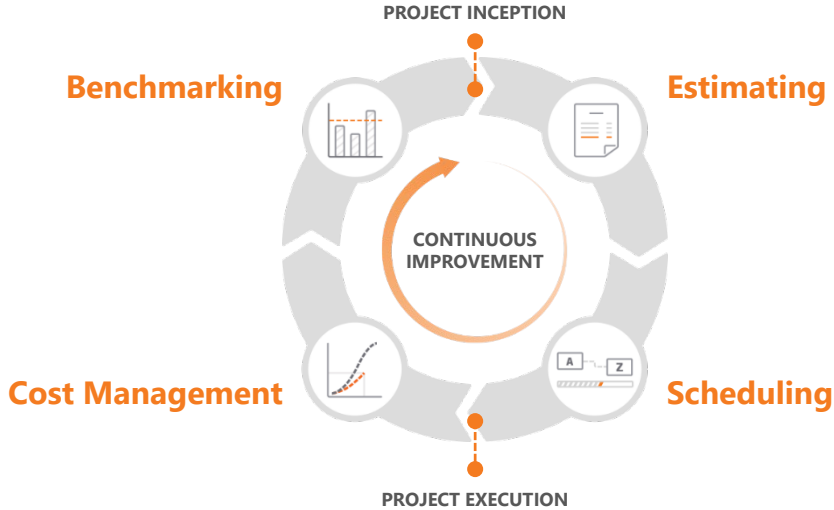
About Cleopatra Enterprise and Cost Engineering

A brief Introduction

- 25 years experience
- Software and Consultancy solutions
- Operating worldwide
- Knowledge Provider
- Empowering organizations to improve their project performance



Vision & Activities



Our clients



 CLEOPATRA

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What are Metrics and KPIs?



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Metrics are everywhere!

Matches played	Wins	Losses	Goals	Goals conceded	Clean sheets
11	4	2	16	15	2

Attack	
Goals	16
Goals per match	1.45
Shots	142
Shots on target	52
Shooting accuracy %	37%
Penalties scored	1
Big chances created	16
Hit woodwork	3

Team Play	
Passes	5,468
Passes per match	497.09
Pass accuracy %	84%
Crosses	223
Cross accuracy %	22%

Defence	
Clean sheets	2
Goals conceded	15
Goals conceded per match	1.36
Saves	44
Tackles	183
Tackle success %	54%
Blocked shots	31
Interceptions	86
Clearances	205
Headed Clearance	114
Aerial Battles/Duels Won	720
Errors leading to goal	2
Own goals	0

Discipline	
Yellow cards	26
Red cards	1
Fouls	68
Offsides	25



What are Metrics & KPIs?

- A metric is a value derived from the relation between two or more units of measurement
- A Key Performance Indicator is a metric that demonstrates the performance of a project, portfolio or company.
- Metrics and KPIs are essential tools within project cost controls

KPI = Metric / Metric ≠ KPI

Where to start?



When to use Metrics & KPIs?

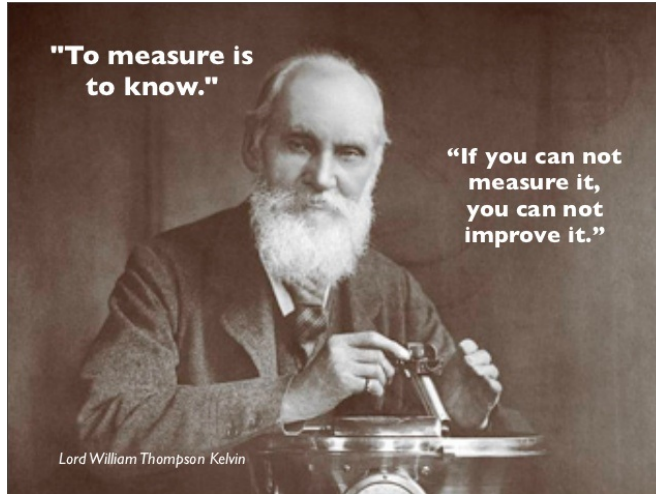
- We apply metrics while creating an Estimate
- We use KPIs to measure project performance during the Cost Management phase
- We derive metrics from actual project results during benchmarking phase to apply again during Estimating or set-up KPIs for Cost Management
- Cleopatra Enterprise offers an integrated platform to easily derive and use metrics and KPIs

Why are Metrics & KPIs important in Project Cost Management?



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Why are Metrics & KPIs important?



Why are Metrics & KPIs important?

- Metrics are essential in effectively creating early phase or conceptual Cost Estimates
- KPIs can present a summarized overview of the project performance
- KPIs and Metrics can provide early warnings and trigger actions to avoid faulty investment decisions and overruns
- KPIs are objective and unbiased

Examples of Metrics & KPIs in various project phases



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Essential: Breakdown Structures



Hierarchical classification



Break down scope to standard chunks to allow for analysis



I.e. disciplines, project phases or materials



Examples of Metrics & KPIs



Cleopatra Cost Estimating

- Project capacity vs total costs
- Equipment costs vs other disciplines costs
- Direct costs vs Indirect costs
- Material costs vs labour costs
- £ / kg
- £ / m



Total installed costs methodology

- Adding factors of costs and labour hours over the basis of Equipment costs
- Hand & Lang methodology developed after numerous years of executing & analysing projects.

Level ID	CBS	Description	Quantity	Unit	
Unit-Rates	2200 - Pressure Vessel Vertical	/# Y-1310, Suction scrubber Train 1, CS, L=2.85 m, D=1.25 m, P=60 bar, T=100 °C, Supply	1.00	pc	
Unit-Rates	1200 - Compress, Blowers, Drives	/# G7-1330, Gas Turbine Train 1, CS, 3300 kW, Supply	1.00	pc	
Unit-Rates	2700 - Heat Exchangers	/# E-1510, Glycol Gas Exchanger, CS/CS, 1200 m³, Pshell=75 bar, Ptube=75 bar, Supply	1.00	pc	
Composite Rates		Exchanger_jt, Total Installed Costs, Equipment based (Hand method)	1.00	pc	
Level ID	CBS	Description	Grand total cost	Quantity	Unit
/# Details	1000 - Mechanical Equipment	Equipment, Supply	0.00	1.00	pc
/# Details	7310 - Concrete Foundations	Material foundations and pavement	161,248.23	1.00	pc
/# Details	7400 - Buildings	Material buildings	0.00	1.00	pc
/# Details	3000 - Piping Materials	Material piping	1,612,482.26	1.00	pc
/# Details	4000 - Instrumentation Materials	Material instrumentation and control	1,096,487.94	1.00	pc
/# Details	5000 - Electrical Materials	Material electrical	96,748.94	1.00	pc
/# Details	7500 - Structural Steel	Material supporting and platforms	806,241.13	1.00	pc
/# Details	7640 - Insulation	Material insulation and fireproofing	451,495.03	1.00	pc
/# Details	7630 - Painting	Materials painting, cleaning, testing and miscellaneous	96,748.94	1.00	pc
/# Details	7310 - Concrete Foundations	Labour foundations and pavement	3,545,423.02	1.00	pc
/# Details	7400 - Buildings	Labour buildings	0.00	1.00	pc
/# Details	7630 - Painting	Labour painting	36,794,932.72	1.00	pc
/# Details	7710 - Installation Instruments	Labour instrumentation and control	21,264,233.89	1.00	pc
/# Details	7720 - Installation Electrical	Labour electrical	2,361,571.40	1.00	pc
/# Details	7500 - Structural Steel	Labour supporting and platforms	29,059,870.48	1.00	pc
/# Details	7640 - Insulation	Labour insulation and fireproofing	10,640,356.32	1.00	pc
/# Details	7610 - Equipment Erection	Labour transport and installation	3,542,738.36	1.00	pc
/# Details	7630 - Painting	Labour painting, cleaning, testing and miscellaneous	2,365,658.55	1.00	pc
Composite Rates		Compressor, Total Installed Costs, Equipment based (Hand method)		1.00	pc
Composite Rates		Vessel, Total Installed Costs, Equipment based (Hand method)		1.00	pc

Express cost validation

Easily look at some ratios like:

- Material vs Installation costs
- Direct vs Indirect costs

100%	Cost category	Total cost	%
<input type="radio"/>	Install	13,703,942.31	39.67%
<input type="radio"/>	Remove	511.52	0.00%
<input type="radio"/>	Prefabrication	356,703.09	1.03%
<input type="radio"/>	Testing	112,090.49	0.32%
<input checked="" type="radio"/>	Material	34,546,890.13	100.00%
<input type="radio"/>	Consumables	5,344.77	0.02%
<input type="radio"/>	Subcontracting	11,377,511.81	32.93%
<input type="radio"/>	Construction tools	15,872.80	0.05%
<input type="radio"/>	Construction tools & equipment	14,028.36	0.04%

100%		Total cost	%
<input checked="" type="radio"/>	Direct costs	60,132,895.29	100.00%
	Allowances	3,216,877.46	5.35%
<input type="radio"/>	Sub total	63,349,772.75	105.35%
<input type="radio"/>	Indirect costs	33,490,323.84	55.69%
<input type="radio"/>	Sub total	96,840,096.59	161.04%
<input type="radio"/>	Escalation	5,489,869.60	9.13%
<input type="radio"/>	Sub total	102,329,966.19	170.17%
<input type="radio"/>	Contingencies	26,605,791.21	44.24%
<input type="radio"/>	Sub total	128,935,757.39	214.42%
<input type="radio"/>	Grand total	128,935,757.39	214.42%

Examples of Metrics & KPIs

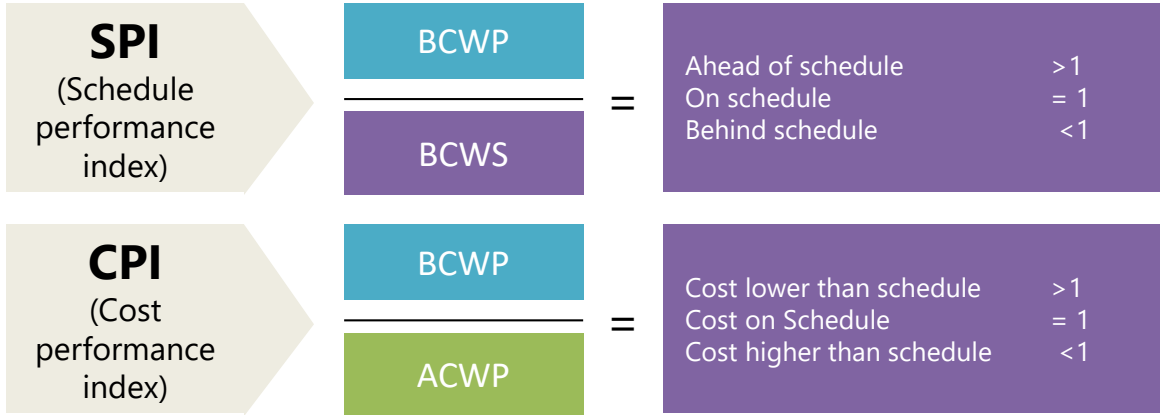


Cleopatra Cost Management

1. Cost Performance index (CPI)
2. Schedule Performance index (SPI)
3. So many possibilities....



Cost Management KPIs

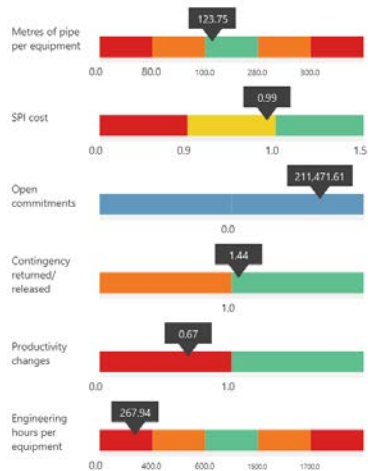


● BCWP (Budgeted cost of work performed)

● (Budgeted cost of work scheduled)

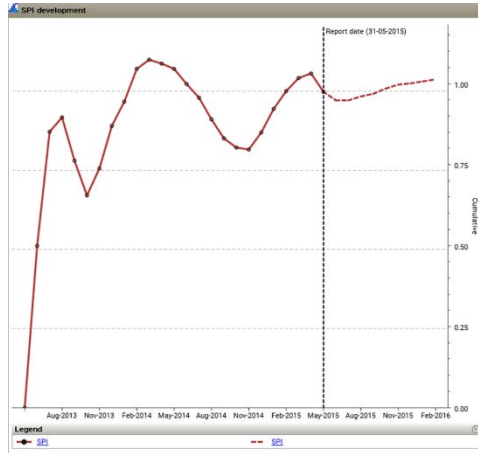
● ACWP (Actual cost of work performed)

Cleopatra - Visualize Cost Management KPIs



Cleopatra - Track through time

SPI
(schedule
performance
index)



How to find Metrics & KPIs by analysis in Benchmarking phase?



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Cleopatra Benchmarking

- Collect all historical projects
- Normalization & indexation of data
- Big Data analysis to improve estimating
- Asset, Project or Portfolio level analysis
- Use intelligence to create cost models



Breakdown overviews

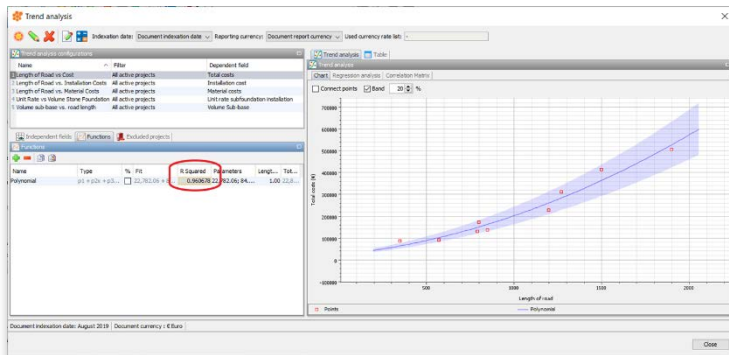
- Breakdown per work package or discipline
- Find factors, e.g. mechanical equipment cost distribution

Project comparison

Name	Total		Barry Barish		Charles Kao		Gerty Cori	
	Cost	%	Cost	%	Cost	%	Cost	%
Benchmark structure	\$ 14.861.870	309,87%	\$ 2.344.873	286,29%	\$ 1.521.731	651,03%	\$ 2.017.203	197,94%
Base Estimate	\$ 13.562.401	282,78%	\$ 2.215.654	270,52%	\$ 1.383.720	591,99%	\$ 1.836.457	180,20%
Direct Cost	\$ 10.018.913	208,90%	\$ 1.546.257	188,79%	\$ 1.135.923	485,98%	\$ 1.579.914	155,03%
Materials and Equipment	\$ 9.991.461	208,32%	\$ 1.518.805	185,44%	\$ 1.135.923	485,98%	\$ 1.579.914	155,03%
Mechanical Equipment	\$ 4.796.147	100,00%	\$ 819.042	100,00%	\$ 233.741	100,00%	\$ 1.019.111	100,00%
Pumps	\$ 364.955	7,61%	\$ 196.661	24,01%	\$ 0	0,00%	\$ 84.147	8,26%
Pressure Vessel	\$ 4.237.259	88,35%	\$ 594.287	72,56%	\$ 181.149	77,50%	\$ 934.964	91,74%
Heat Exchangers	\$ 193.934	4,04%	\$ 28.094	3,43%	\$ 52.592	22,50%	\$ 0	0,00%
Electrical Equipment	\$ 5.195.314	108,32%	\$ 699.762	85,44%	\$ 902.182	385,98%	\$ 560.803	55,03%
Direct Contracts	\$ 27.452	0,57%	\$ 27.452	3,35%	\$ 0	0,00%	\$ 0	0,00%
Indirect Cost	\$ 3.543.488	73,88%	\$ 669.397	81,73%	\$ 247.797	106,01%	\$ 256.542	25,17%
Escalation	\$ 744.155	15,52%	\$ 70.732	8,64%	\$ 67.051	28,69%	\$ 119.525	11,73%
Contingency	\$ 496.359	10,35%	\$ 58.488	7,14%	\$ 51.308	21,95%	\$ 61.220	6,01%
Capitalized Interest	\$ 58.955	1,23%	\$ 0	0,00%	\$ 19.652	8,41%	\$ 0	0,00%

Trend analysis

- Using regression functions to determine the relation between various units
- E.g. length of road vs project costs
- R-squared states the usability of this function



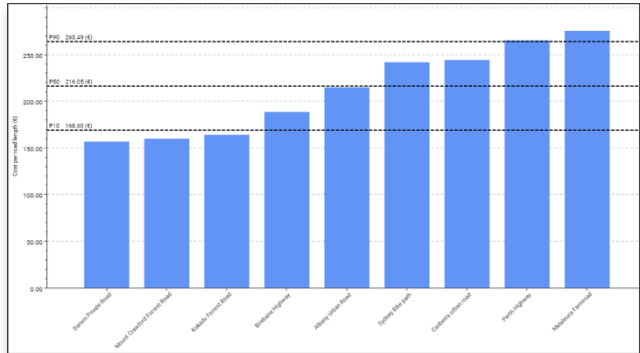
How to use Benchmarking intelligence?



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Distribution chart

- Metrics per project can be compared in order to find applicable cost for probability
- Outcomes may advise contingency to be applied from a perspective of analysing metrics.



Cost modelling

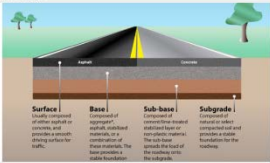
Benchmark information can be used to create new parametric cost models for early phase estimating

Specify the variables for "Maintenance on Bitumen road, adding new Bitumen. Foundation works: Base only"

Please specify the user defined variable values of the cost model below:

Variables Show the input variables Show all variables

Name	Value	UNIT
Level of urbanisation		
Level of urbanisation	Urban area	
Road length	1,000.00 m	m
Number of lanes	1+1	
Additional pavements	None	
Existing surface type	Bitumen	
New surface type	Bitumen	
Number of new layers on existing pavement?	2 Bitumen layers	
Apply oil-resistant rubber layer in bitumen?	Yes	
Replace sub/bases	Base only	
Materials		



Surface
Usually composed of asphalt or concrete, and provides a smooth, skid-resistant surface for traffic.

Base
Composed of aggregate, asphalt, crushed materials, or a combination of these materials. The base provides a stable foundation for the subgrade.

Sub-base
Composed of coarse-grained material or non-plastic material. The sub-base spreads the load of the roadway onto the subgrade.

Subgrade
Composed of natural or added granular material and provides a stable foundation for the roadway.

Results Show component results Show all results

Name	Value	UNIT	Description
Description	Maintenance on Bitumen (m		
Quantity	1,000.00	m	
UNIT	m		

Setting a cost without currency is not recommended. If the document currency is changed, the cost will not be converted; and 11 more (see tooltip)

Close

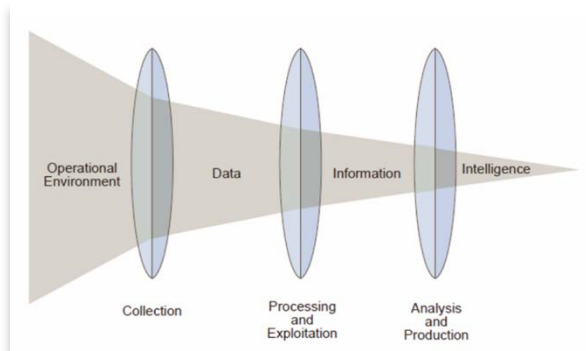
Project Metrics & KPIs vs Business Objectives



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How to tie KPIs to your business objectives?

- Identify metrics within successful and unsuccessful projects for lessons learned
- Tie KPIs to those metrics in order to make projects measurable and manageable
- For asset owners: incorporate performance bonuses for contractors based on KPIs
- For contractors: use KPIs as a tool to drive project performance and take timely corrective action



Be careful!

- Metrics & KPIs might not tell the whole story
- Always make sure to understand the situation behind the numbers!
- Common sense by human intelligence is still required



This is not reality for a while



Conclusions

- Metrics and KPIs can be found and used throughout the project lifecycle, from Estimating to Cost Management and Benchmarking.
- Metrics and KPIs are essential to determine the presumed costs and performance of your projects
- Metrics and KPIs are of key importance in order to make sound data driven business decisions
- Cleopatra Enterprise can help you to obtain and use all useful metric and KPI intelligence!

Use Metrics & KPIs and win!



Thank you for joining



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