Software Metrics Best Practices -- 2001

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Summary

In the 4th quarter of 2001 and the 1st quarter of 2002, KLCI conducted its fourth annual Software Metrics Best Practices study (sponsored in part this year by Distributive Software). The results of the survey were presented at the ASM 2002 conference on 14-Feb-02. The results described in this paper include the following topics:

- Profile of metrics "Best Practices"
- Benchmarking of metrics spending
- Software metrics benefits
- Software measurements used
- Commonly used software metrics tools

Figure 1 below shows the importance that is placed on metrics use with software development activities. 45% of the respondents rated metrics as either important or integral. These respondents were considered "best practices" organizations in analysis of study results. This shows an 8% increase from the results of last year's study.

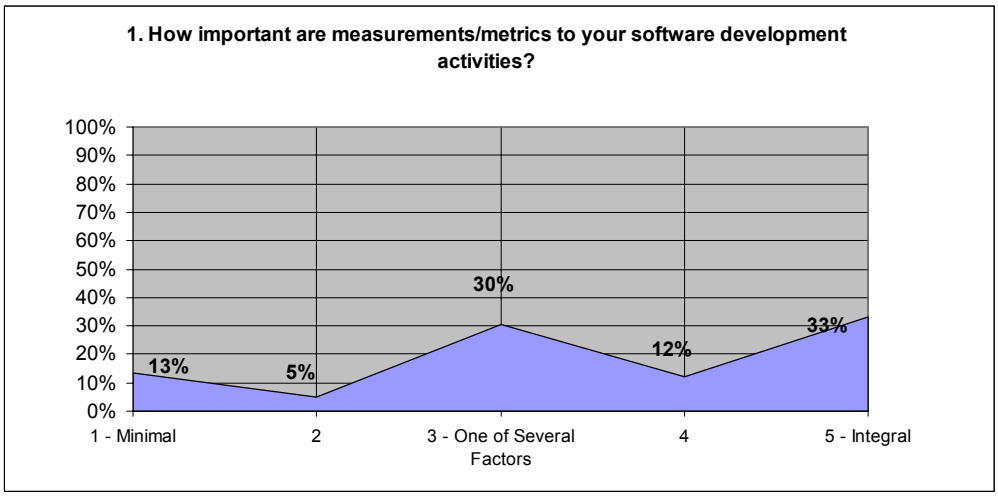

Figure 1 – Importance of Software Metrics

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Demographics

More than 570 individuals worldwide participated, representing 43 different countries. Over half of the respondents were a Manager or Project Leader, with almost 25% of the respondents being at the senior or executive level. In total, over 80% of the respondents had some level of managerial responsibility. Almost half of the organizations of survey respondents have more than 100 software developers. A majority of the organizations had not formally assessed their SEI-CMM level. The charts in Figure 2 summarize the results.

Survey respondents were self-selecting through various interactive media. The sample included previously registered visitors at KLCI and Distributive Software. The survey was also made available to any KLCI website visitor. For example, some of the participating organizations included Boeing, Diebold, EDS, Intel, Lucent, and Nokia.

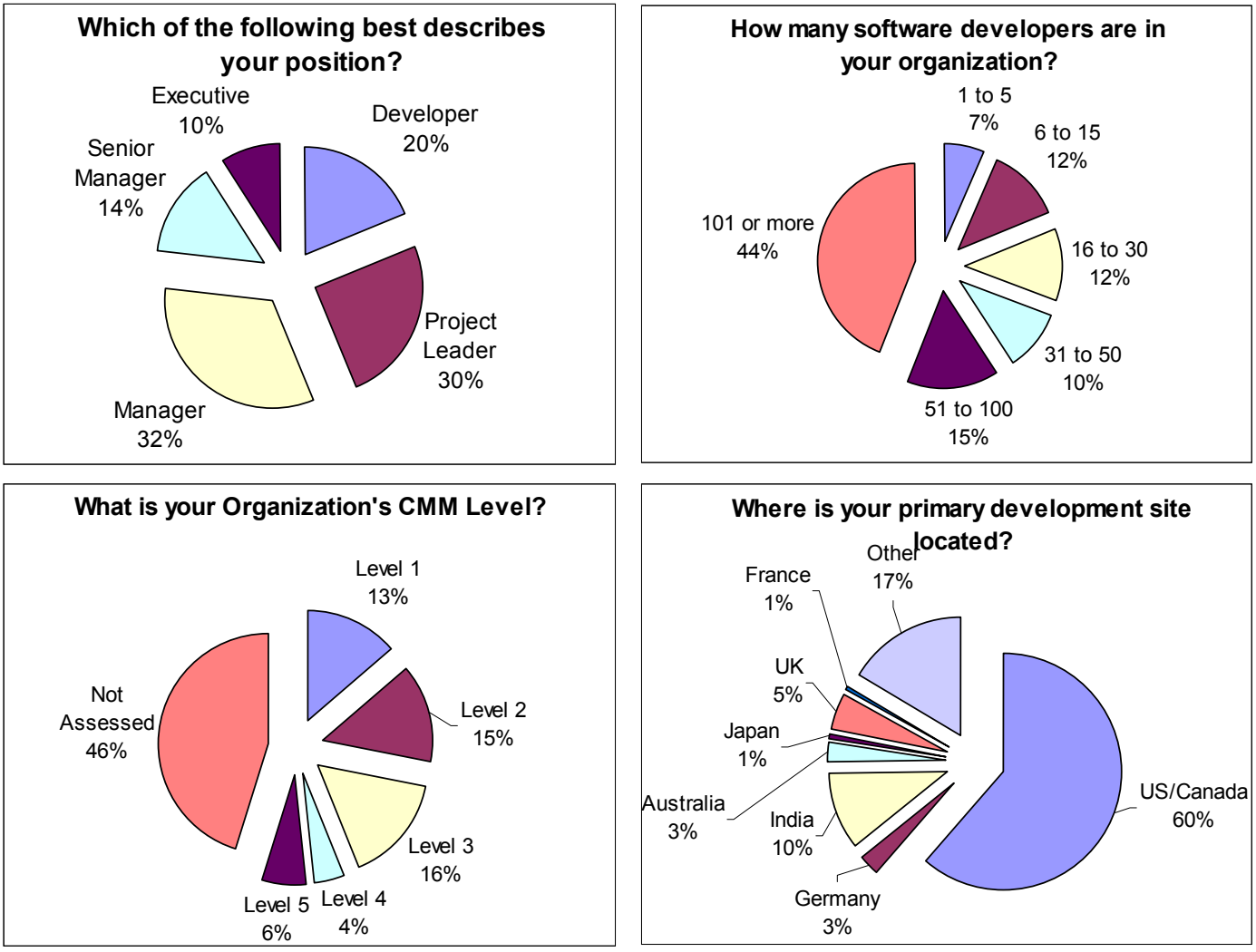

Figure 2 – Demographics

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Profile of Best Practices Organizations

Some Characteristics of "Best Practices" organizations include the following:

- "Best Practices" organizations tend to rely more on the use of metrics (81%) by considering them important to integral compared to "All Other" organizations (34%).

- 52% of Best Practices" organizations responded as having More than 100 software developers, while 43% of "All Other" organizations responded this way. On the other hand, 29% of "All Other" organizations completed more than 40 projects a year and 22% of "Best Practices" organizations complete more than 40 projects a year.

- "Best Practices" organizations are more likely to have formally assessed their SEI-CMM Level; 63% of "Best Practices" organizations have been formally assessed compared to 45% of "All Other" organizations.

- Other characteristics of "Best Practices" organizations with high correlation include:

	Best Practices	All Others
CMM Level	56% Level 2 or Higher	27% Level 2 or Higher
Spending on Measurement	4.2% of R&D/IT Budget	1.8% of R&D/IT Budget
Impact of Metrics	90% Positive Impact	47% Positive Impact
Metrics in Decisions	81% Important or Integral	34% Important or Integral
# of Measurements	7.7 Measurements	3.7 Measurements
# of Metrics Tools Used	2.1 Tools	1.4 Tools

Figure 3 – Best Practices Organizations Overview

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Profile of Metrics Practices

Figure 4 below shows the usage of quality measurements/metrics by survey respondents. The most commonly used measurements include the following: Lines of Code (49%), Schedule Metrics (59%), and Requirements Metrics (49%). "Best Practices" organizations use on average 7.7 metrics, compared to 3.7 metrics for "All Others".

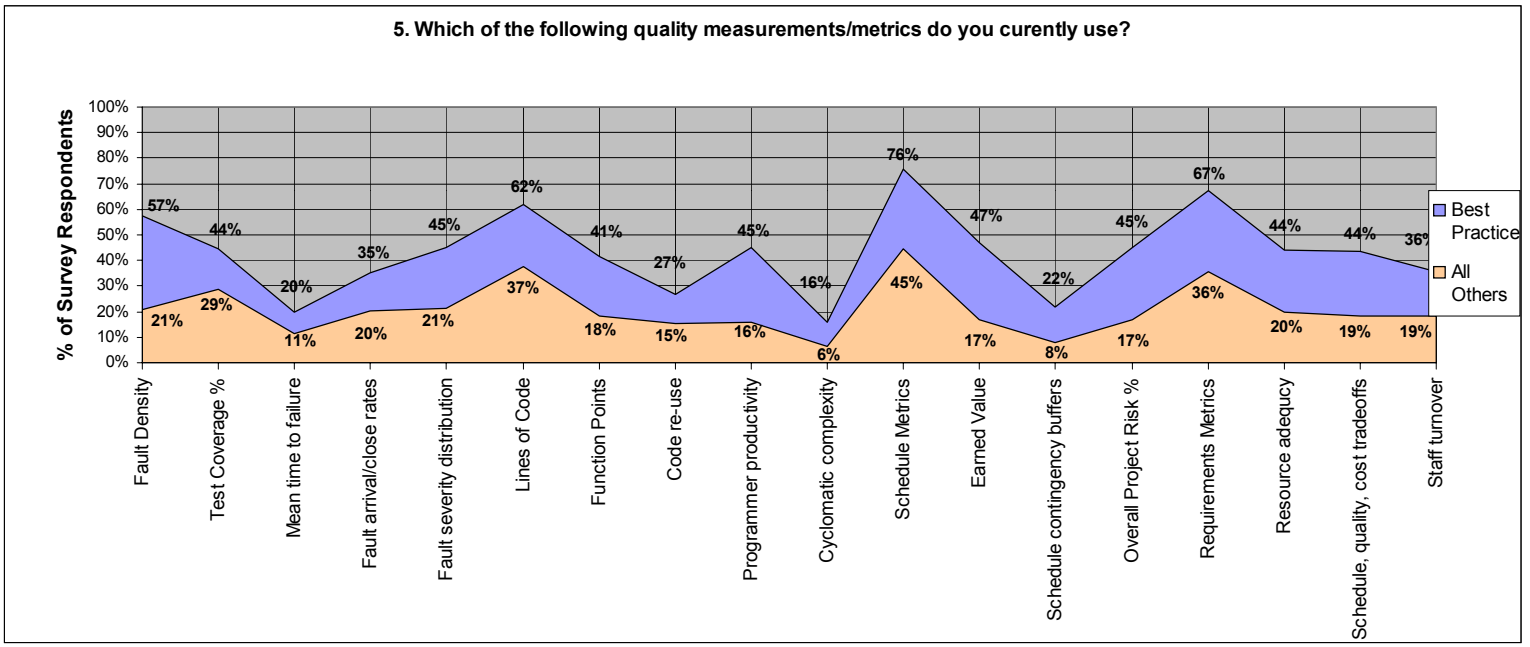

Figure 4 – Quality Measurements/Metrics Used

Figure 5 shows the usage differences between Best Practices organizations and all other organizations. Measurements/metrics used by 35% or more are compared below.

"Best Practices" Organizations	Other Organizations
• Schedule Metrics (76%)	• Schedule Metrics (45%)
• Requirements Metrics (67%)	• Lines of Code (37%)
• Lines of Code (62%)	• Requirements Metrics (36%)
• Fault Density (57%)	
• Earned Value (47%)	
• Overall Project Risk Percentage (45%)	
• Fault Severity Distribution (45%)	
• Programmer Productivity (45%)	
• Test Coverage Percent (44%)	
• Resource Adequacy (44%)	
• Schedule, Quality, Cost Tradeoffs (44%)	
• Function Points (41%)	
• Staff Turnover (36%)	
• Fault Arrival/Close Rates (35%)	

Figure 5 – Comparison of Top Measurements/Metrics

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Metrics Tools Used

The most common tool used by organizations to capture and analyze software metrics is Microsoft® Excel. There is not a great disparity in the usage of each specific tool between "Best Practices" organizations and "All Others." Overall, Figure 6 indicates the following:

- "Best Practices" organizations are more likely to use industry tools to analyze software metrics regularly.
- On average, "Best Practices" organizations use 2.1 tools while "All Other" organizations use 1.4 tools.

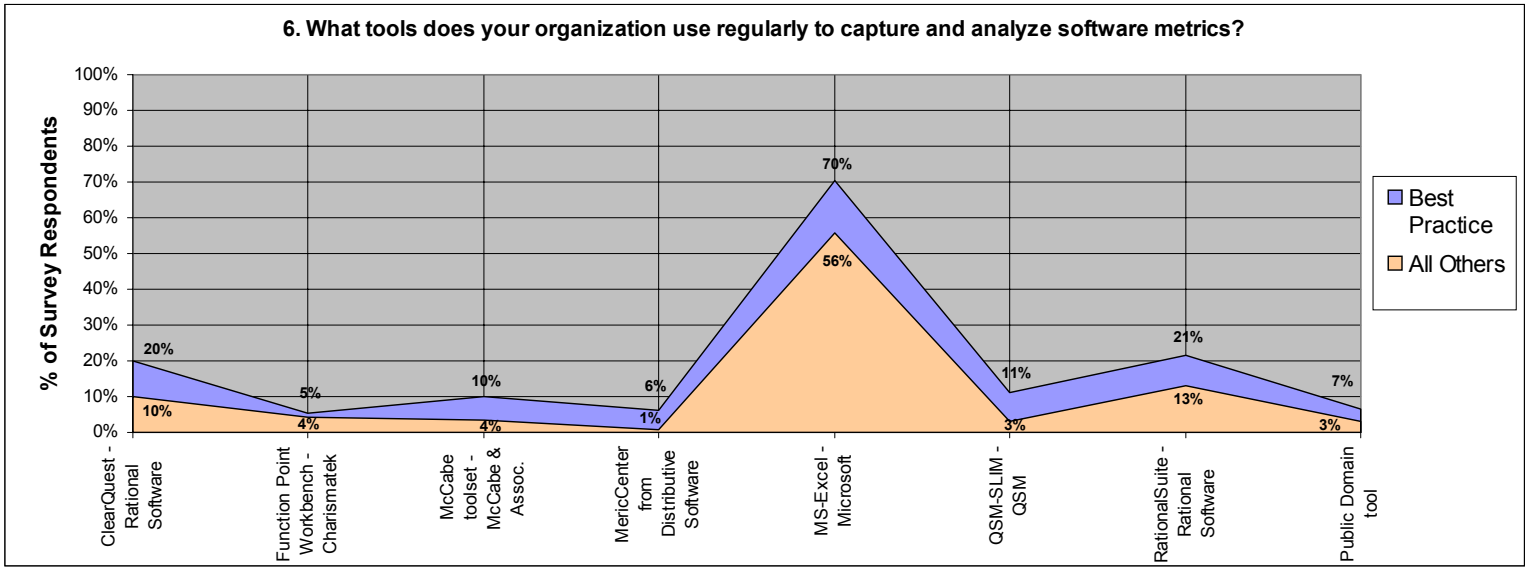

Figure 6 – Metrics Tools Used by Organizations

Figure 7 shows the overall usage rates for the listed tools (note that this list includes only tools used by at least 5% of "Best Practice" or "Other" participants).

Top Tools Used to Regularly Capture and Analyze Data by All Survey Respondents
• MS-Excel – Microsoft (63%)
• RationalSuite - Rational Software (17%)
• ClearQuest - Rational Software (14%)
• QSM-SLIM – QSM (7%)
• McCabe toolset - McCabe & Associates (6%)
• Function Point Workbench – Charismatek (5%)
• Public Domain tool (5%)
• MericCenter from Distributive Software (3%)

Figure 7 – Ranking of Tools Used by Respondents

The tools with the highest satisfaction ratings reported by participants were Function Point Workbench and MetricCenter, at 3.4 (on a scale of 1 to 5 where 1 is "very dissatisfied", 5 is "very satisfied", and 3 is "neutral"). This compares favorably to the overall average reported of 2.9.

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Benefits of Software Metrics/Measurements

Figure 8 shows the benefits of metrics usage with software development projects. The most significant (50% or more of total respondents) include the following:

- More predictable schedule
- Better able to understand project schedule
- Better estimates of size/cost
- Improved communication with management.

Figure 8 indicates that "Best Practices" organizations experience more benefits from the use of software measurements/metrics. On average, "Best Practices" organizations report 7.2 benefits whereas "All Other" organizations report on average of 4.4 benefits.

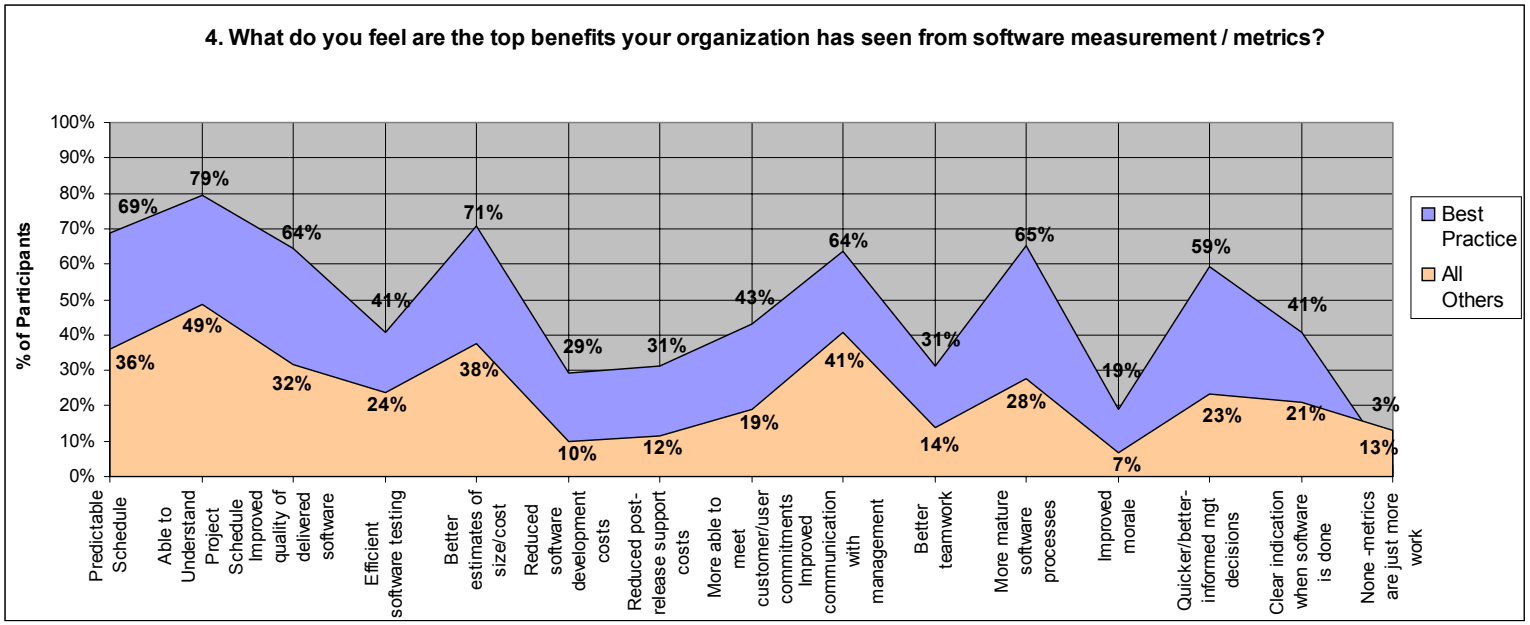

Figure 8 – Top Benefits of Software Metrics/Measurements

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Benchmarking Metrics Spending

Figure 9 shows the differences in the amount spent on software measurements/metrics. Best Practices organizations spend an average of 4.2% of their R&D/IT Budget on software measurements/metrics compared to 1.8% for Other organizations. 52% of Best Practices organizations spend between 1% and 7% of their budgets on measurement, compared to just 28% of Other organizations.

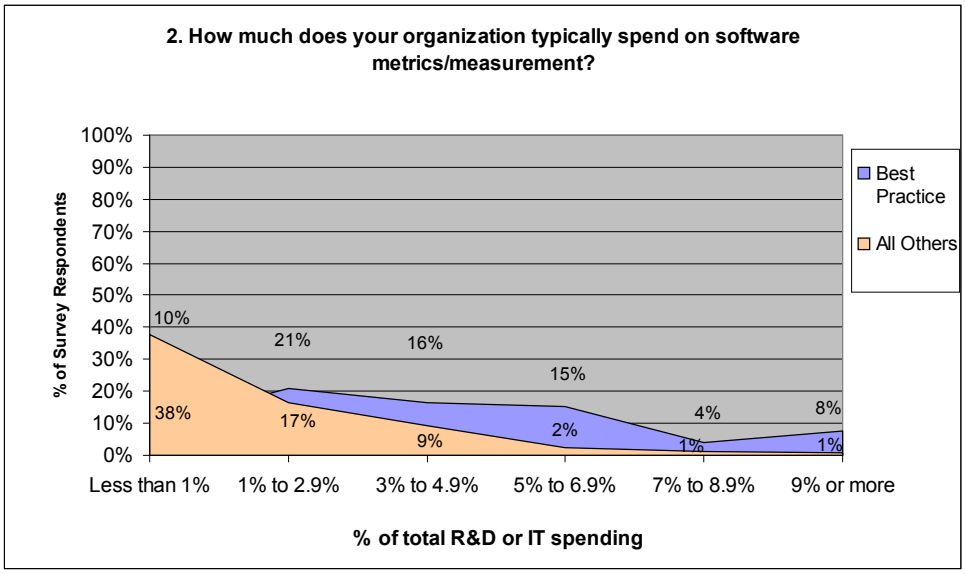

Figure 9 – Metrics/Measurement Spending

Impact of Metrics

Figure 10 below shows the various levels of impact that metrics/measurements have on surveyed organizations' software development projects. 80% of "Best Practices" organizations report that metrics have a positive impact compared to 47% of "All Other" organizations.

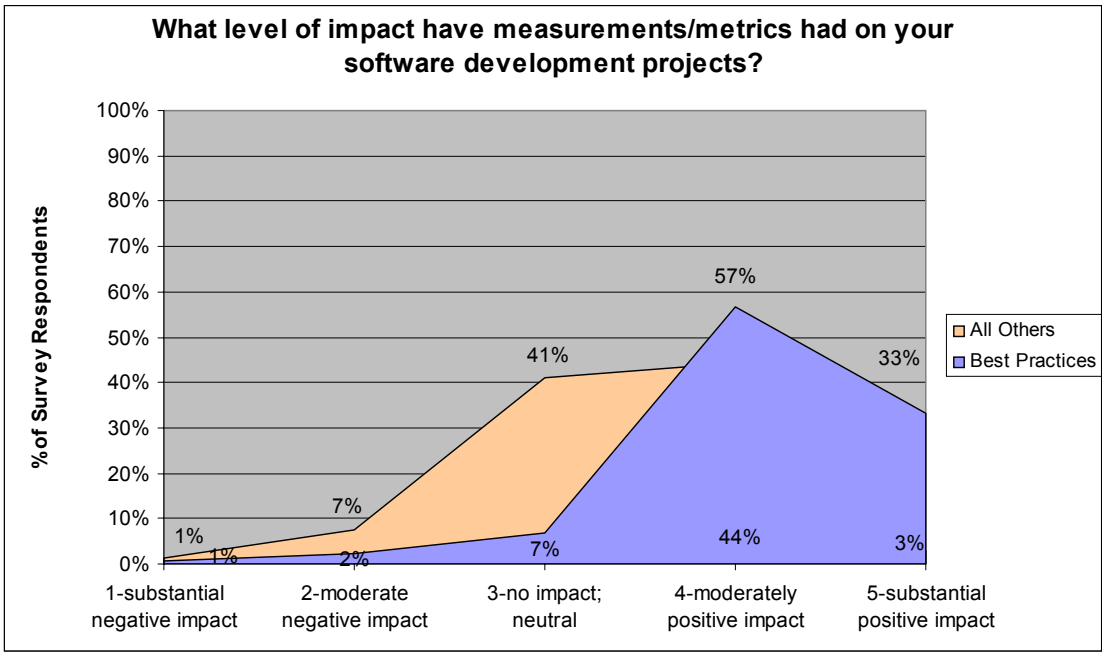

Figure 10 – Impact of Metrics on Software Development Projects

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Influence of Metrics in Decision-Making

81% of "Best Practices" organizations responded that metrics were either considered important or integral to decision-making. This compares to just 34% of "All Other" organizations, which responded that metrics were either important or integral to decision-making. The results are summarized in Figure 11 below.

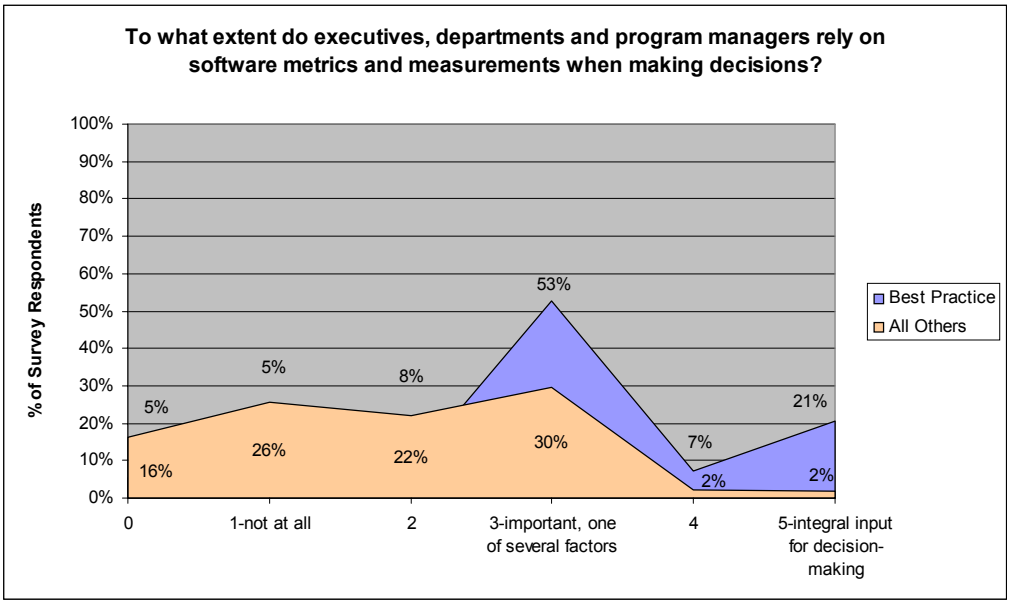

Figure 11 – Level of Metrics Influence in Decision-Making

Conclusions

The results of this study can be used to guide managers of software organizations in implementing metrics. KLCI uses the following recommended steps in helping organizations implement or improve their metrics programs:

1. Identify business goals
   - Involve Senior Management
   - Link metrics and process improvement initiatives
2. Set spending targets
3. Select metrics and tools
4. Gather historical data
5. Use metrics in decision-making

Organizations who are making a commitment to improve their metrics and follow these steps will be positioned to realize benefits attributed to Software Metrics, including more predictable schedules, better schedule tracking, better up-front estimation and planning, and improved communications.

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