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Technical Debt
New solutions for an old problem

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Technical debt (TD)

Technical compromises*

that can yield short-term benefit

but may hurt the long-term health of a software system

* 1. Immature artifacts
  2. Postponed tasks

Technical Debt metaphor

- Debt is a necessary tradeoff
  - Loan for investment
  - Quality-- for business value++
- Pay back *capital* (fix TD) + *interest* (maintain SW)
- Complete payoff may be unrealistic
- Debt should be monitored and managed
  - Risk – keeping debt into control

Caveat: Metaphors have limits

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Breaking the metaphor

- People who collect TD ≠ people who repay TD
- Relating TD to an interest rate or interest period
- TD can be unintentional
- TD does not always have to be repaid
- TD does not necessarily have a bad side

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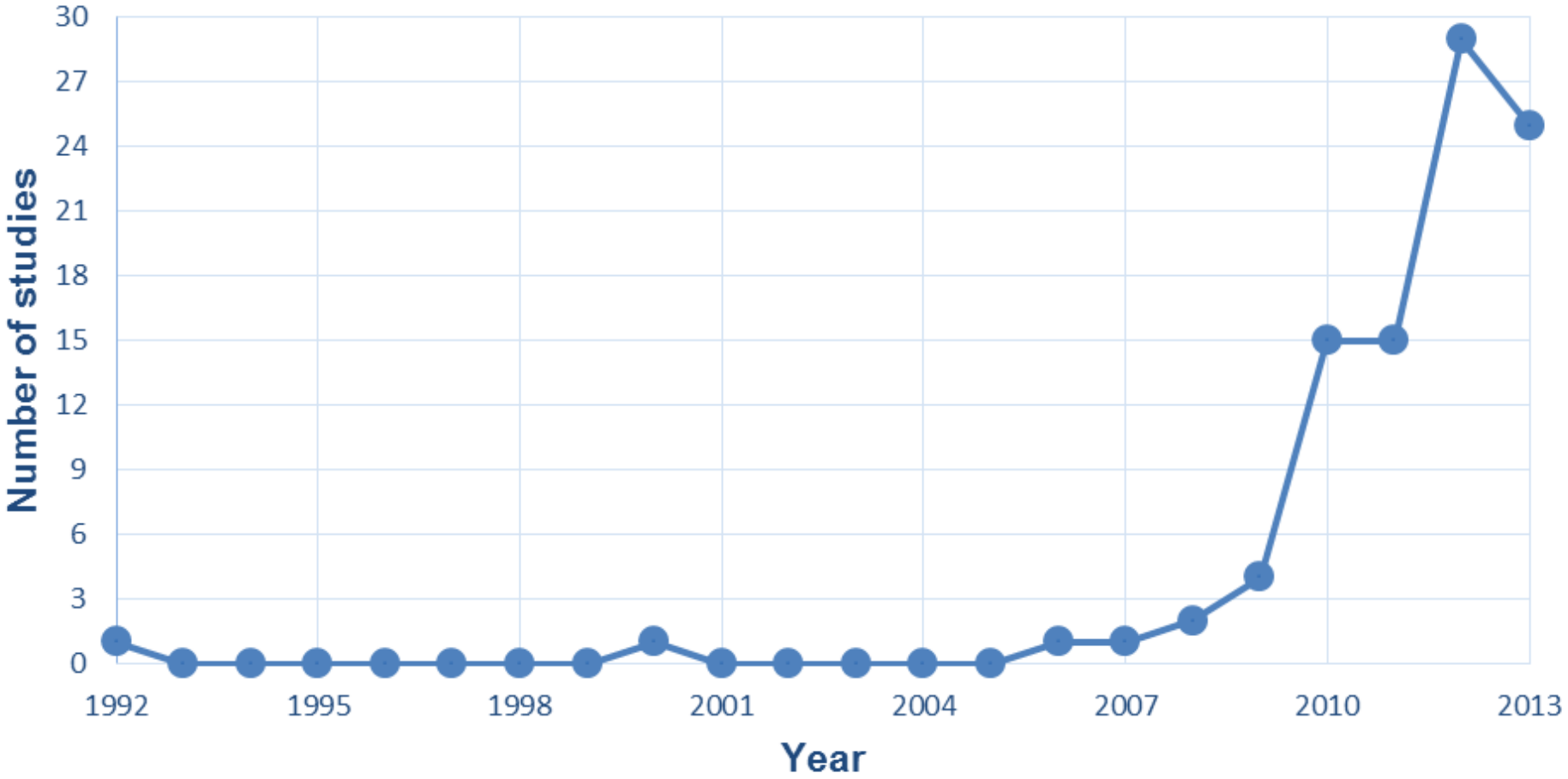
Research is picking up!



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What do we know so far?

- A lot of literature
  - Not much consensus
  - Not much evidence
  - Gray literature aggravates things
- A state of the art in 2 secondary studies
  - Concept of TD and management (94)
  - Financial aspects of TD (69)
  - Both excluding gray literature

Study 1
Concept of TD and management

Concept of TD

"Shipping first time code is like going into debt. A little debt speeds development so long as it is paid back promptly with a rewrite …"

"The danger occurs when the debt is not repaid. Every minute spent on not-quite-right code counts as interest on that debt. Entire engineering organizations can be brought to a stand-still under the debt load of an unconsolidated implementation, object-oriented or otherwise."

Ward Cunningham, The WyCash portfolio management system, OOPSLA '92

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Just the code?

Not quite right

- Requirements
- Architecture
- Design
- Code
- Test
- Build
- Documentation
- Infrastructure
- Versioning

...

Just the code?

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Complex dependencies
Architecture smells
Architecture drift

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Just the code?

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Duplicate code
Code violations
Complex code

Just the code?

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Low code coverage
Lack of test automation
Expensive tests
Residual defects not found

Just the code?

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Insufficient/incomplete/out of date
Lack of code comments

What is not TD?

Is TD everything detrimental to SW product & process?

- Internal focus
  - Defects
  - Low external quality
  - Unimplemented features
- Sub-optimal process

If you are not incurring any interest, then it probably is not a debt

McConnell 2013

Managing TD

- TD prevention
- TD identification
- TD measurement
- TD prioritization
- TD monitoring
- TD repayment
- TD representation/documentation
- TD communication

Managing TD

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Code analysis
Dependency analysis
Solution comparison
Reverse engineering

Managing TD

- TD prevention
- TD identification
- TD measurement
- TD prioritization
- TD monitoring
- TD repayment
- TD representation/docu tation
- TD communication

TD dashboard
Backlog
Dependency visualization
Code metrics visualization
TD list
TD propagation visualization

Study 2
Financial aspects of TD

Why Financial Aspects of TD?

TD is not just an economics metaphor used in SE

It is a financial overhead

Communication bridge: engineers vs. management

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Financial terms

Interest	business value	compound interest
Principal	Option	Effort
Cost	interest rate	financial leverage
Repayment	present value	future value
return on investment (ROI)	Revenue	Hedging
Asset	Capital	loan shark
Investment	Benefit	opportunity benefit
Value	Bankruptcy	voice of market
Risk	cash flow	Savings
Liability	by-product	value-added
Productivity	total cost of ownership (TCO)	voice of business
opportunity cost	Depreciation	voice of customer

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Missing: debtor/creditor, debt instrument, maturity date, liquidity

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Financial Theory - Measuring TD

Measured Term	Measuring Approach			
	Portfolio Management	Real Options	Software Economics	Value Based
Amount of debt	0	1	7	1
Compound Interest	0	0	1	0
Interest	1	0	5	0
Repayment	0	0	1	0
Principal	1	0	3	0
ROI	0	0	0	1
Simple Interest	0	0	1	0
Future Value	0	1	0	0
Present Value	0	1	2	0
Total	2	3	20	2

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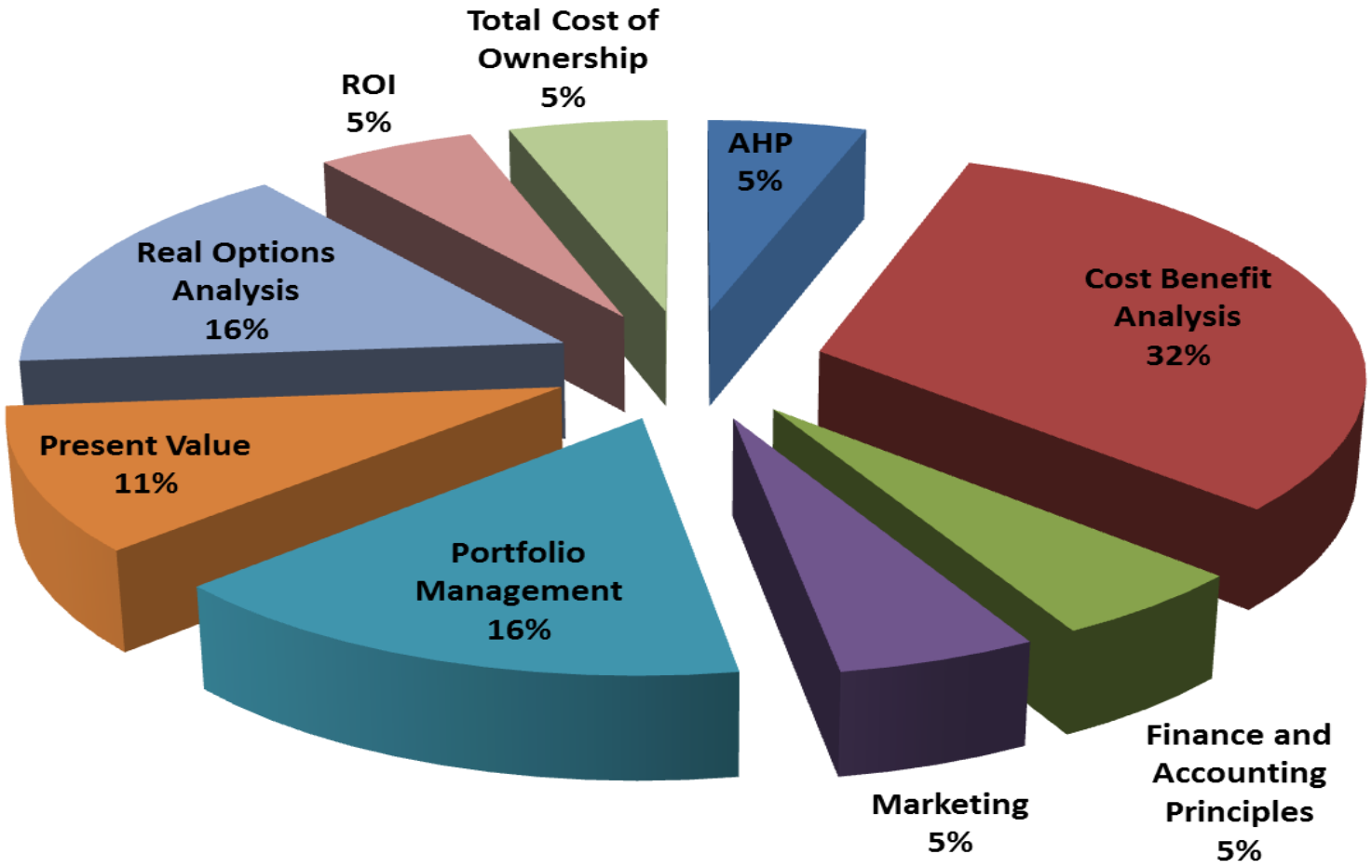
Financial Theory – Managing TD



Standard glossary

Asset
By-product
Bankruptcy
Compound Interest
Financial Leverage
Future Value
Interest
Interest Rate
Liability
Present Value
Principal
Repayment
Risk
ROI
Value-Added

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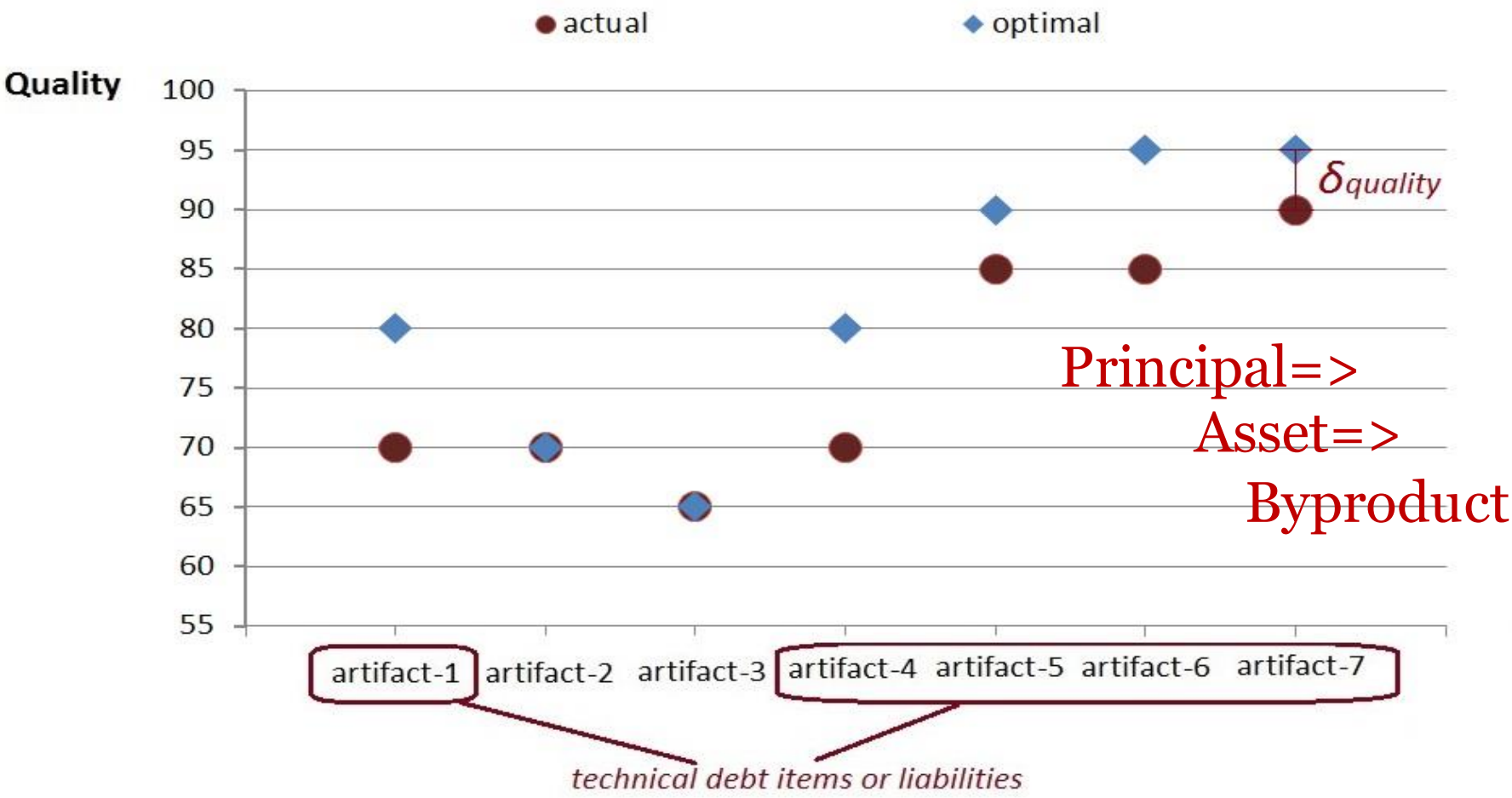
Standard glossary usage



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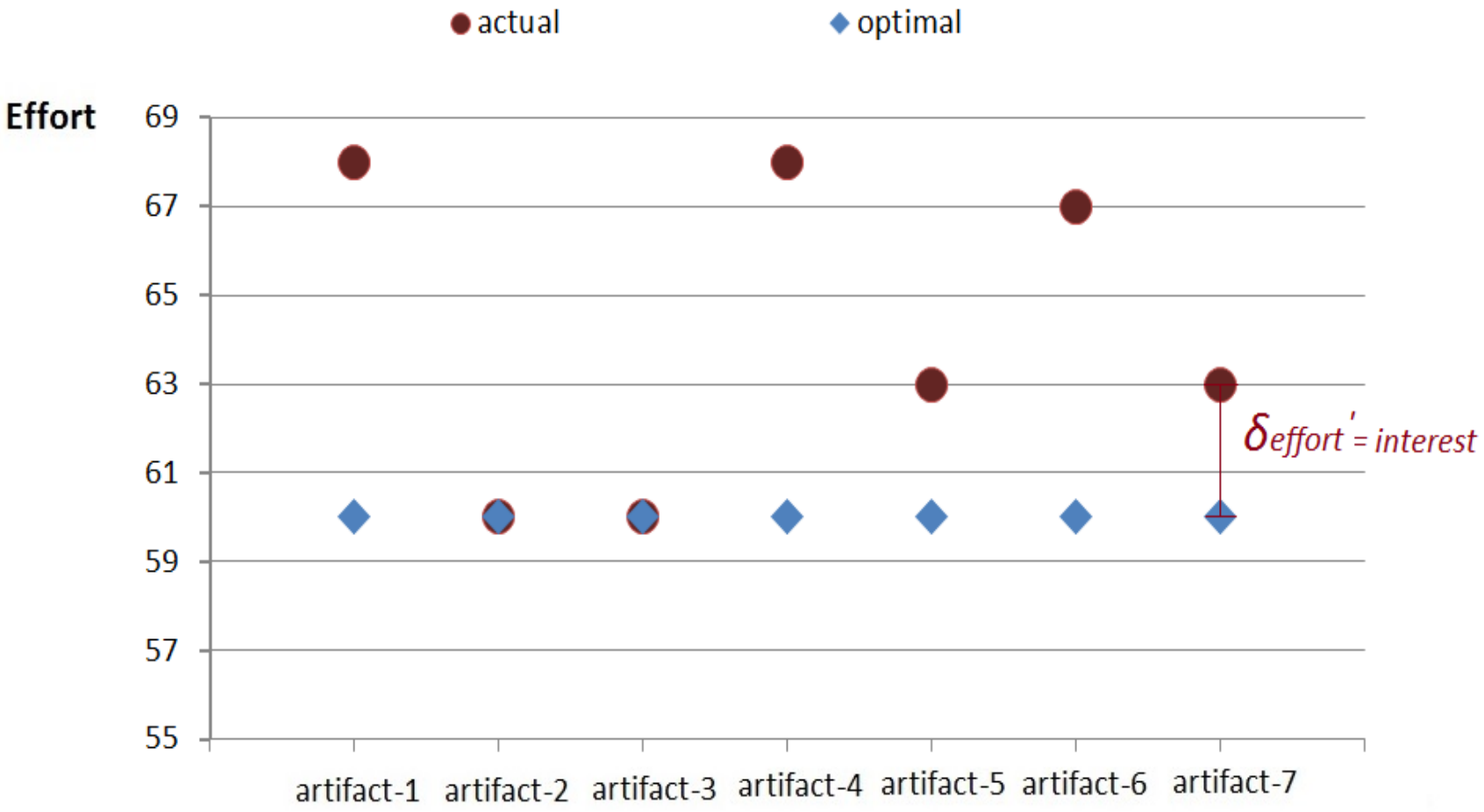
Standard glossary usage



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Future directions

- Managing business constraints
  - External decisions, acquisitions, market ecosystem
- Measuring TD
  - Which TD items have the highest cost?
  - Assigning business value to intrinsic qualities
  - Quantifying cost and benefit of refactoring
- Lack of underlying theory
- Tooling mostly for code and design TD
- Dependencies between TD items
- Traceability between TD and related artifacts

Parting thoughts

Cunningham

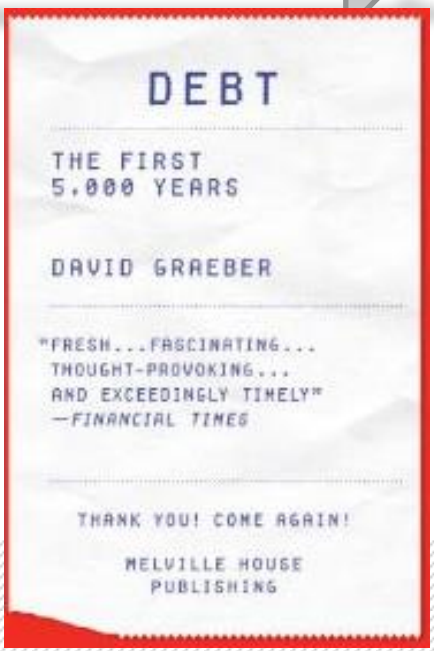
This talk

TD re-heated & re-served

1992 2014 2036

SE Ideas recycling iterations

- TD is not a fashion or buzzword
- Seize the momentum
- Stick with the problem
- Work with economists



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Thank you

Credits:

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