



Vic Basili: A Qualitative Empirical Study

ICSE 2005 Basili Legacy Symposium

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- **Empirical question: How to explain Vic's**

- Volume of contributions
 - Largest individual contributions to ICSE series
- Amount and breadth of impact
 - Enterprise/project, large/small, Govt./industry/academia
- Ability to form and grow a community of interest
 - Here we are – plus many others

- **Empirical method: Opportunistic observation**

- ICSE 6 (Japan, 1982) through IPRC 3 (Italy, May 2005)

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Hypotheses: Main Contributing Factors

- **Friendly curiosity**
- **Bias for action, exploring new areas**
- **Internalization of scientific method**
- **User orientation**
- **Public service orientation**
- **Vision and leadership**

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Friendly Curiosity: Vic is

- **Interested in what you're doing**
 - How you got interested in it
 - What you've learned about it
- **Curious about everything**
 - Software, Italian food, air travel, people
 - Example: early programming language work
- **Plus bias for action**
 - HPC productivity studies, HDCP testbed
- **Plus exploring new areas**
 - Example: 1982 US/Japan software practices study

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Early Programming Language Work

- **SIMPL family: user orientation**
 - What did users want from, like about, do with languages?
 - Measure, analyze, iterate
 - Requirements emerge vs. being prespecifiable
- **Led to early work on how to do iterative development**

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US/Japan Software Practices Study

– Sponsor: IBM; Performer: UMaryland

- **Relatively few organizations had much data**
- **High usage rates for HOLs, workstations, reviews**
- **Low usage rates for recommended practices, test tools, code auditors**
 - Probably not much different now
- **No one-size-fits-all solutions**
 - Helped crystallize goal-question-metric
 - Study valuable to companies (TRW), government (STARS)
- **Breadth of analyzed experience for Vic**
 - Effective consultant, further enhancing experience base and user orientation

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Internalizing of Scientific Method

- **Way of life at Fraunhofer-Maryland**
 - Built-in hypothesis testing, use as testbed
- **Software Engineering Lab**
 - Evaluated project use of languages, testing, reading, reuse, object-oriented methods, Cleanroom, COTS,...
 - Evolved user-oriented empirical methods
 - Qualitative Improvement Paradigm (QIP)
 - Goal-Question-Metric (GQM)
 - Experience Factory (EF)
 - CeBASE Method (with USC MBASE)
 - Major productivity and quality improvements
 - Existence proof for empirical methods payoff
 - First winners of IEEE-SEI Process Achievement Award

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25 Years of Learning

Experiences with the Software Engineering Laboratory (SEL)

Consortium of

NASA/GSFC

Computer Sciences Corporation

University of Maryland

Established in 1976

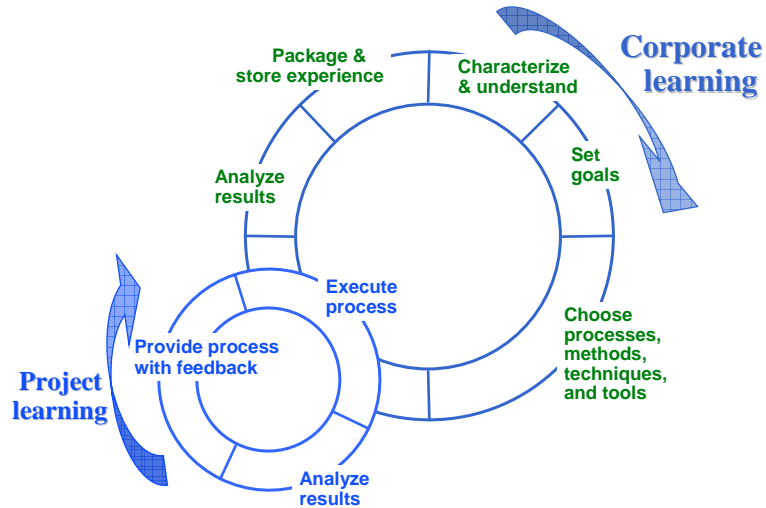
Goals have been to

- better understand software development
- improve the process and product quality at Goddard, formerly in the Flight Dynamics Division, now at the Information Systems Center

using observation, experimentation, learning, and model building

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Quality Improvement Paradigm



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Quality Improvement Paradigm 1976 - 1980

Learned

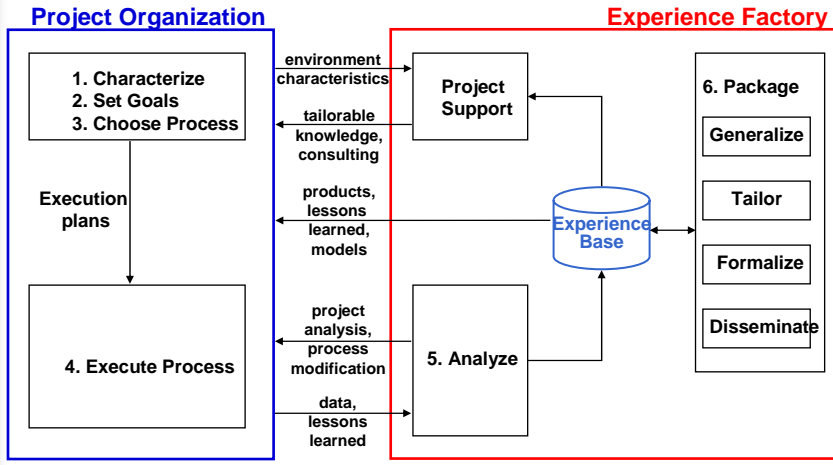
Need to **better understand** environment, projects, processes, products, etc.

Need to **build our own models** to understand and characterize locally

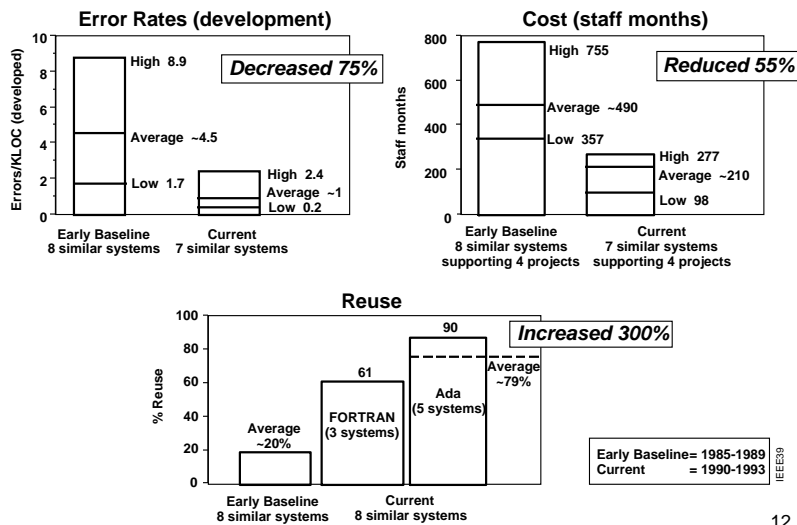
Data collection has to be **goal driven**
– Goal-Question-Metric approach

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The Experience Factory Organization



Quality Improvement Paradigm 1991-1995





Effects of the SEL Activities Since 1996

Continuous Improvement in the SEL

Decreased **Development Defect rates** by
75% (87 - 91) **37%**(91 - 95)
Reduced **Cost** by
55% (87 - 91) **42%** (91 - 95)
Improved **Reuse** by
300% (87 - 91) **8%** (91 - 95)
Increased **Functionality** five-fold (76 - 92)

CSC

officially assessed as CMM level 5 and ISO certified (1998),
starting with SEL organizational elements and activities

Fraunhofer Center

for Experimental Software Engineering - Maryland created 1998

CeBaSE

Center for Empirically-Based Software Engineering created 2000

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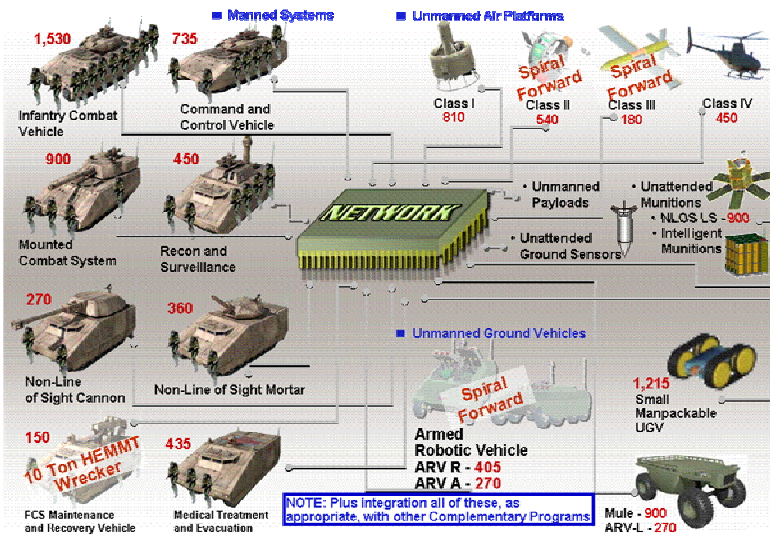


UMD-USC Center for Empirically-Based Software Engineering (CeBASE)

- **Goal: An empirically based software development process**
 - covering high level lifecycle models to low level techniques
 - necessary step toward a scientific foundation for software engineering in which the effects of development decisions are well understood
 - we can't improve without a rigorous foundation
- **A first step is an empirical experience base**
 - validated guidelines for selecting techniques and models
 - ever evolving with empirical evidence to help us
 - identify what affects cost, reliability, schedule,...
- **To achieve this we are**
 - Integrating existing data and models
 - Experimentally applying and refining techniques
- **Major support from NSF, NASA, OSD, DARPA, US Army**

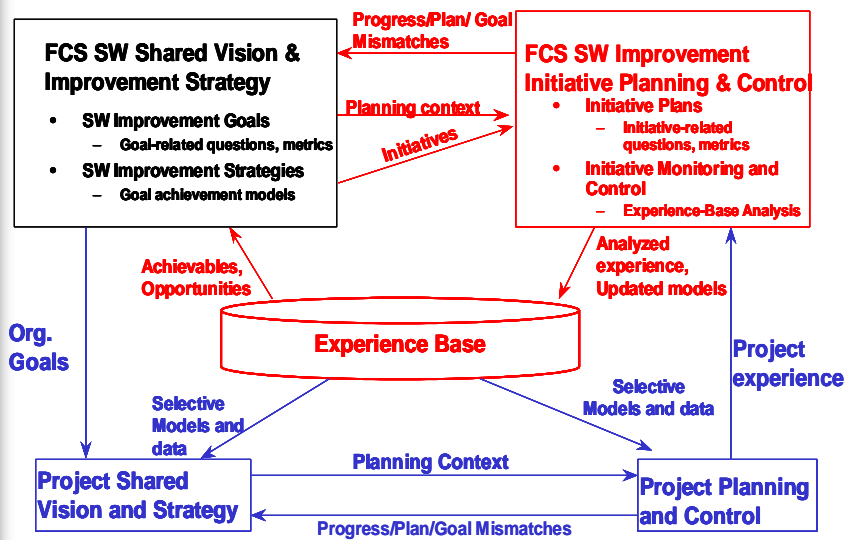
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Future Combat Systems: 26 system suppliers, 4000 software developers



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Experience Factory Framework - FCS



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Public Service Orientation: Vic as Volunteer Examples

- **ICSE 6 (1982)**
- **IEEE Transactions on Software Engineering**
- **Brooks Defense Science Board Software Study (1986)**
- **FAA Use of Ada study (1987)**
- **Software Process Achievement Award Committee (1994-)**
- **NSF/ITR Software Engineering Workshops (1998-99)**

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Vision and Leadership: Vic's Legacy

- **SEL and its alumni**
- **Empirical Software Engineering Journal**
- **Fraunhofer Centers: Kaiserlautern, Maryland**
- **International Software Engineering Research Network (ISERN)**

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Creating a Community of Interest



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