Role of Measurement in Mature Project Management

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TOTAL METRICS

Project Management Institute
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"Measure what you want to improve. The very act of measuring a business process can result in improvement"

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Agenda

- Measurement and its role in Project Delivery Processes
- Process Maturity and the capability to implement measurement
- Base Project measures - Product Size
- Using measurement for informed decision making - case studies
- Where to get assistance - ASMA , ISBSG

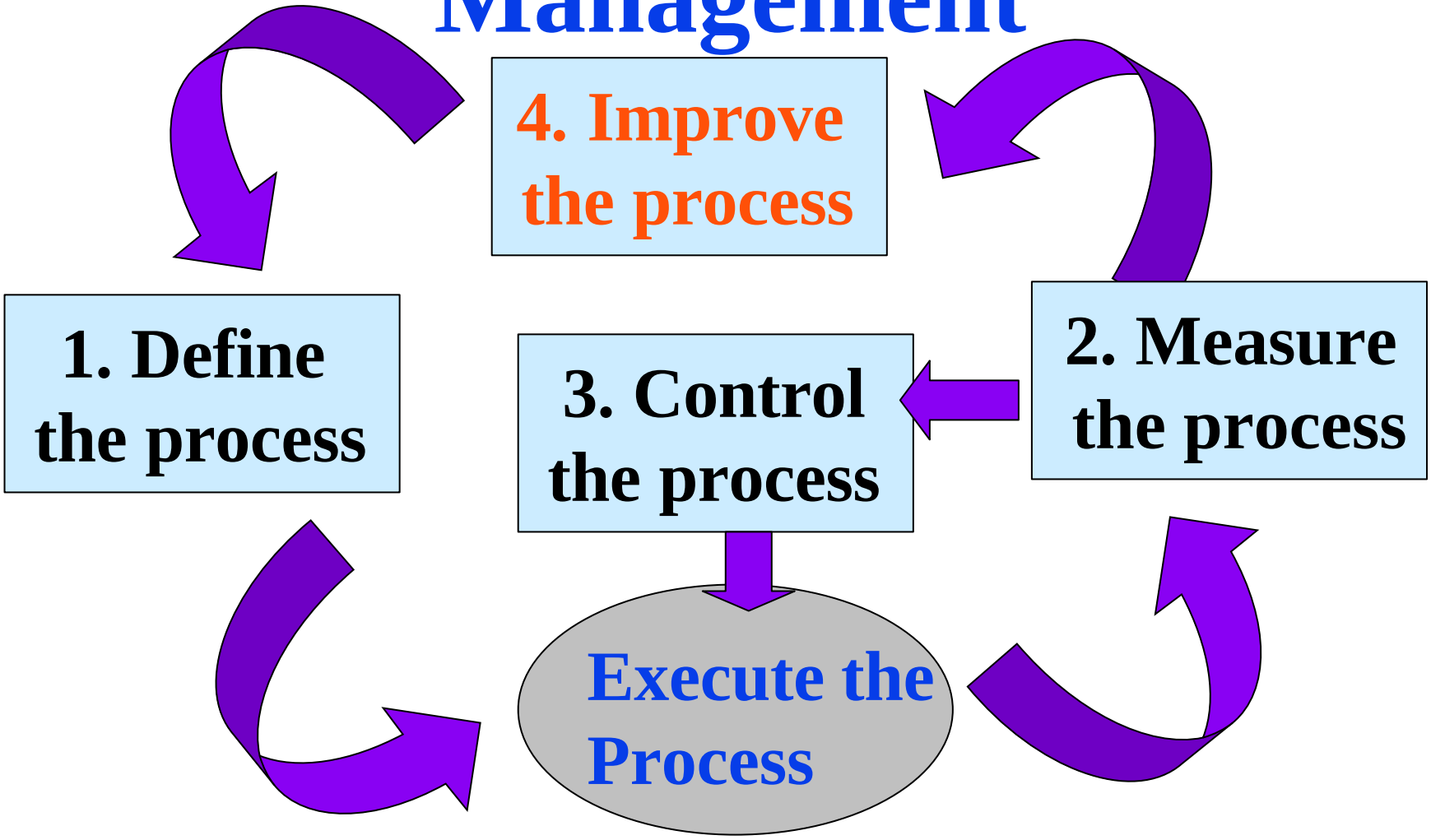
Three Main Reasons for Implementing Software Measurement

- **UNDERSTANDING**
  - Better understand and model the software process and its products
- **MANAGEMENT AND DECISION MAKING**
  - Facilitate better management of software process and its products
- **IMPROVING**
  - Provide guidance on improving software process and its products

Key Process Areas for IT Projects

- Requirements Management
- Project Planning
- Project Monitoring and Control
- Supplier Agreement Management
- **Measurement and Analysis**
- Process and Product Quality Assurance
- Configuration Management

Each Process within the Project Cycle needs Management



Improve the Process

"Ideally processes should be technologically and cost competitive, adaptable and timely and must produce products that consistently meet customer and business needs"

- **Did the process work as expected? What changes are needed?**
  - Understand the process through measurement
  - Analyse and compare performance against our objectives
  - Plan, justify and implement actions, redefine process
  - Assess impacts and benefits gained against cost of implementation

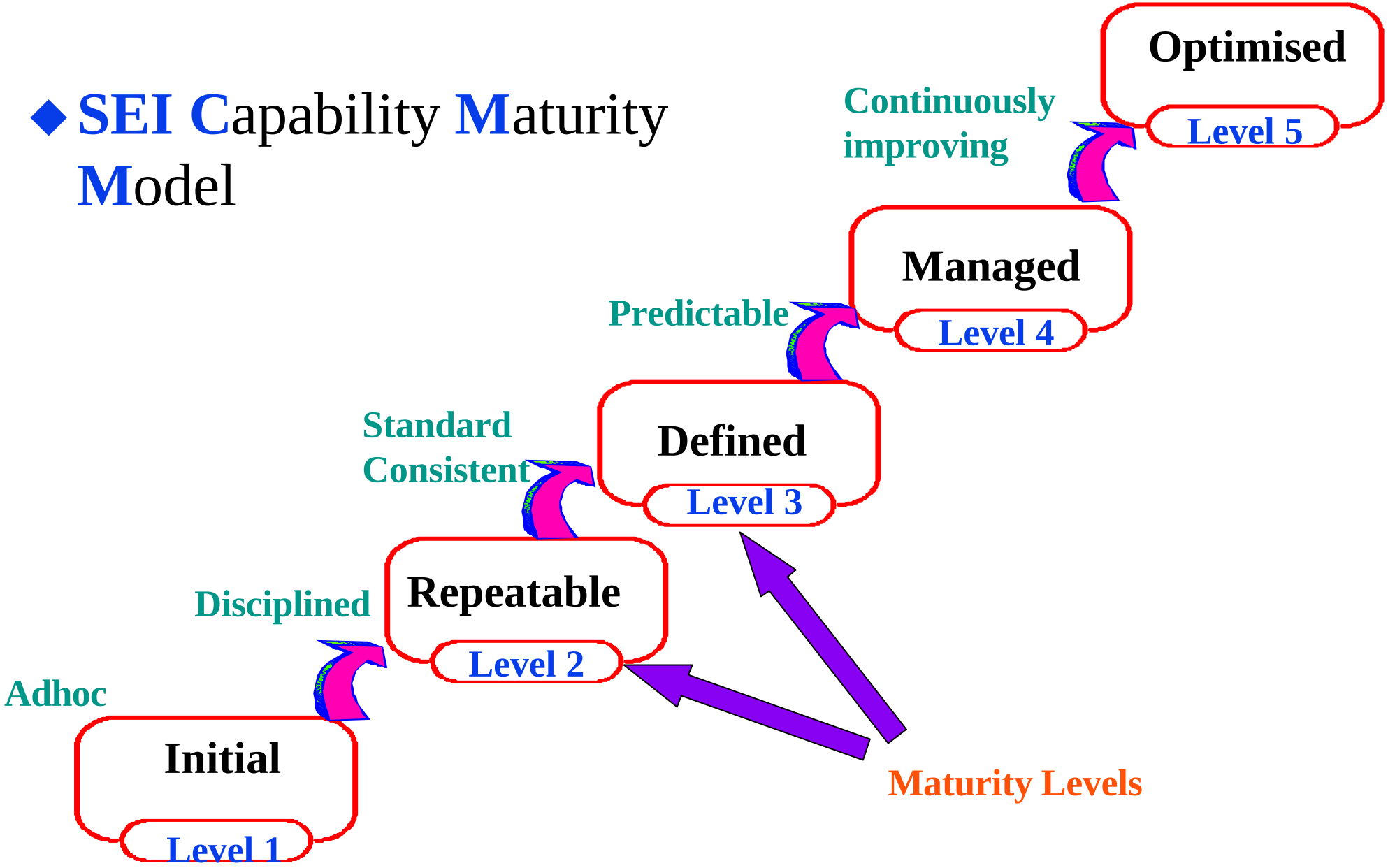
Software Process *Maturity*

- **The extent to which a specific process is explicitly defined, managed, measured, controlled, and effective.**
- Maturity implies a **potential for growth in capability** and indicates both the richness of an organization's software process and the consistency with which it is applied in projects throughout the organization

(Reference : SEI:SW-CMM)

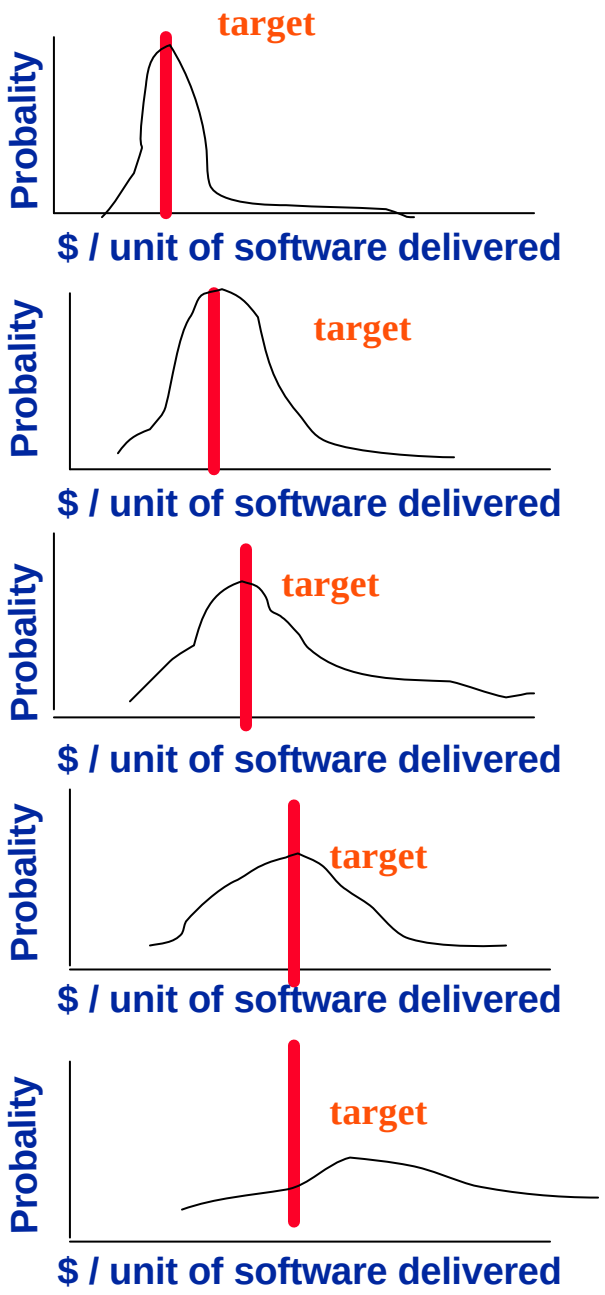
SEI - CMM Maturity Level

- **SEI C**apability **M**aturity **M**odel



Focus for Improvement

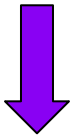
- 5 Optimised
  - Process improvement is institutionalised. Includes Change management and defect prevention
- 4 Managed
  - Product and processes are quantitatively controlled with detailed measurement
- 3 Defined
  - Software engineering and management practices defined and integrated, plus training
- 2 Repeatable
  - **Project management system in place; performance is repeatable**
- 1 Initial
  - Process is informal and adhoc; performance is unpredictable



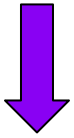
Measurement Focus at Each Maturity Level

- **Level 2 - project management**
  - plan versus actuals, major milestones
- **Level 3 - product quality**
  - defect data for product and work products
- **Level 4 - process capability and control**
  - process performance distributions
- **Level 5 - change management**
  - field experiments
  - parameterised process models
  - system dynamics models

Project focus



Product and technical focus



Process focus

Level 2 - Key Process Areas
Project Focus

- Requirements Management
- Project Planning
- Project Monitoring and Control
- Supplier Agreement Management
- Measurement and Analysis
- Process and Product Quality Assurance
- Configuration Management

CMM vs CMMI and ISO 15504

- ***CMM - Organisational Maturity - 5 point scale***

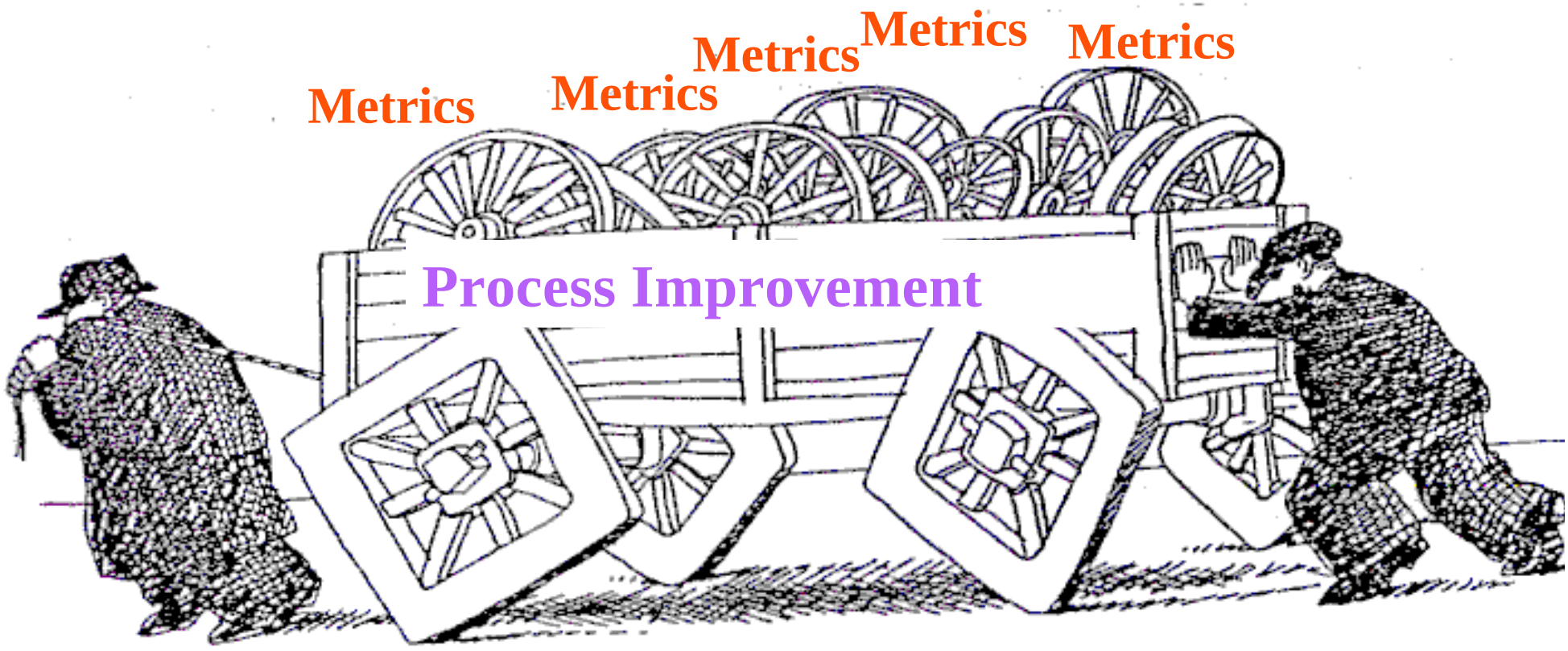
NOW

- ***CMMI - Process Maturity - Staged and Continuous representation***
  - provides choice of processes to focus to improve and flexibility to improve to a certain level
- ***ISO 15504 - Process Maturity- (SPICE) Continuous representation***

ISO 9000 and Measurement

- ISO 9001:1994 clause was
  "The supplier shall identify the need for statistical techniques required for establishing, controlling, and verifying process capability and product characteristics"
- ISO 9001:2000 now has a requirement for:
  - Measurement and monitoring of processes.
  - Measurement and monitoring of product
- Includes a concept that you can start anywhere - and get better.
- An obligation to implement objective measurement as a basis for improvement.

Process Improvement without Measurement



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Using Project Process and Product Measurement to Improve IT Management Decision Making

Australian Industry Case Studies

Types of software measures

Project attributes

Effort
Duration
Defects
Activities

➡ **Software Size**
Quality
Technical characteristics

Product Measurement as an Indicator of Process Effectiveness

- Productivity Rates

$$\frac{\textbf{Units of Software Product Delivered}}{\text{Person Hours of Effort}}$$

- Cost Effectiveness

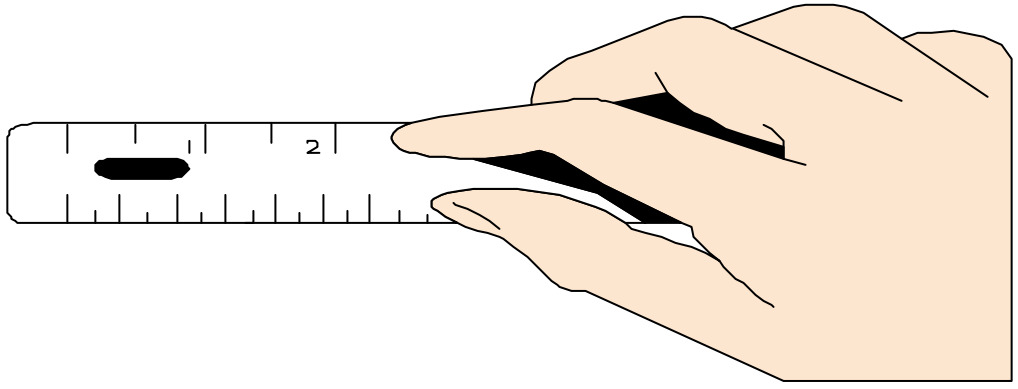
$$\frac{\textbf{Units of Software Product Delivered}}{\text{Project Dollar Cost}}$$

- Product Quality

$$\frac{\text{Defects Delivered}}{\textbf{Units of Software Product Delivered}}$$

Software Product Size

- **Code Size**
  - Measure of **S**ource **L**ines **o**f **C**ode (SLOCs, LOC, KLOCs)
- **Functional Size**
  - Measured in **F**unction **P**oints using technique called **Functional Size Measurement**



WHAT is Functional Size Measurement

- **ISO/IEC/JTC1/SC7 Standard #14143 definition**:

"Functional Size : A size of software derived by quantifying the ***functional user requirements***"

Example
Functional User Requirements

- **Processes**

  eg. Modify Job Details

  Enquire Job Details

  Report Job Allocations

- **Data**

  eg. Job Details

  Employees

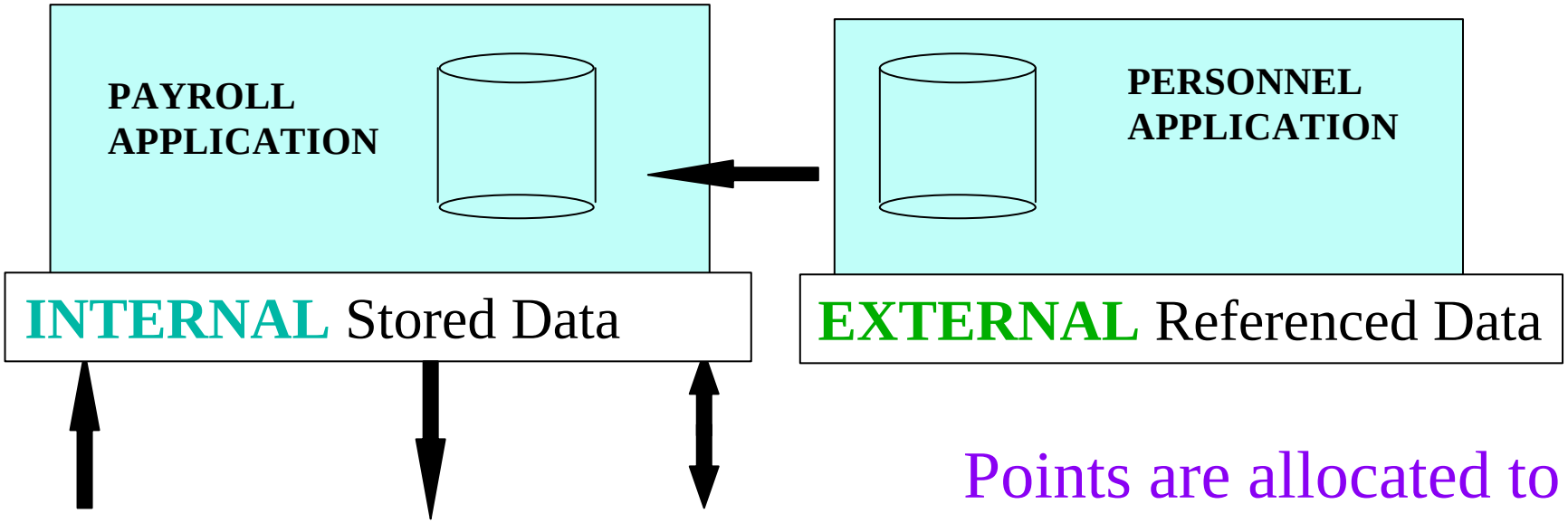
Origins of Functional Size Measurment

- Developed late 1970's by Alan Albrecht at IBM
- Needed a measure of size which was independent of language, tools, techniques and technology
- **Size = functions delivered to the user**
- Allowed comparative measures of productivity

Characteristics of Functional Size Measurement

- Measures Functional User Requirements
- external 'User' view
- applied any time in SDLC
- derived in terms understood by users
- derived without reference to:
  - effort
  - methods used
  - physical or technical components

Measured components



Data INPUT to Store

Information Extracted as OUTPUT

ENQUIRY on stored Data

Points are allocated to each **Transaction** and **Data File** based on the type and complexity of the function.

Functional Size

- For example: Functional Size

  = 675 (IFPUG 4.1 Function Points)

- Measures the size of the software '**problem**' not the '**solution**'
- Is the '**generic**' size of the software
- Measures the '**what**' NOT the '**how**'

Size Contributions to Decisions

- Tactical Decisions - project based
- Strategic decisions - portfolio based

“Measurement supports objective decisions”

Project Based - Evaluate Estimates

- **Situation** *: Urgent management requirement for software to support the Registration of Stock - needs to be implemented as soon as possible.*
- **Issue** *: Favoured supplier price is 3 times that expected. Is the price inflated or did the business get it wrong?*
- **Solution 1** - Put development out to Tender, use industry supplier's quotations to check initial proposal.**(Turnaround time 1 -2 months)**
- **Solution 2** - Measure the size in function points, use industry based productivity and cost figures to estimate likely cost and compare with initial proposal. **(Turnaround time 3 days)**

Registration Development Project

- Functional Size Measurement based on Functional Specification
- Calculated Functional Size Development Project = 899 IFPUG function points (medium size application)
- Developed independent estimate of Post - design phase based on industry productivity data

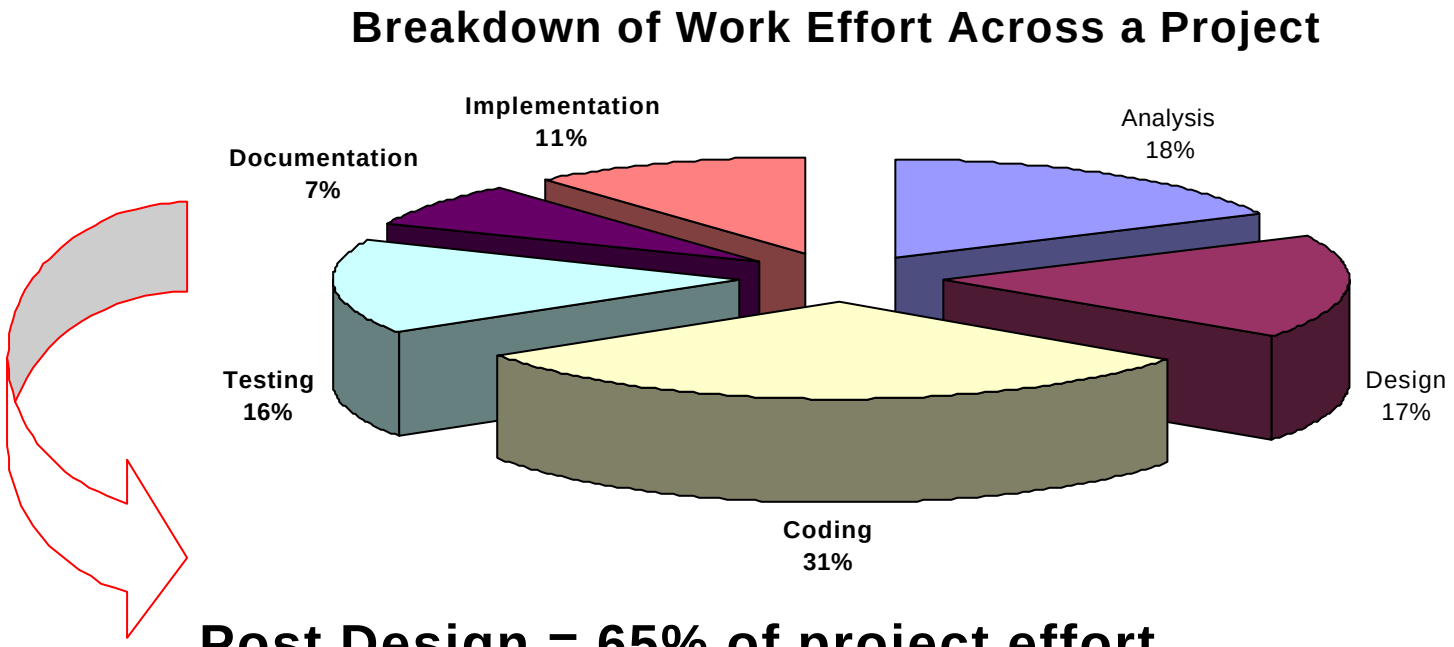
*Industry Figures for for C++

- **Productivity Data**
  - predicts **14 hours per function point** to build
- **Cost Data**
  - predicts **$1,234** per function point
- **Contractor Median Rates C++ = $90** per hour

* International Software Benchmarking Standards Group Release 6 - April 2000

Industry Figures for Projections

Project Lifecycle Profile (non-USA companies)
- effort breakdown
•Post- Design = 65% of Total Effort



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IT Performance Trends 2000 - Meta Group - Howard Rubens

Approximate Cost Projections

- **Industry *ISBSG Cost Data**
  - Median $1,234 per function point (899 fps)
    - **$1,109,366** for **total** project life cycle
    - **$721,087 post-design**
  - Median $119 per hour spent (at 14 hours/fp)
    - **$1,497,734** for **total** project life cycle
    - **$973,527 post-design**
- **Contracting Rates**
  - Median $90 per hour spent (at 14 hours/fp)
    - **$1,132,740** for **total** project life cycle
    - **$736,281 post-design**

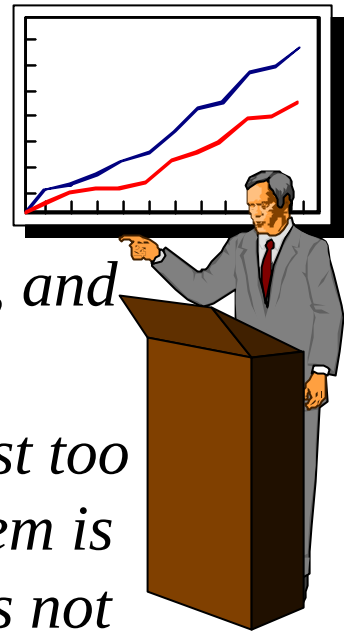
*International Software Benchmarking Standards Group

Approximate Cost Projections

- **Summary**
  - project size = 899 adjusted function points
  - Industry figures *rough* prediction is that the cost for the:
    - Total project = **$1.1 to $1.5 million**
    - Remaining Post-Design = **$700k - $1000K**
  - project then used functional size for:
    - fixed price tendering (dollar cost per FP)
    - negotiating scope / price alterations
    - monitoring project performance
    - estimating defects
    - estimating support ratios

Later TM informed that the supplier bid was $780K. Project was immediately approved!

Project Based - Planning Future Direction



- **Situation** *: Just implemented new application to track agents, and new release is planned.*
- **Issue** *: Management believe that the original development cost too much and are hesitant to continue. Developers claim the system is very large and high costs were to be expected. Management is not convinced and do not want to throw good money after bad!*
- **Solution 1** - Accept developers appraisal as correct as they must know and approve new release, (**high risk of overspending again).**

- **Solution 2** - Roughly estimate the size in function points, use industry based productivity figures to predict what should have been the cost. **(Effort = 1 day)**

Industry figures for Cost Projections

- Size estimated to be between 900 and 1200 function points best guess=1100 function points
- Industry ISBSG Cost Data
  - Median $1,234 per function point (1100 fps)
    - **$1,357,400**
  - Median $90 - $119 per hour spent (at 14 hours/fp)
    - **$1,386,000 - $1,832,600**

Actual cost was almost 20 times this figure!

Industry figures Effort Predictions

- Industry ISBSG Cost Data indicates a project Productivity rate of around **14 hours per function point**.
- Effort figures collected from the project indicated a project Productivity rate of around **65 hours per function point**.

Even allowing for techical complexity, large project team size (35) this is still low productivity!

Management decided not to proceed with second release before finding a way to improve productivity and reduce costs!

Project Based - Manage Outsourced Development

- **Situation** *: New Software Application - development to be outsourced*
- **Issue** *: Very restricted budget, potential for changes to requirements - time and materials billing is not an option*
- **Solution 1 -** Accept fixed price quotations and expect very high penalties for changes.**(Potential for high quotes and budget blowout)**
- **Solution 2 -** Use ***SouthernScope*** methodology ie. Fixed priced quotations based on dollars per function point delivered. Pay an agreed penalty rate of dollars per function point changed. **(Budget can be agreed, monitored and controlled. Price for changes agreed up front)**

SouthernScope Methodology

- Developed and used by Victorian Govenment
- Initially Size Projects using Function Points
- Suppliers quote fixed price *Dollars per function point*
- Penalties ie. +% *Dollars per function point* negotiated based on the phase of lifecycle the change is introduced
- Use independent scope manager to arbitrate

For details see: www.mmv.vic.gov.au/southernscope

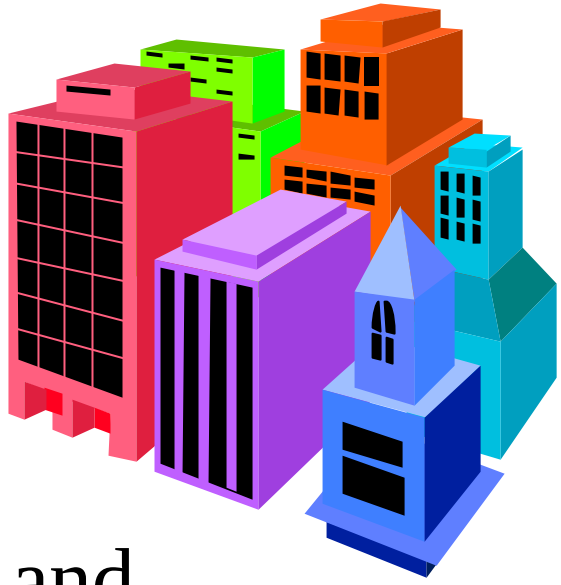
Portfolio Based - Controlling IT Contracts

- **Situation** : *Organisational requirement to outsource IT*
- **Issue** : *How big is our IT portfolio? What should we expect to pay? How do we assess the benefits? How do we ensure we are getting value for money?*
- **Solution 1** - Trust the outsourcing organisation to do the right thing and hope it is the best solution.**(Time to find out 3 - 5 years)**
- **Solution 2** - Measure the portfolio size to establish reasonable contract price, establish current baseline productivity rates, set improvement targets to be achieved on a annual basis that incur penalties and bonuses. Regularly audit suppliers figures **(Objective measure of suppliers performance and early warning of non-performance)**

Contract - Service Level Agreements

- **Productivity Measures:**
  - **Portfolio Assessment - Contract Negotiations**
    - overall size in function points eg. Large contracts approx 700K fps
  - **Performance Improvements**
    - development $/function point, delivery rates/ function point
    - CMM capability rating eg. Level 3 within 3 years
  - **Maintenance Productivity rates**
    - Turnaround time
    - $ / function points supported
  - **Estimating Enhancements**
    - establish enhancement productivity rate $/function points in different environment, client and supplier agree.

Measurement is used by :



- **Software Houses**
  - developing fixed price quotes
  - managing project scope creep
- **Outsourcing Arrangements**
  - suppliers to constrain client changes and estimate costs
  - clients to verify suppliers claims, compare suppliers

Measurement is used by :

- **IT departments**
  - estimate costs, schedules and resources
  - planning replacement software
  - developing budgets
  - evaluating packages
  - comparing tools, techniques, technologies

- **Organisations benchmarking IT**
  - performance
  - productivity
  - quality

More Information and Resources

- **Australian Software Metrics Association (ASMA)**
  - contact : Robyn Smith 03 844 0560
  - www.asma.org.au
  - asmavic@ozonline.com.au
- **International Software Benchmarking Standards Group (ISBSG)**
  - contact : Peter Hill 0411 111 439
  - www.isbsg.org.au
  - peter.r.hill@bigpond.com.au
- **Total Metrics**
  - contact : Pam Morris 03 9882 7611
  - www.totalmetrics.com
  - Pam.Morris@Totalmetrics.com

ASMA

- **Membership includes:**
  - **Evening Industry seminars**
  - **Annual Conference and Workshops**
  - **Metrics Resource Materials**
  - **Discount on ISBGS products**

ISBGS

- The **International Software Benchmarking Standards Group**
  - maintains and exploits a repository of international software project metrics
  - to help improve the management of I.T. resources, by both business and government,
  - through improved project estimation and productivity, risk analysis and benchmarking.

ISBGS

- **9 countries actively particiapate (plus 7 others contribute project data)**
  - Australia (ASMA)
  - Germany (DASMA)
  - India (NASSCOM)
  - Italy (GUFPI)
  - Japan (JFPUG)
  - Netherlands (NESMA)
  - Spain (AEMES)
  - United Kingdom (UKSMA)
  - United States of America (IFPUG)

ISBGS - Products and Services

- Venturi (free software) for the collection and submission of project data.
- Practical Project Estimation Toolkit (book and CD) - an invaluable resource for estimating software development effort and duration.
- The Benchmark Series - analyses Repository data.
- ISBSG Estimating Benchmarking & Research Suite (incorporating Data Disk Rel 7) A CD with data on 1238 projects
- ISBSG Reality Checker
- Project Benchmarking Service

Total Metrics

- **Measurement and Process Improvement Consulting and Training Services**
- **WWW site**
  - **metrics News**
  - **metrics research papers and free downloads**
  - **links to Metrics sites**
  - **metrics events internationally**
- **Quarterly Newsletter - Metrics related news (free)**

This presentation is available from DOWNLOADS Total Metrics WWW Site - *WWW.Totalmetrics.com*

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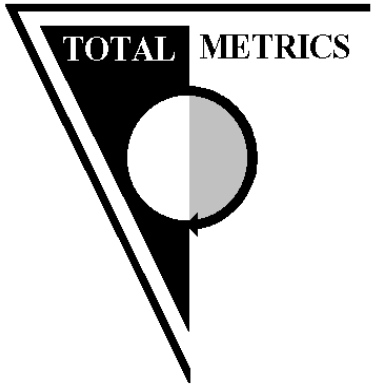
The End

" To measure is to know!"

"Without objective data you are just another person with an opinion"

Thank You and Good Luck with your Project Measurement !



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