University of Maryland

Project Management Symposium

NEXT SESSION

Turbocharging Your Estimation Process Using Data You (Probably) Already Have

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This session will be recorded.

Project Management Symposium

Turbocharging Your Estimation Process Using Data You (Probably) Already Have

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University of Maryland 1856

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About DC Water

McMillan Water Treatment Plant (photo credit: DC Water)

Blue Plains Advanced Wastewater Treatment Plant (photo credit: DC Water)

DC Water Headquarters (photo credit: SK&A Engineers)

Some Awards….

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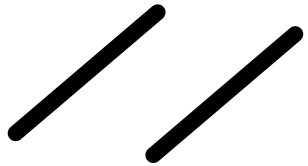
Civil & Environmental Engineering Department

GLOBAL WATER AWARDS

CSWEEK
Expanding Excellence in **Customer Service**

Project Management Institute

What is an Estimate?



“a quantitative assessment of the likely amount or outcome of a variable”

- PMBOK Guide 7th edition

Some key terms….

Range

A list of possible outcomes within a set lower & upper limit

01

Accuracy

The correctness of an estimate

02

Precision

The degree of exactness ascribed to the estimate

03

Confidence

The level of certainty (%) that the estimate will fall within a given range

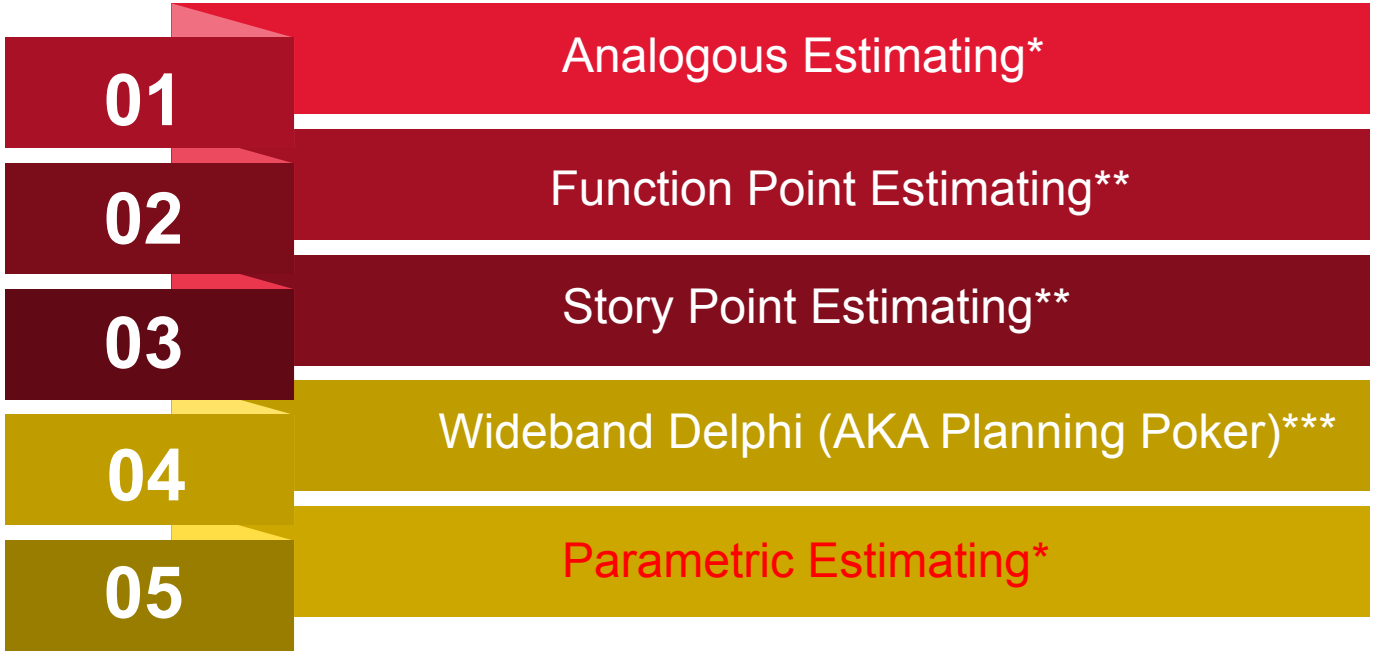
04

Deterministic vs Probabilistic

Point (or point in time) estimate vs range of estimates (with associated probabilities)

05

Common Estimation Methods



* Top-down estimation method
** Bottom-up estimation method
*** Top-down or bottom-up estimation method

Data Collection: Building your Estimates Database

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Actuals

- Timesheet Hours
- Costs
- Durations
- Story Points
- FTE

Estimates

- Effort Hours
- Costs
- Durations
- Story Points
- FTE

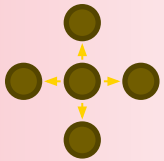
Automated (Weekly) Inputs

Manual Inputs

ESTIMATES DATA WAREHOUSE

Dimensions include:

- Task
- Assignment
- Sprint
- Release
- Epic
- Phase
- Project/Program
- Resource
- Portfolio
- Project Size
- Complexity
- Project Methodology
- Estimation Method



Reporting

Data Analytics

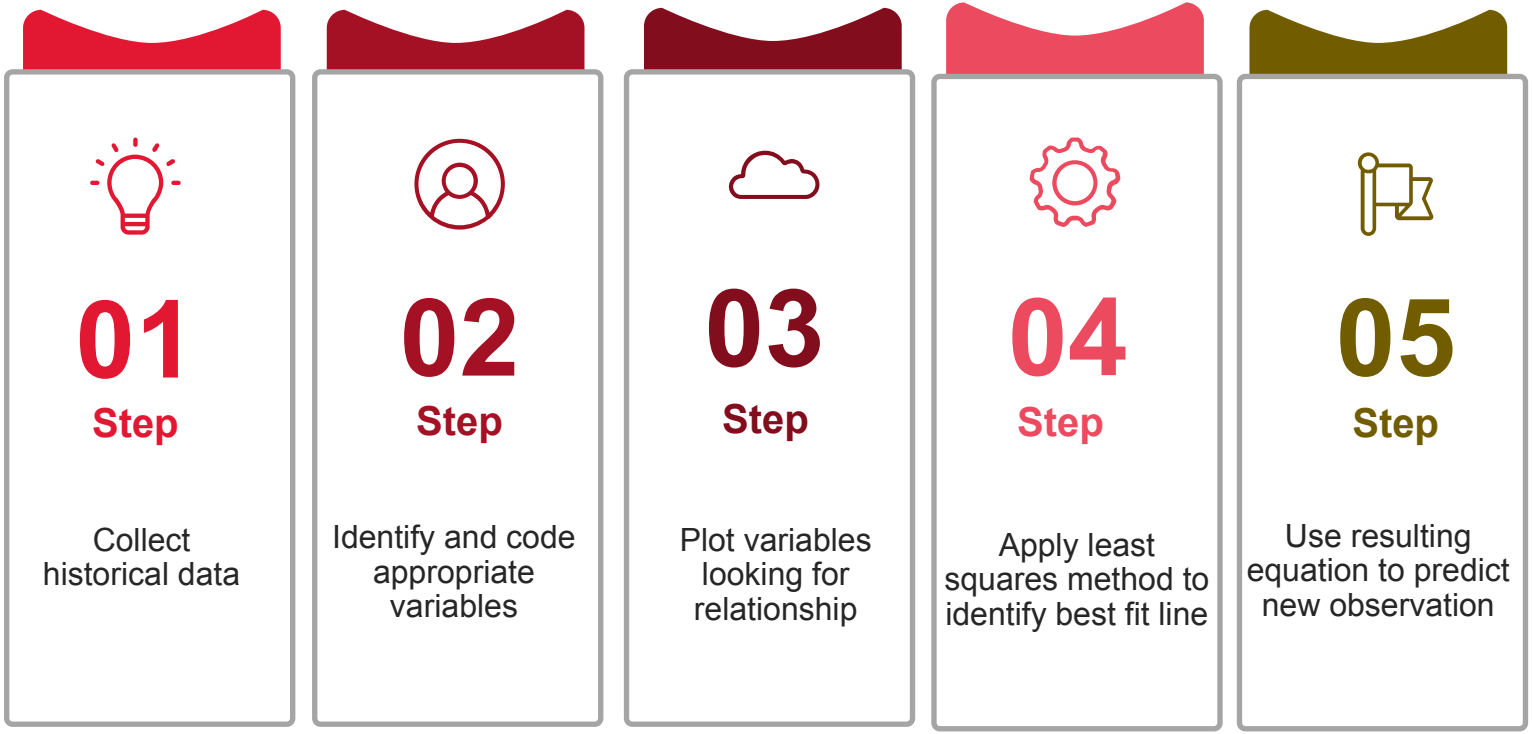
Predictive Modeling

Error Reduction

Estimates Generation: Parametric Models

- Compares each variable against Y to determine the best fit
- Historical data must be collected
- Model must be scalable
- Use excel's data analysis add-in, BI tools or build into your PMO tool!

Parametric Models - Process



Parametric Models - Example

What independent variable that best predicts individual sprint costs on an agile project?

Effort Hours?

Median Resource Rate?

Story Points + Effort Hours?

Story Points?

Story Points + Median Rate?

Effort Hours + Median Rate?.

All 3 Variables?

Is story points the "best fit" variable?

Regression Statistics	
Multiple R	0.928153612
R Square	0.861469127
Adjusted R Square	0.860486638
Standard Error	18415.5081
Observations	143

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	170.3697701	3405.237144	0.050032	0.960168	-6561.550767	6902.290307	-6561.550767	6902.290307
Story Points	1991.696973	67.26159075	29.61121	2.18E-62	1858.725417	2124.66853	1858.725417	2124.66853

…maybe effort hours is the “best fit”

Regression Statistics	
Multiple R	0.986691192
R Square	0.973559508
Adjusted R Square	0.973371986
Standard Error	8045.354577
Observations	143

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	394.7730812	1415.175161	0.278957	0.780687	-2402.931257	3192.47742	-2402.931257	3192.47742
Effort Hours	94.64305085	1.313507913	72.05366	4E-113	92.0463357	97.239766	92.0463357	97.239766

…perhaps median rate is the “best fit”?

Regression Statistics

Multiple R	0.055019181
R Square	0.00302711
Adjusted R Square	-0.004043619
Standard Error	49402.8603
Observations	143

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	147345.0176	87582.12938	1.682363955	0.094711542	-25798.85186	320488.887	-25798.85186	320488.887
Median Rate	-604.2361611	923.4740748	-0.65430766	0.513979431	-2429.881138	1221.408816	-2429.881138	1221.408816

… will effort hours + story points do the trick?

Regression Statistics	
Multiple R	0.986926911
R Square	0.974024728
Adjusted R Square	0.973653653
Standard Error	8002.690308
Observations	143

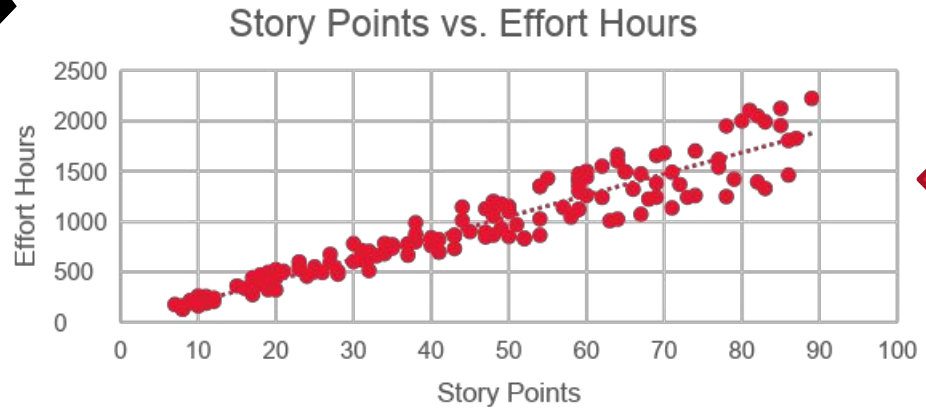
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1119.939367	1480.290693	0.756567188	0.45058	-1806.674854	4046.553589	-1806.674854	4046.553589
Story Points	-144.9539788	91.54124662	-1.583482683	0.115568	-325.9359409	36.02798336	-325.9359409	36.02798336
Effort Hours	100.7832641	4.091861243	24.63017637	9.63E-53	92.69343459	108.8730936	92.69343459	108.8730936

…. what about adding all 3 variables?

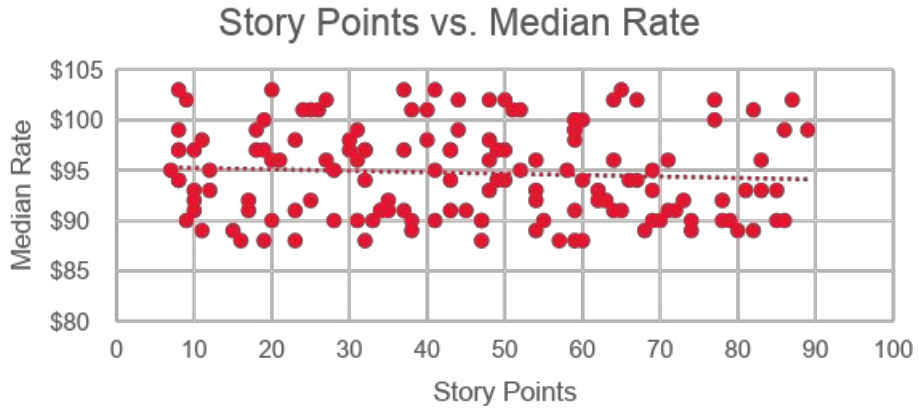
Regression Statistics	
Multiple R	0.986930044
R Square	0.974030911
Adjusted R Square	0.973470427
Standard Error	8030.469419
Observations	143

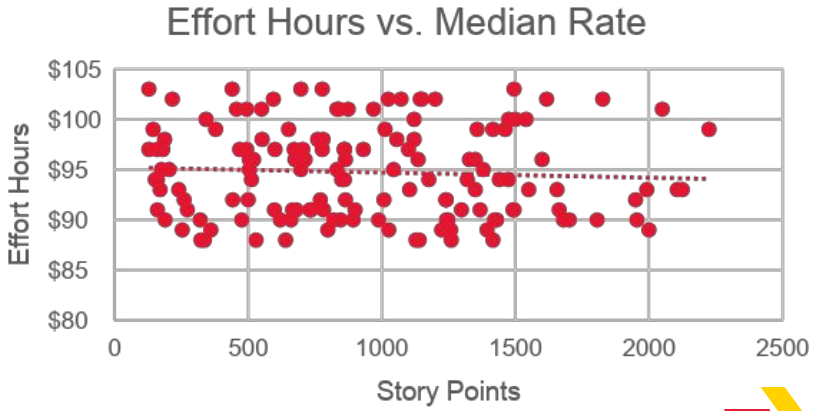
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1493.244092	14440.95581	-0.103403411	0.917791844	-30045.58023	27059.09205	-30045.58023	27059.09205
Story Points	-144.0676245	91.98812561	-1.566154583	0.119586212	-325.9444974	37.8092484	-325.9444974	37.8092484
Effort Hours	100.759938	4.108066487	24.52733868	2.38746E-52	92.63756049	108.8823156	92.63756049	108.8823156
Median Rate	27.39527198	150.588517	0.181921388	0.855909452	-270.3449894	325.1355334	-270.3449894	325.1355334

Checking for collinearity….



Collinearity problem!





And the winner is….

ANSWER: Effort Hours, represented by:

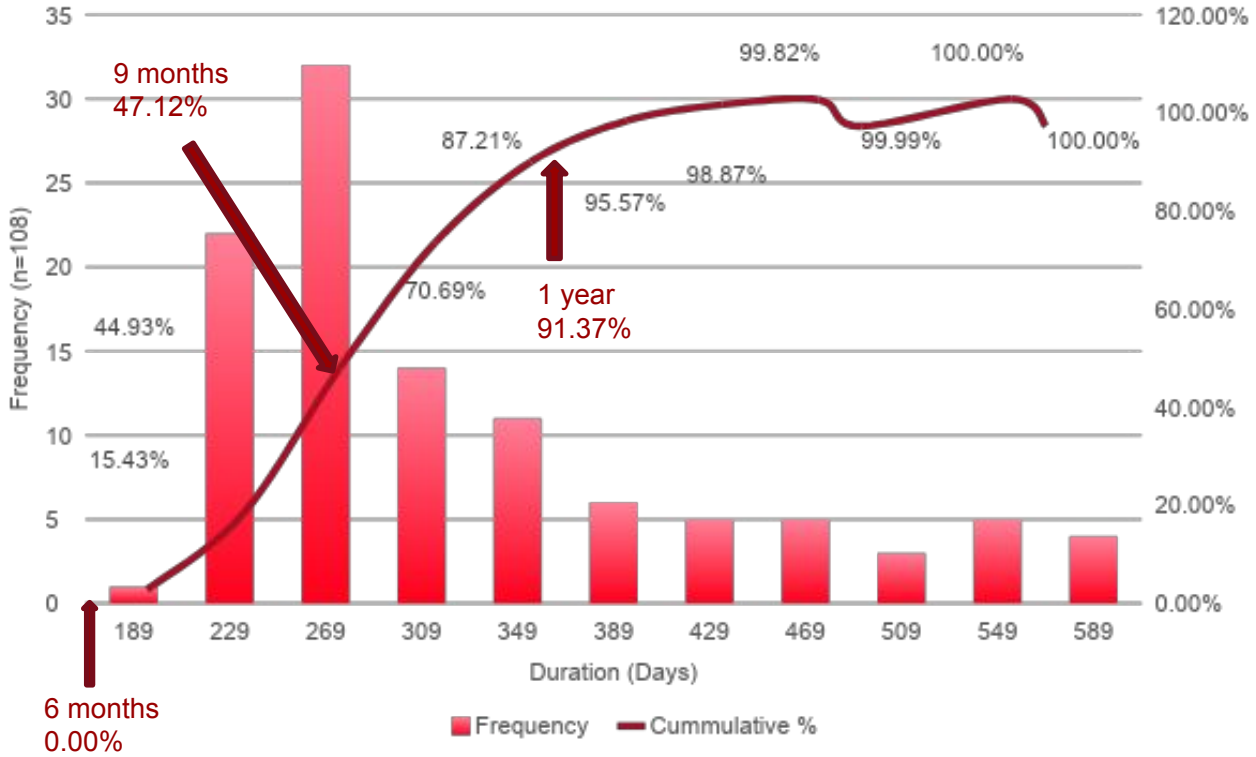
$$y = 94.059x + 394.77$$

(i.e. 1 hour of effort is worth 94.059 + 394.77 = $488.83 @95% confidence level)

Estimates Generation: Beta Distribution

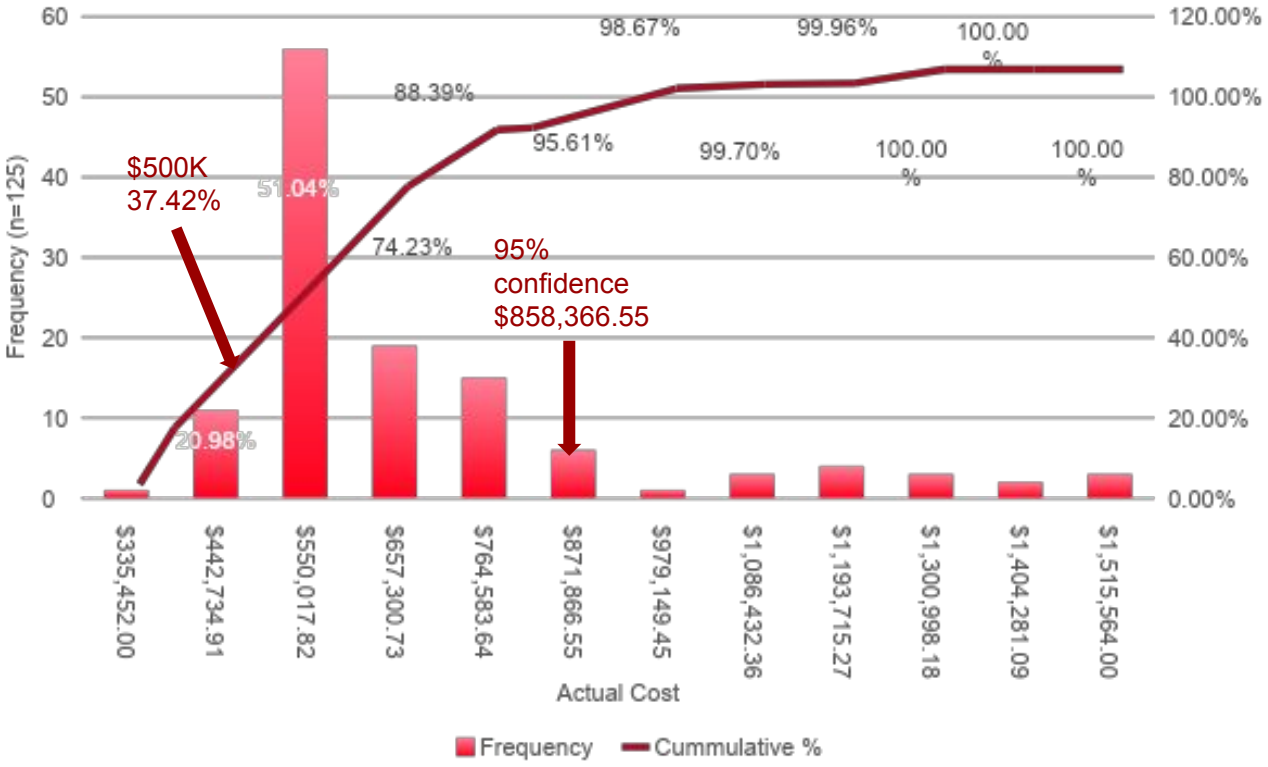
- Our cost and duration data has “best fit” into a beta
- Historical data must be collected
- Use excel’s beta dist. function or build into your PMO tool!

Beta Distribution– Duration Prediction Example



Sample data from 108 App Dev projects
Mean = 308.42 days
Standard deviation = 102.63
Median = 267 days

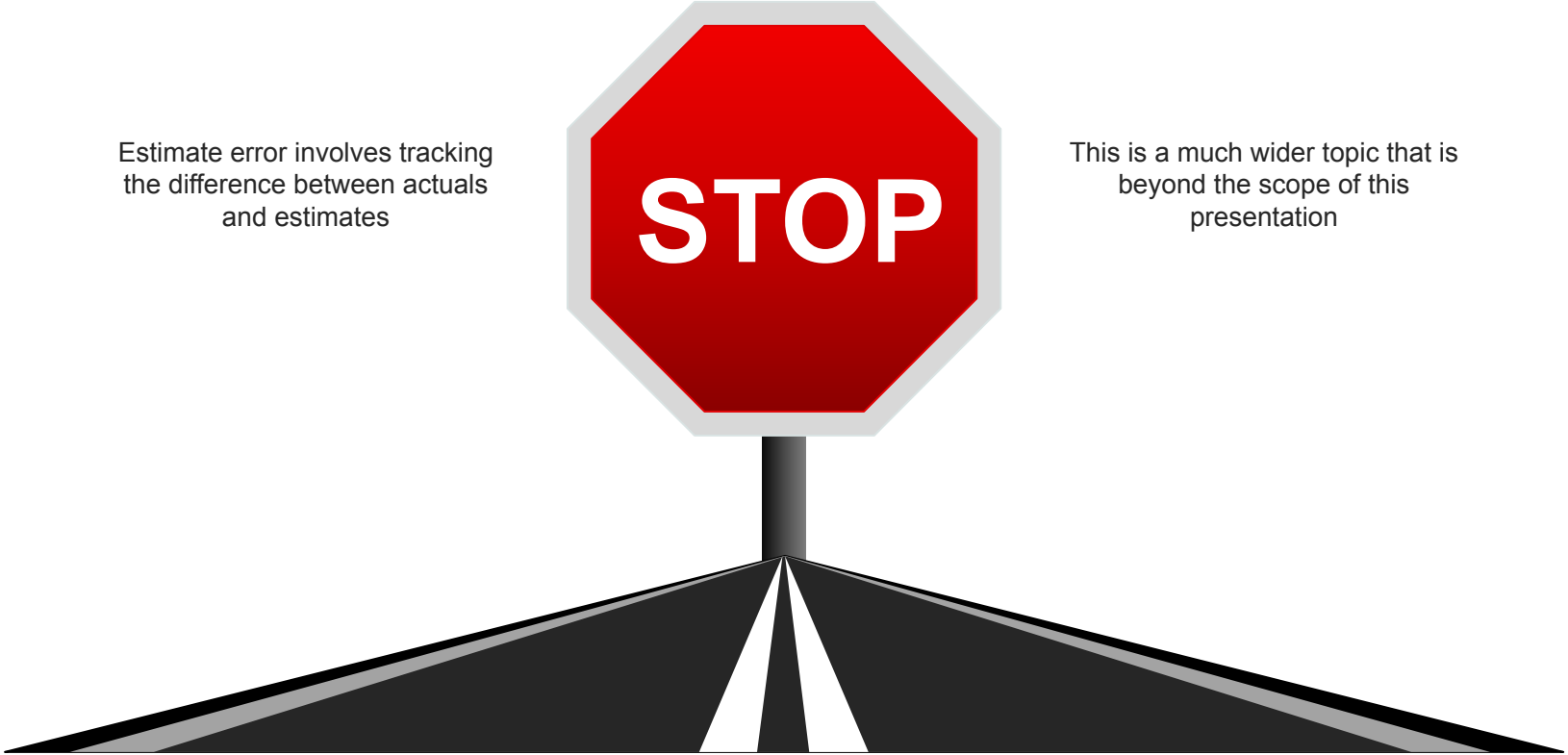
Beta Distribution– Cost Prediction Example



Sample data from 125 COTS projects
Mean = $633,762.57
Standard deviation = 259,427.28
Median =$540,431.00

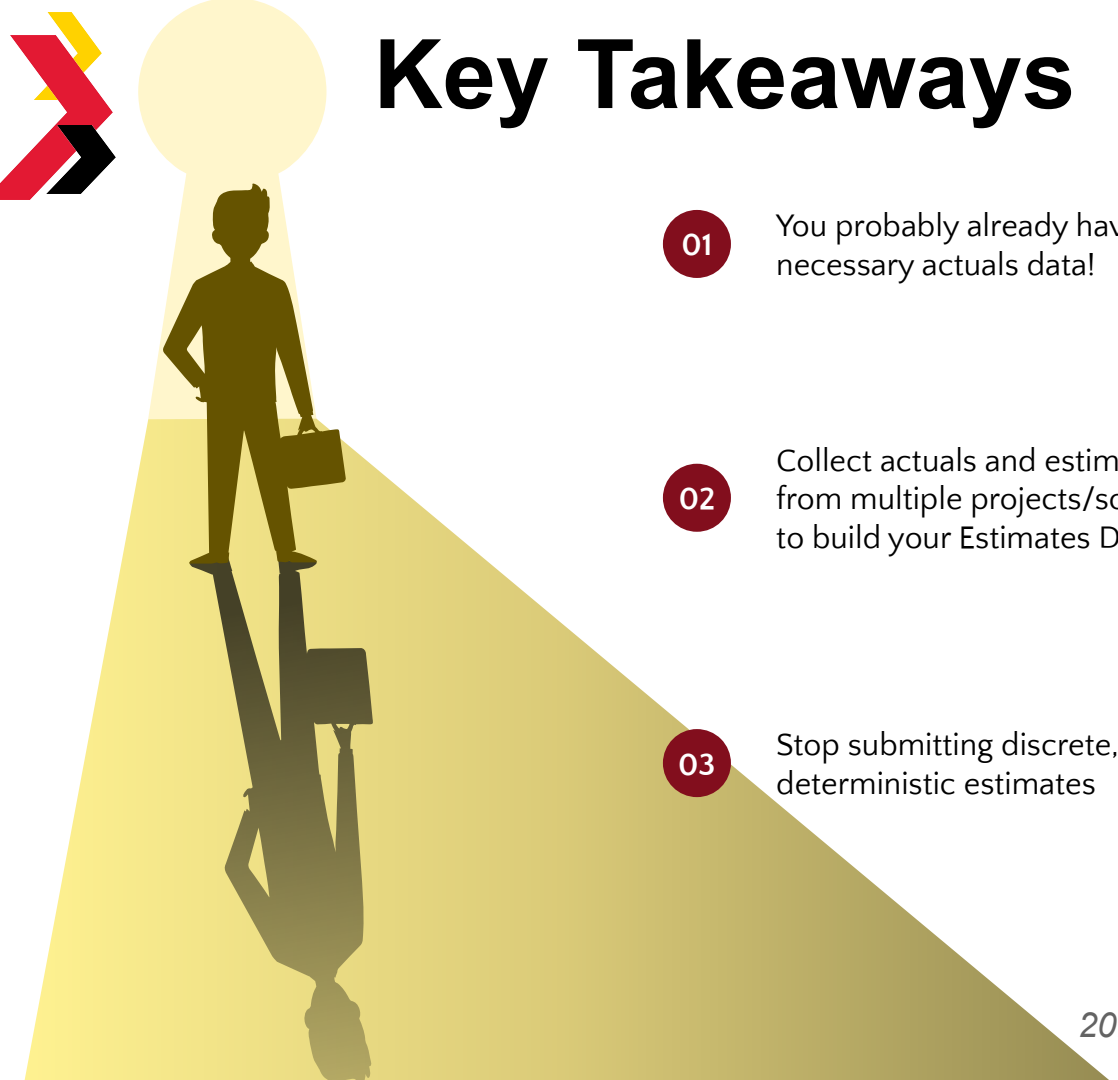
Estimates Optimization: Tracking Estimate Error

Estimate error involves tracking the difference between actuals and estimates



This is a much wider topic that is beyond the scope of this presentation

Key Takeaways



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01 You probably already have the necessary actuals data!

02 Collect actuals and estimates from multiple projects/sources to build your Estimates DB.

03 Stop submitting discrete, deterministic estimates

04 Both models presented today are “top-down”

05 Use parametric models to test which variables best influence an estimate for better prediction

06 Use β distributions for prediction if parametric models are not an option

Let's continue the conversation!

Nana Kwame

Building metrics-based PMOs | 2020 PMI PMO of the Year A...

Evaluate Session

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