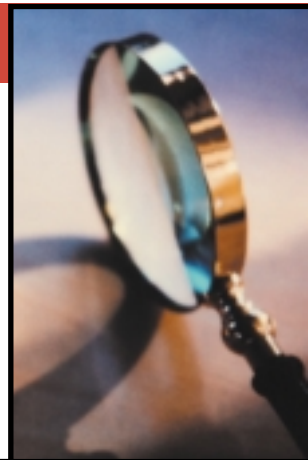


LEVERAGE OUR POWERHOUSE SOFTWARE REPOSITORY

At Quantitative Software Management, we maintain one of the most comprehensive repositories of software projects ever collected. With trends compiled from more than 5,920 worldwide completed projects, 685 million lines of code, 320 development languages, and 1.2 million person-months of effort, our **QSM Historical Database** is leveraged by companies around the globe as *the* authoritative benchmarking tool for their own software and IT project metrics.



CASE IN POINT: QSM Data Reveals a Season of Change

To demonstrate the utility and value of the QSM Historical Database, we recently conducted a Long Term Productivity Study using the information captured within our extensive repository. We analyzed the following 7 metrics to discover significant differences between the 15-year period between 1982 and 1997, and the 3-year period between 1997 and 2000:

- Project Developed Size
- Average Productivity Index (PI)
- Staffing
- Schedule
- Effort
- Software Re-Use
- Mean Time to Defect

The results, described for each metric below, lead to a more in-depth understanding of software productivity trends.

Project Developed Size

1982-1997: On average, a project's developed size was cut in half during this 15-year period.

1997-2000: The average developed size of IT projects nearly doubled during this 3-year period.

Analysis: The size reduction experienced during the 80s and early 90s can be attributed to more powerful development languages, projects being restricted to 12-to-18 month schedules, and deliberate architecture re-use implementations. However, due to the 'explosion' of the Internet and object-oriented (OO) technologies in the late 90s, many 1st-generation web and OO architectures had to be built from scratch, resulting in less re-use.

Average Productivity Index (PI)*

1982-1997: The average PI increased from an initial base value of 13.8 to 17.3.

1997-2000: The average PI dropped to 16.6.

Analysis: Several factors may have driven productivity downward in the late 90s: the amount of resources diverted to Y2K; labor churn and staff rotation to dot-com start-ups; the learning curve associated with implementing large-scale ERP applications; and a shift in project complexity—such as the need for more middleware, for seamless integration within multi-platform environments.

Staffing

1982-1997: Average of 6 to 7 people per project.

1997-2000: Average of more than 9 people per project—an almost 50 percent increase.

Analysis: Two factors could have contributed to this trend: project size growth and an acceleration of deadlines to complete at "Internet Speed." In essence, companies in the late 90s were striving to build more functionality in less time. Therefore, they added more people to projects.

(continued on back)

THE QSM HISTORICAL DATABASE COVERS MORE THAN...

- 5,920 completed software projects
 - 685 million lines of code
 - 320 development languages
 - 1.2 million person-months of effort
- ...and growing.

Schedule

1982-1997: The typical project went from taking nearly 2.5 years to taking only 8 months.

1997-2000: The average project schedule grew to 9.5 months.

Analysis: Decreases in project size and improvements in productivity resulted in substantial schedule reduction in the 80s and early 90s. A combination of project growth and drop in productivity likely increased project length in the late 90s.

Effort

1982-1997: The average effort per project dropped from 165 person-months to almost 50 person-months.

1997-2000: Average effort nearly doubled to more than 100 person-months.

Analysis: The increase in effort in the late 90s was probably due to the combination of more software being developed from scratch, a 50% increase in average team size, and the modest drop in productivity.

Software Re-Use

1982-1997: The overall trend was an increase in software re-use, approaching 65% in the mid-90s.

1997-2000: The trend retreated back to approximately 50%.

Analysis: More than likely, most of the late 90s Internet and 1st-generation OO projects were comprised of new development.

Mean Time to Defect (MTTD)**

1982-1997: MTTD remained relatively constant during the 80s at about 5 days on average, improving to just under 9 days in the mid-90s.

1997-2000: MTTD improved another dramatic step to an average of 12.5 days.

Analysis: Contributing factors likely included improved process maturity, and more attention to quality issues. Many modern-day client server and web applications also require 24/7 operations, with greater emphasis on system availability.

AT A GLANCE: THE LATE 90s BIG PICTURE

reversal of a 15-year industry trend

- Staffing and Effort: **Higher**
- Schedules: **Longer**
- Software Re-Use: **Lower**
- Project Developed Size: **Larger**
- Productivity: **Down**

*The QSM Productivity Index is an aggregate measure of process productivity, calculated from metrics for size, time, and effort of completed software projects. These represent 3 of the 4 core metrics expressed by the Carnegie Mellon SEI Minimum Data Set, an established industry standard.

Conclusion

The results of our Long Term Productivity Study showed significant changes in application productivity in the late 90s. With the exception of quality improvement, all other indicators reversed a long-term trend since 1982: **Staffing and effort were higher. Schedules took longer. Software re-use was lower. Project developed size was much larger. And productivity was down.**

At QSM, we speculate that several key factors contributed to these results:

- **Companies greatly underestimated the complexity** of the large-scale COTS ERP solutions they attempted for Y2K.
- **Companies started OO development in earnest**, meaning they had to build a new infrastructure for all the application-specific classes. Many organizations found implementing OO to be more difficult than they anticipated.
- **Web-based development and the advent of dot-coms** pulled many talented engineers away from traditional development, producing turbulence as highly skilled people left for Internet startups and lowered the overall skill level at Fortune 1000 companies.

While the software and IT industries have definitely experienced a turbulent end to the 20th century, over the long term there is no question that they shall see their effort result in more productivity improvements. The results most likely reflect a temporary “slowdown” that manifested itself during the e-commerce revolution and Y2K.

Need More In-Depth Metrics? Contact the Proven Leader—QSM.

For industry analysts, trade publications, or organizations seeking a dependable road map for their next software project, QSM is the authoritative resource for software project and research metrics.

Quantitative Software Management, Incorporated, was founded in 1978 by Lawrence Putnam—the world-renowned expert in the software measurement industry. Since its inception, QSM has provided superior and effective solutions to the software industry for estimation, project control, process improvement, and risk mitigation. And we continue to do so today.

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**The MTTD is the average time between occurrences of runtime errors in a software application.