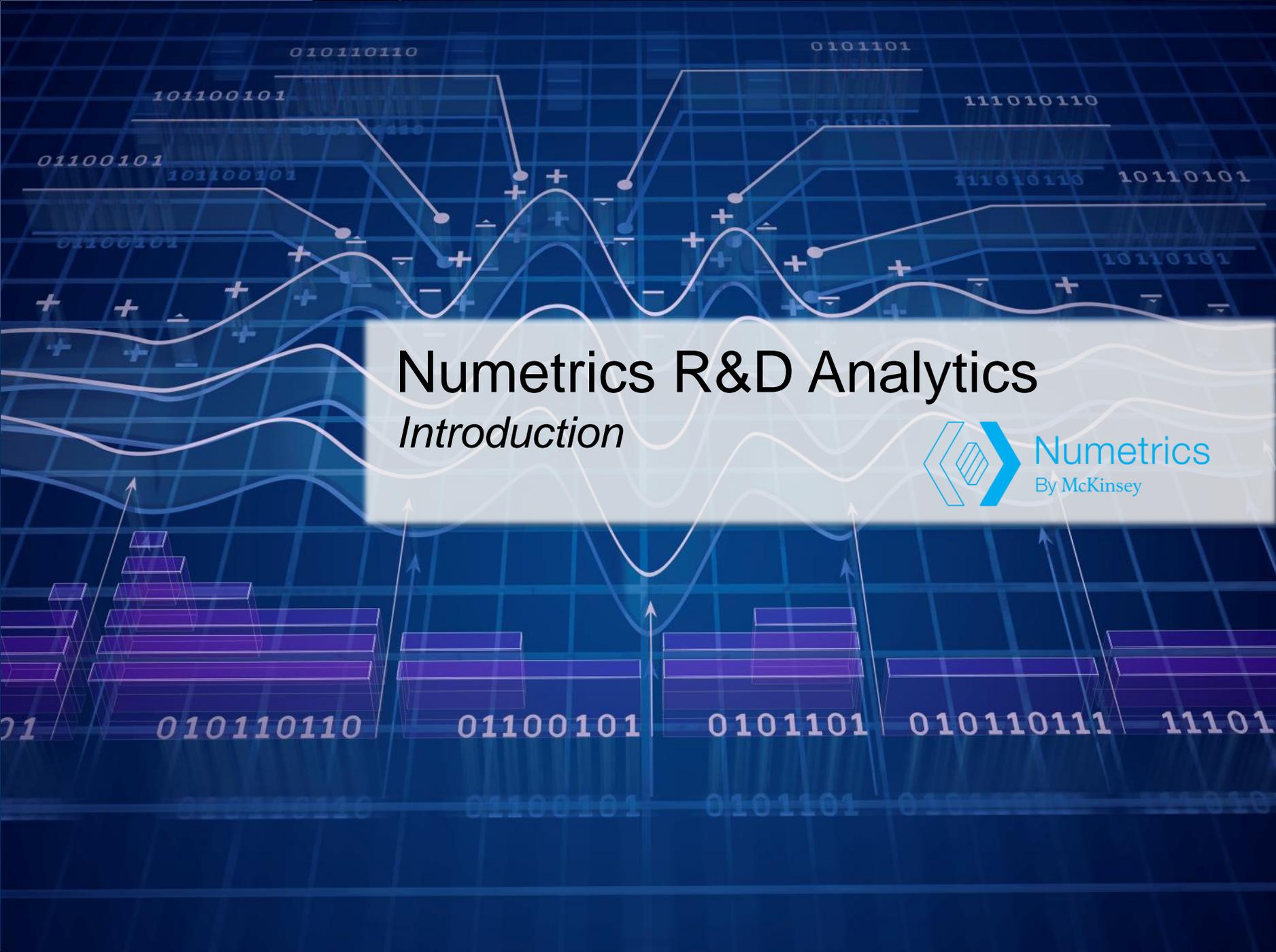


# Numetrics R&D Analytics

## *Introduction*



# There are many questions that can be answered by leveraging analytics in R&D and project planning

## Examples of questions analytics can help with

### Predictability & planning

- **Project planning** – How can we have better predictability on duration, resources and cost for new projects?
- **Portfolio planning** – How can we best manage the portfolio and optimize our R&D spend?
- **Resource allocation** – How can we ensure optimal staffing and avoid resource bottlenecks?
- **Risk management** – How can we identify execution risk and early on and minimize costly schedule slips?
- **What-if analysis** – What are the cost/resources/schedule trade-offs for different project plans and scenarios?

### Performance improvement

- **Performance benchmark and root cause analysis** – How does our performance vary internally? How does it compare to peers and what best practices should we adopt?
- **Improvement tracking** – How well are our improvement initiatives (e.g. Agile transformation, complexity reduction, etc.) working?
- **Informed operational decisions** – Is our outsourcing strategy working? Is our footprint harming productivity? How can we identify best practices across BUs?

# Numetrics offer analytic solutions, applicable to embedded SW, semiconductor IC and application SW development

## What is Numetrics?

**SaaS-based** R&D predictive analytics platform based on a **patented complexity algorithm** to provide:



**Performance benchmarking**



**Root cause analysis**



**Project planning**

## Where can Numetrics be applied?

- **Software (Embedded and application):**
  - **Verticals:** Automotive, Telecom, Financial, Medical devices, Industrial controls, Aerospace & Defense, etc.
  - **OS:** Android, IOS, Linux, Microsoft, Wind River, TI, etc.
  - **Platforms:** ARM, MIPS, Broadcom, Freescale, IBM, Microchip, Renesas, Samsung
- **Semiconductors (ICs):** Across segments, including Analog, Mixed signal, Memory, SOC, FPGA, IP, RF

# Numetrics leverages advanced and predictive analytics to enable step-function improvements in R&D performance and project predictability



## Performance benchmarking

Measure performance and benchmark against industry peers



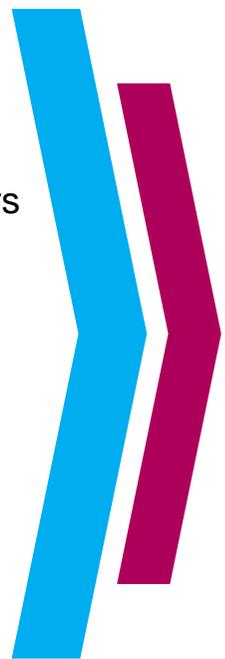
## Root cause analysis

Use analytics to find causes and drivers of low performance

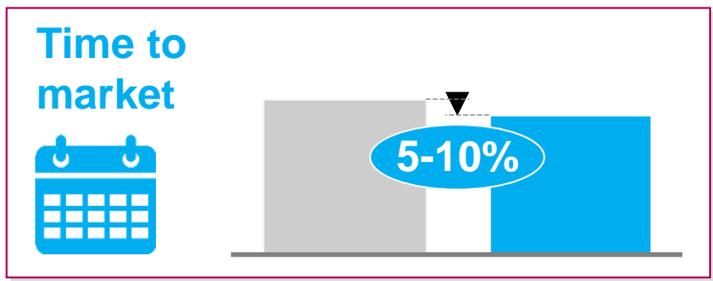
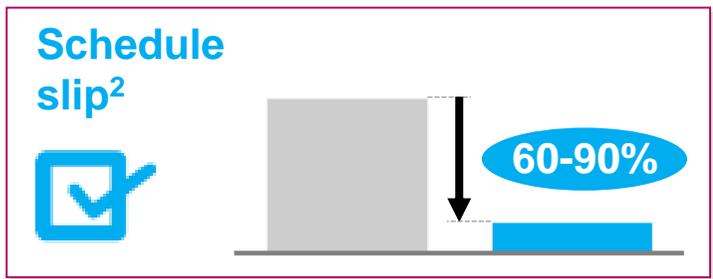
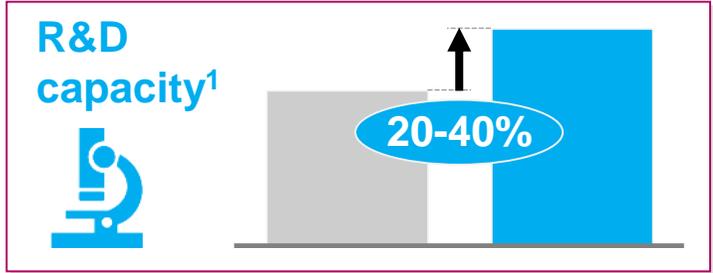


## Project planning & risk assessment

Provide an accurate estimation of time and resources required



■ Before analytics  
■ After analytics



<sup>1</sup> R&D Capacity is measured as “complexity units per person-week”

<sup>2</sup> Schedule Slip is the amount of schedule overrun, expressed as a % of the original schedule. (e.g. if a 100-week project slips 12 weeks, then schedule slip = 12%)

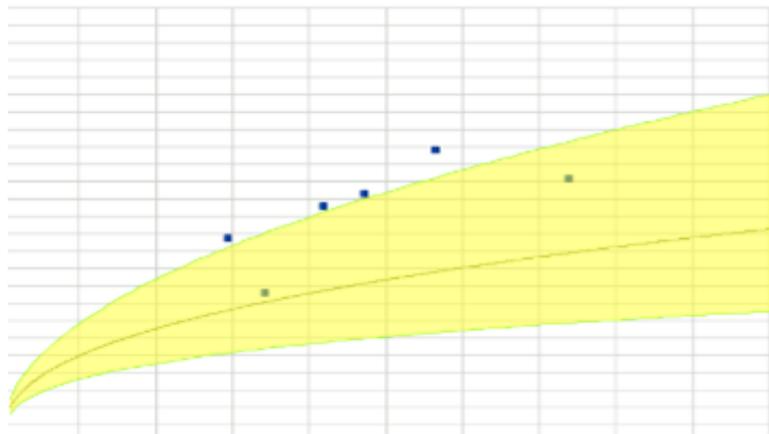
# Performance benchmarking – Creates a productivity baseline to enable internal and industry benchmarking

## Performance benchmarking

Create a project-level productivity baseline based on recent projects, and benchmark across multiple dimensions against a database of ~2,000 IC and 1,700+ SW projects

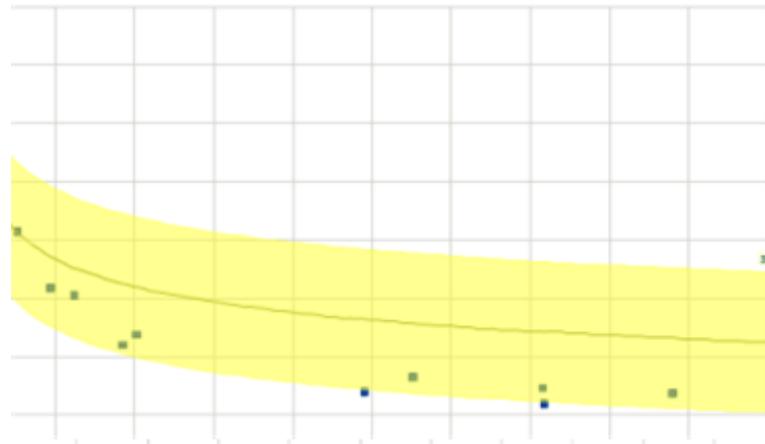
### Sample outputs

#### Project duration Vs. Design complexity



■ Industry peers ■ Client projects

#### Productivity Vs. Team size

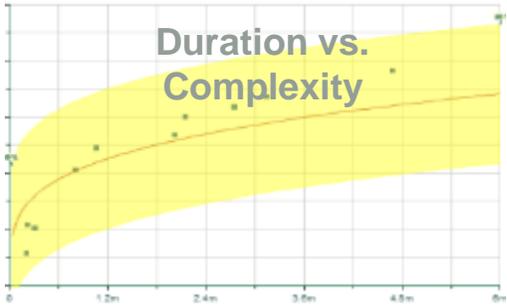


# Performance benchmarking – Wide range of metrics can be benchmarked

NOT EXHAUSTIVE

■ Client Software Projects ■ Band containing 50% of industry peers

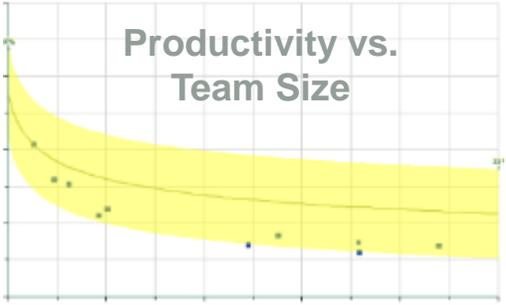
How fast can we deliver SW?



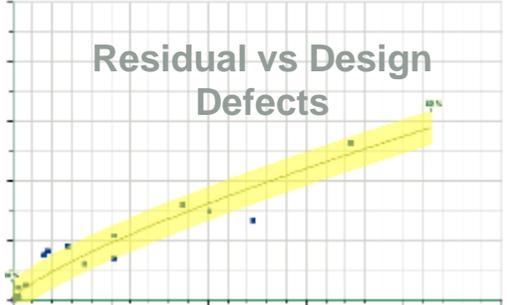
How many people do we need?



How efficient are we?



Is our verification strategy effective?



How granular are our requirements?



How cost competitive are we?



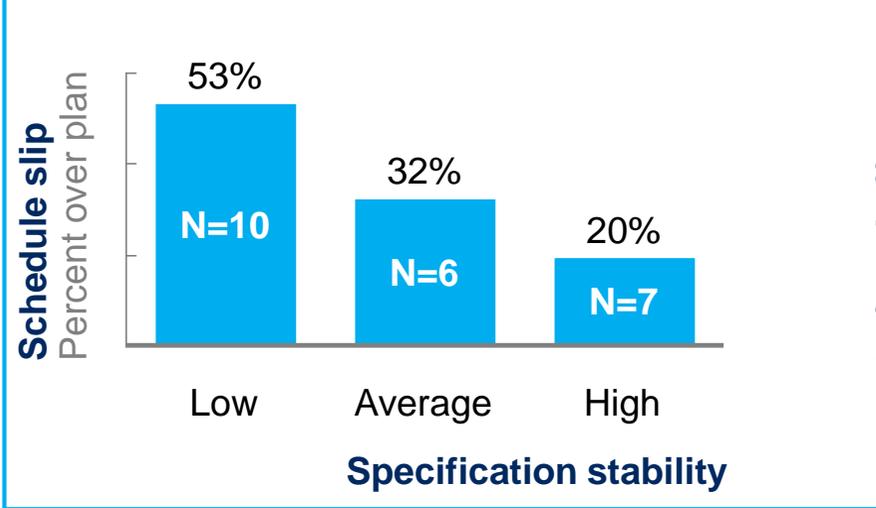
# Root cause analysis – Analyzes industry database and best practices to identify likely causes of low productivity

## Root cause analysis

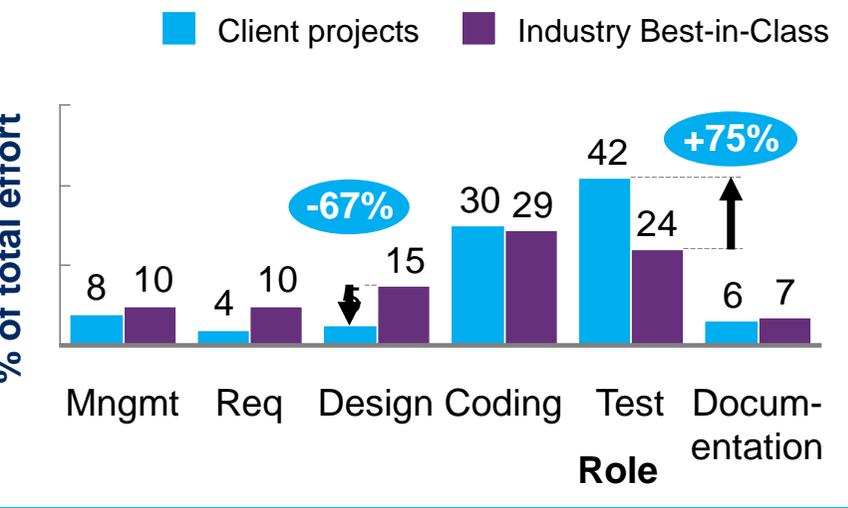
Use analytic tools to find root causes and drivers of low performance, and compare to industry best practices to determine recommended course of action

## Sample outputs

### Poor spec stability caused significant schedule slip



### Insufficient effort during design phase caused higher test effort



# Project planning – Predictive analytics used to generate robust project plans and identify time-to-market risks

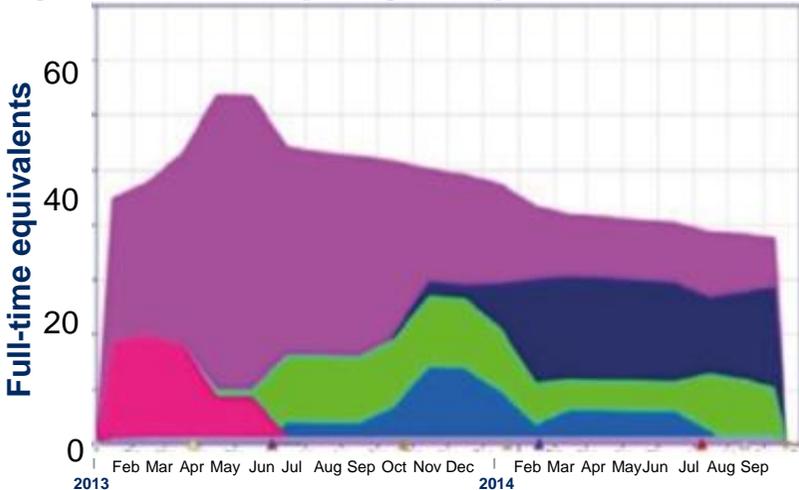


## Project planning and risk assessment

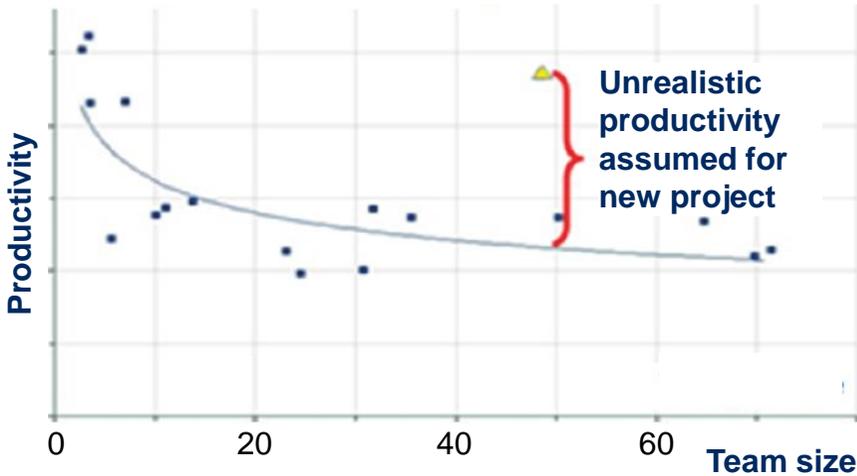
Use predictive analytics to provide better transparency to schedule and required resources at the project's outset and assess schedule risk due to unrealistic productivity assumptions

## Sample outputs

### Predicted staffing requirements by role and project phase

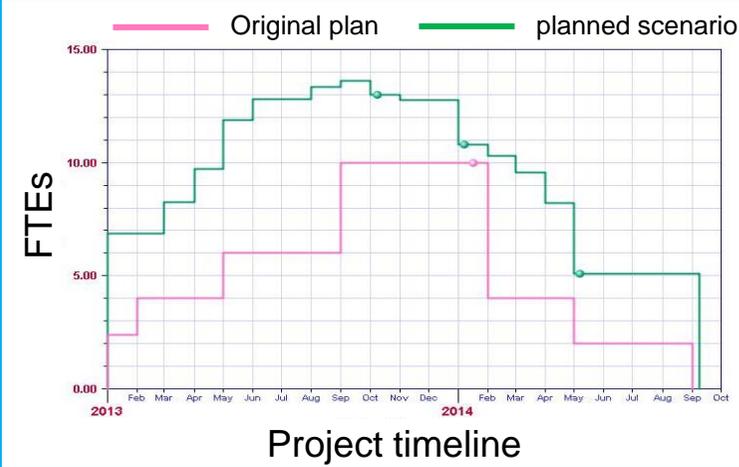


### Schedule risk due to unrealistic productivity assumption



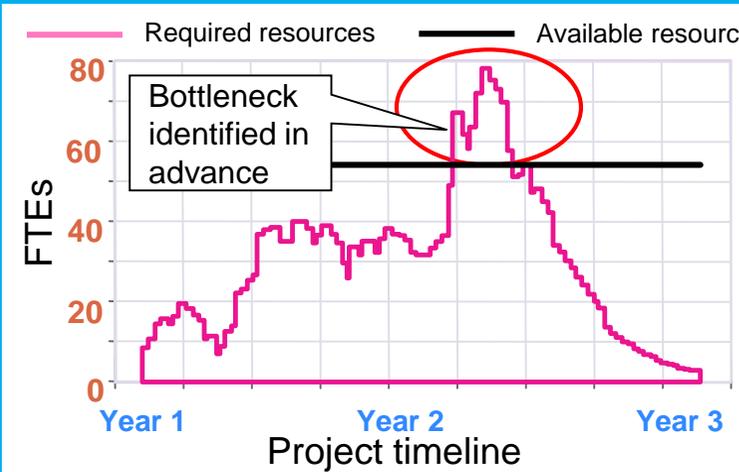
# Project planning – predictive analytics is used to optimize schedule and staffing at the project and portfolio levels

## “What-if” scenarios to determine tradeoffs and optimize the plan



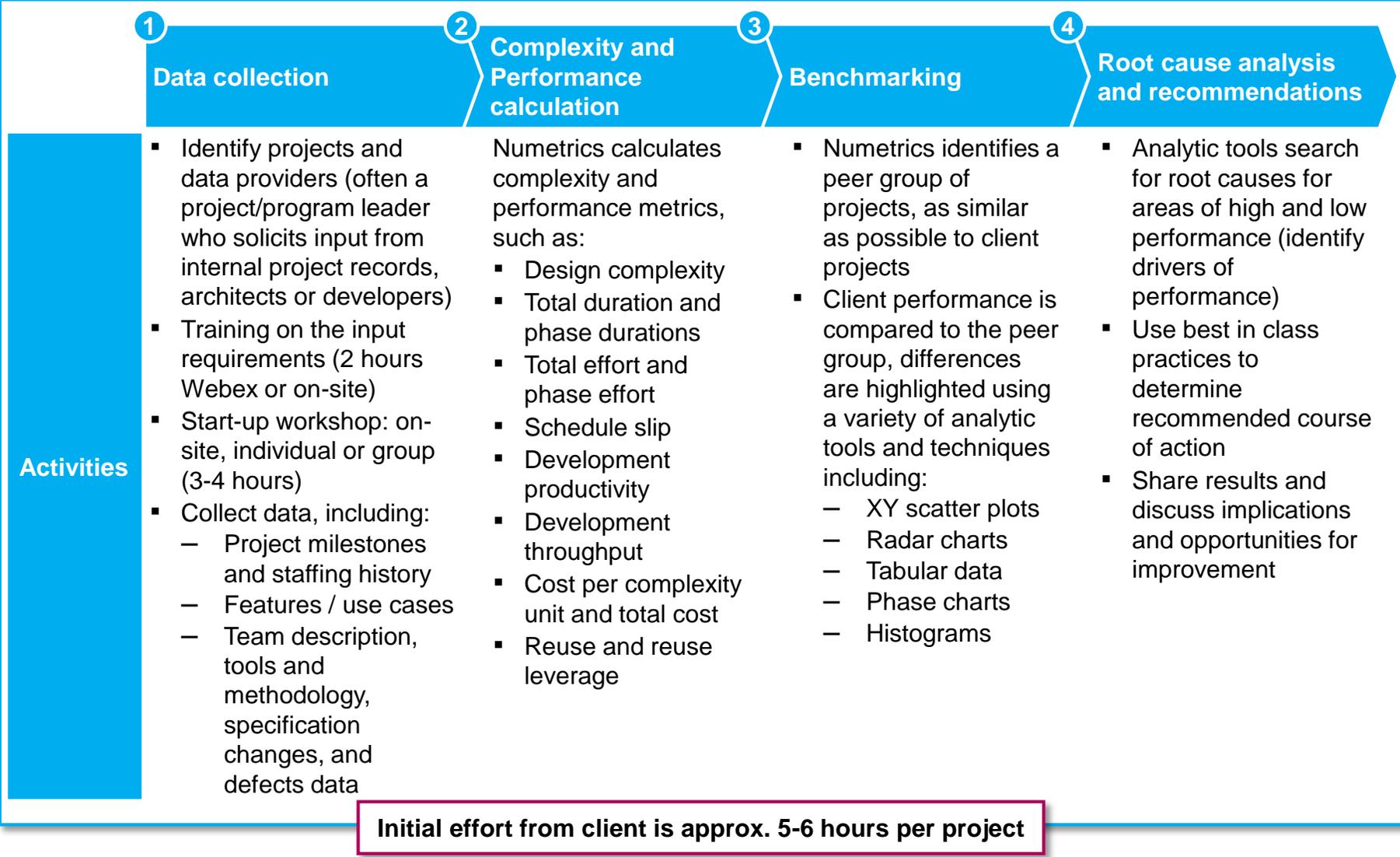
- Planned staffing plan is plotted against the predicted resource requirements to identify gaps
- “What-if” scenarios can be run to better understand tradeoffs between specifications, resources, budget and timeline, and to determine the optimal plan for the project

## Analytics on required staffing and available resources across multiple projects

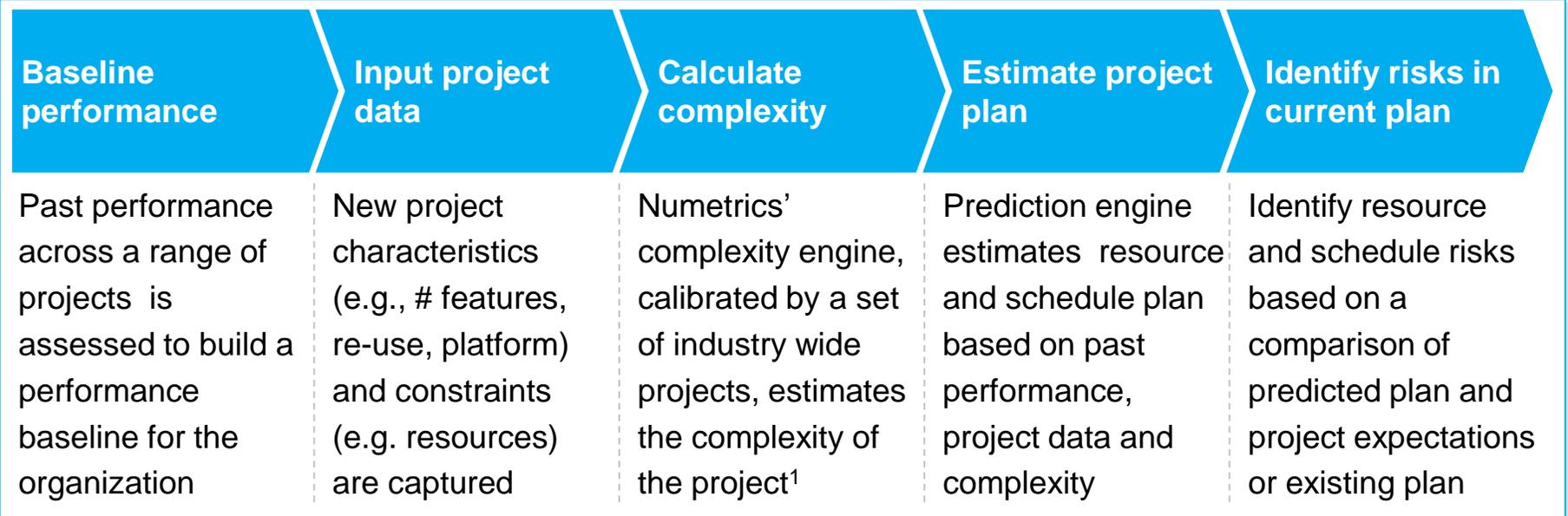


- Estimated staffing requirements by role and project phase across multiple projects is compared to available resources
- Resource gaps and bottlenecks are identified early on with plenty of time to adjust staffing levels, modify scope or reprioritize projects

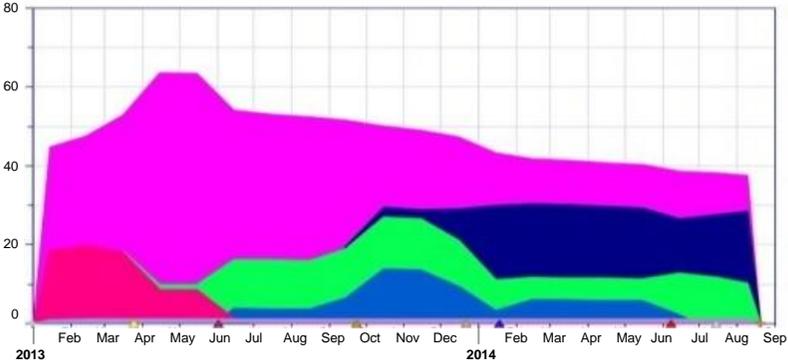
# Benchmarking and root cause analysis require project data and timelines of several completed projects



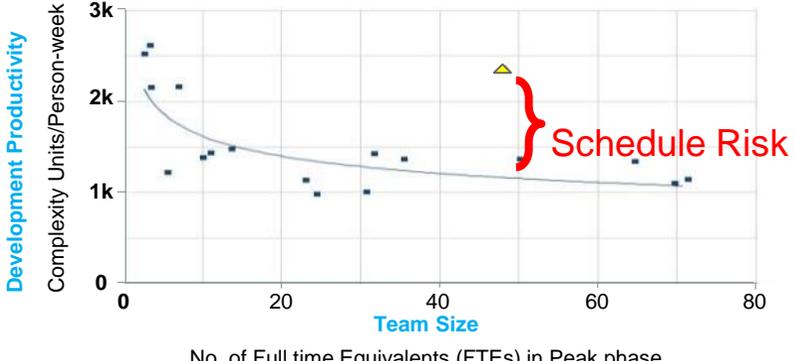
# Numetrics' predictive analytics can help optimize project planning and timely execution



## Schedule & Resource Estimation



## Schedule Risk Analysis



1 Measured in Complexity Units - A metric reflecting the amount of effort the average development team will spend on the project

# There are several ways to engage Numetrics

	Scope	Engagement model
Analytics focused diagnostic	<ul style="list-style-type: none"> <li>4-6 week (depending on data availability), <b>Numetrics led diagnostic</b></li> <li><b>Standalone analytic assessment</b> of 5-7 completed projects</li> <li>Provides a productivity baseline , industry benchmarks and analytic root cause analysis</li> </ul>	<ul style="list-style-type: none"> <li>Numetrics team handles data entry, validation, analyses, and reports</li> <li>Client collects required project data under Numetrics' guidance and support</li> </ul>
Deep R&D diagnostic	<ul style="list-style-type: none"> <li>8-10 weeks <b>deep diagnostic, combining analytic and qualitative analyses</b></li> <li>Includes <b>analytics focused diagnostic, complemented by qualitative tools</b> such as surveys, project deconstruction, process mapping, interviews and workshops to provide a complete view of productivity and performance drivers</li> <li>May include <b>planning of a new project</b> to determine required resources and schedule risk</li> </ul>	<ul style="list-style-type: none"> <li>Numetrics team handles data entries, validation, analyses, tailored benchmarking and reports</li> <li>Client collects required project data with Numetrics' guidance</li> </ul>
Subscription	<ul style="list-style-type: none"> <li>Embed Numetrics planning tool in the standard PD process to <b>continuously track performance</b></li> <li>Use predictive analytics to <b>increase TTM transparency and optimize resource allocation</b></li> <li>Includes initial benchmark and baseline creation and access to the planning tool</li> </ul>	<ul style="list-style-type: none"> <li>Client trained to input project data and run reports directly using the web interface</li> <li>Numetrics team runs the analyses and provides insights</li> </ul>

# Numetrics provides a field proven, analytics based productivity and planning suite of solutions



## Experience and expertise

- **Core competence** in developing complexity and productivity models
- **Mature complexity models (10<sup>th</sup> generation of the IC and 7<sup>th</sup> generation for SW model)** with over 10 years of continuous development
- Models calibrated based on a **database with 2000+ IC and 1700+ SW industry projects**
- **Supported by a team of experts** with hands-on R&D and productivity enhancement experience



## Distinctive, readily available tools

- **Full productivity and planning solution readily available** for productivity measurements and benchmarks, root cause analysis and project and portfolio planning and risk assessment
- Immediate productivity improvement with **minimal distraction from maintaining and reconciling internal complexity tools**



## Analytics-based accuracy and proven impact

- **Demonstrated ~90% accuracy** across all predictive models
- Provides **unbiased, independent view of complexity**, that is not subject to manipulations
- **Output is facts and analytics based** rather than subjective assessments and opinions
- Typical impact in the range of **20 - 40% increase in R&D productivity and 60 - 90% reduction in schedule slips**



## Field proven across clients and technologies

- **Successfully deployed** by large, diversified clients with distributed teams
- Scope includes: **IC (SoC, Analog, RF, IP, Mixed Signal, FPGA), Embedded Software and Application/Enterprise Software**

# Who to contact to get started?



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# Appendix

# Numetrics is a SaaS-based analytics solution that enables rapid improvements in embedded SW and IC development



**Proven complexity measurement method**

**Large industry database of peer projects**

**Established analytics platform**

**Proprietary** complexity algorithm successfully applied in **>400** companies

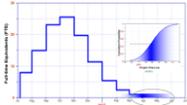


- 2,000+** IC projects
- 1,700+** software projects
- 40+** industry segments
- 50+** operating systems
- 20+** programming languages

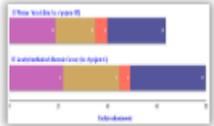
Industry Benchmarking



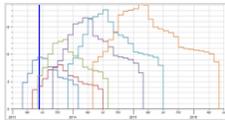
Project Planning & Estimation



Root Cause Analysis / Productivity Diagnosis



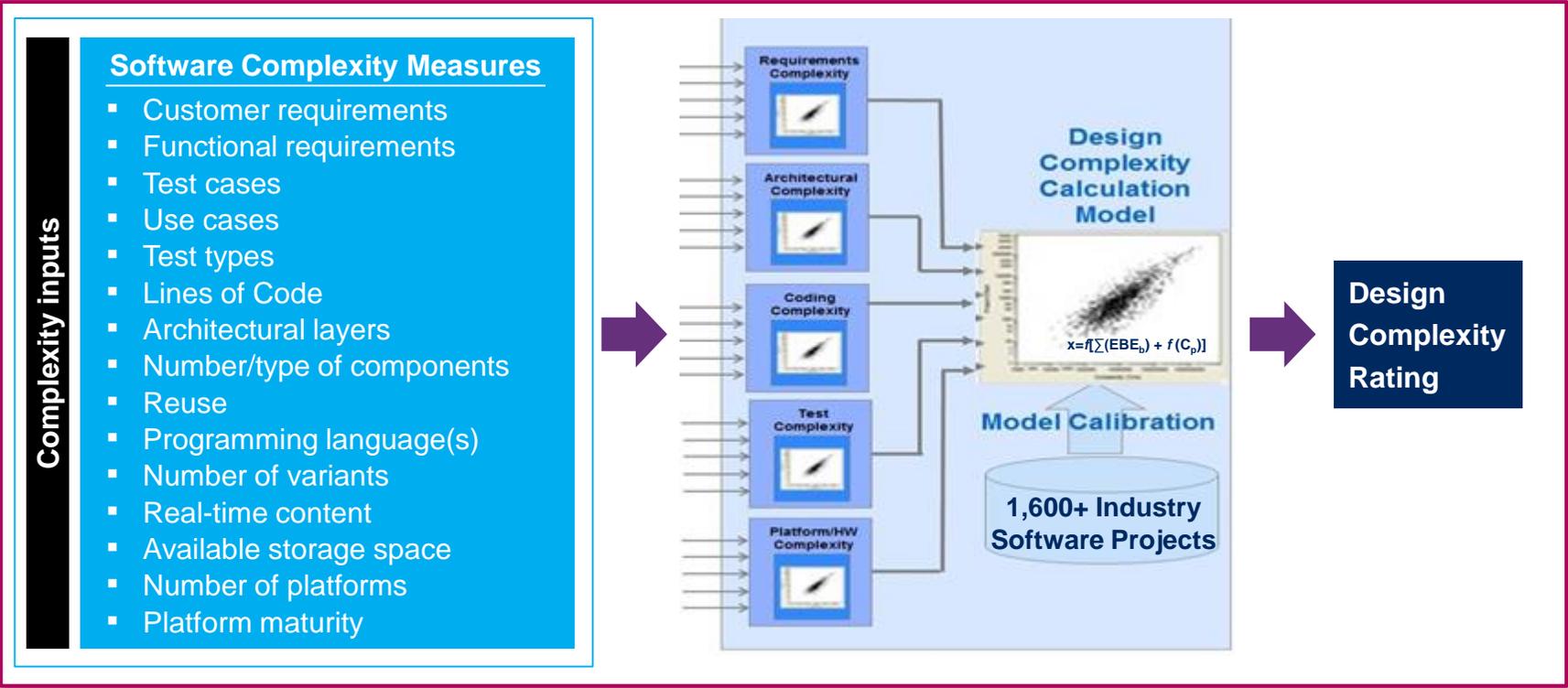
Portfolio & Resource Planning



# Numetrics' analytics engine is based on a proprietary "design complexity" model that normalizes productivity across projects

### Design/development complexity:

- A metric representing the total amount of project effort the average design/development team in the industry would expend on the project – quantifies the true, normalized output of the design team
- The complexity model fully takes into account the stochastic nature of product development, which enables the predictive analytics engines to reliably estimate schedule & resource requirements and perform meaningful comparisons of performance metrics across different projects/designs



# Project selection guidelines

- Project scope (phases) must include requirements definition, implementation, verification and validation, and a production release

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- Projects must be finished, having been released into production and/or the project has transferred to sustaining engineering

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- Choose projects for which you can access with reasonable effort, the milestones, staffing and technical characteristics

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- Include a variety of projects, from small to large, to facilitate drawing trends. First-timers typically choose projects with teams from 5 to 50 FTE for which there was a dedicated project manager

---

- Include representative projects, neither the best nor the worst

---

- Include projects from the same business unit. This will 1) facilitate selection of peers from industry and 2) increase consistency of methodology, tools, etc.

---

- Quantity: the smaller the project, the larger the number of projects needed to establish a baseline. Reason: smaller projects exhibit more variation in most dimensions. A typical performance baseline should contain a minimum of 5-10 projects

# Example of project data collected for benchmarking

## Categoryzation

- Type of End Equipment
- Project Scope & Description

## Features (only one required)

- # Customer requirements, or
- # User stories, or
- # Use cases

## Other software measures

- # Functional & non-functional requirements
- # Test cases (Unit, System, Other)
- # Lines of code (reused & new)
- # Variants
- # Platforms
- Object code footprint (size)

## Software architecture

- # Components
- # Components containing real time code
- % code in each architectural layer
- Programming language(s)

## Hardware platform

- # Platforms
- Platform type & maturity
- Available object code storage space
- # and type of processors

## Diagnostic factors

- # Defects
- # Spec changes
- Tools and methodologies employed
- Team environment (#sites, experience, ...)

## Project duration , effort & cost

- Milestone dates
- Weekly or Monthly staffing
- Total project cost



# Numetrics is a well-established company with a field proven sets of solutions



**1998**

Launch of semiconductor benchmarking solution

**2001**

Launch of semiconductor predictive planning solutions

**2004**

First embedded SW complexity model

**2006**

Launch of embedded SW predictive planning solution

**2010**

First 1,000 SW projects released in industry database

**2013**

Numetrics acquired by McKinsey

- **Extensive database of ~2000 IC and ~1700 SW projects**
- **Field proven complexity estimation and predictive analytics algorithms**
- **Wide industry coverage including automotive, aerospace & defense, high tech, financial services, medical, etc.**