

Report:
Worldwide Survey
on
Test Process Improvement

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1 Summary

Many people are interested in what can be achieved with test process improvement. Sogeti Nederland B.V. (Sogeti), developer of the Test Process Improvement (TPI®-) model, has conducted a worldwide survey on the experiences in testing, test process improvement and the model. Subscribers of the TPI®-website were asked to fill in the survey. In total 113 people have participated.

This report contains the results, including a general analysis and an analysis of specific cross-sections.

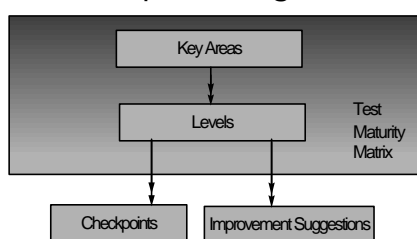
Some highlights are:

- 66% of the people responded that implementation of TPI® lead to better software quality e.g. less failures in production
- 81% of the people responded that implementation of TPI® lead to (much) better testing control
- 88% of the people responded that the return on the TPI® investment is (very) good.
- In the software industry, measurement is still the exception. In only 22%, the results were measurable.
- The two main factors that had a positive influence on the implementation were management commitment (26%) and involvement of people within the test process (26%). As a negative influence, 26% answered unrealistic expectations.
- 81% of the people responded that the contribution of the TPI®-model to the improvement process is (very) good.
- The model is quite stern. On average, 62% of the key areas are initially at level A, while 38% are still at the undefined level. The average required situation is about 1 level higher than the initial levels.
- Organizations that combine TPI® with SPI initially have a more mature test process than organizations that don't. Maybe surprisingly, the results are less positive, perhaps due to the broader scope and already more mature process.

2 Introduction

TPI®-model

With the growing importance of testing, many organizations become aware that their test processes could perform better. Improvement of these processes is the obvious solution. To support the improvements efforts, Sogeti has developed the Test Process Improvement (TPI®-) model¹. Based on current state-of-the-art test process improvement practices, the model gives practical guidelines for assessing the maturity level of testing in an organization and for step by step improvement of the process. A very short description is given in the appendix.



The TPI®-model

The model has been used in numerous countries since its introduction in 1997 (in Belgium and The Netherlands), its publication in English in 1999 and in German in 2000. Besides being publicized in three books (refer to chapter 6), a website is dedicated to the model. At "www.sogeti.nl/tpi" several TPI®-products can be viewed and downloaded, changes to the model are described and questions can be asked. The website also gives the option to subscribe to TPI®-news, to keep those interested informed. At this moment, the website has close to 500 subscribers from all over the world.

Why this survey?

From these subscribers and from other people, we often receive requests asking for experiences with the model and more importantly, suggestions for improving the test process. With this survey, we wanted to create a benchmark of experiences in testing, test process improvement and the model. The benefits of such a survey for the testing world are:

- better insight into how your *test process improvement* efforts compare to those of other companies,
- better insight into how your *test process* is performing compared to that of other companies,

¹ TPI® is a registered trademark of Sogeti Nederland B.V., The Netherlands

- more confidence in and arguments for test process improvement and the model.

This feedback will help you to explain to others in your organization what can (and cannot) be achieved with test process improvement.

3 The questionnaire

The survey was conducted in the period from October 2001 until mid January 2002. On the website a questionnaire was made available and all subscribers received a request to participate in the survey. We also sent the request to several Special Interest Groups in Software Testing. The results have been placed in a database to facilitate analysis.

The questionnaire is organized in the following sections:

- Background information on the respondent and his/her company
- Assessment, analysis of the current test process
- Implementation, implementing improvements
- TPI® model
- TPI®-matrices, describing the initial, current and required situation of the test process
- Feedback.

4 Results

In total, 113 people filled in the questionnaire, from a wide range of countries, including Argentina, India and Japan. Please note that not all questions were answered, so the number of responses for questions is mostly less than 113. In the following paragraphs you first find the general results, followed by some specific cross sections.

4.1 General results

In the table below, the general results are displayed. The first column contains the question, followed by the number of responses in brackets. The next column contains the answers. Only answers that received one or more responses are displayed. For instance, for question "Does the organization have a CMM-level?", CMM level 4 is not displayed, because it received no responses. The third column displays the percentage of responses for each answer. The final column contains some comments on what we think is remarkable.

Question	Answer	%	Comments
Background			
Which country do your TPI® experiences relate to? (113 responses)	Argentina	1%	Compared to the subscriber statistics for the TPI®-website, the countries of the respondents are in general representative to the countries of subscribers. There are three exceptions: a much higher percentage of respondents come from Belgium (4% of site subscribers) and Sweden (5% of site subscribers). Possibly the Special Interest Groups of these countries gave more publicity to the survey. The percentage of respondents from the US is much less than for the site (15%). Reason: unknown.
	Australia	1%	
	Belgium	11%	
	Canada	7%	
	Denmark	3%	
	Finland	4%	
	Germany	4%	
	India	6%	
	Japan	1%	
	Netherlands, The	32%	
	New Zealand	1%	
	Norway	3%	
	Sweden	12%	
	United Kingdom	8%	
	United States	7%	
Which line of business do your TPI® experiences relate to? (113)	Industry	9%	
	(Tele)Communication	14%	
	Financial services	23%	
	Information Technology	34%	
	Healthcare	4%	
	Government	7%	
	Education/Science	1%	
	Other	9%	
What is the size of this business? (111)	< 20	3%	
	20-100	14%	
	100-1000	39%	
	1000-10.000	23%	
	> 10.000	22%	
What is your function? (113)	Test manager	27%	Last answer, "Other" functions mentioned were SPI-coordinator, product development manager, tester + test manager, test coordinator, etc.
	Test consultant	25%	
	Tester	11%	
	QA manager	9%	
	Manager of Test/QA Department	7%	
	Project leader	10%	
	Other	12%	
Does the organization have separate functions for testers (=professional testers)? (113)	Yes	73%	
	No	26%	
	I don't know	1%	

Question	Answer	%	Comments
Does the organization have separate functions for quality assurance (=professional QA-ers)? (113)	Yes	50%	
	No	47%	
	I don't know	4%	
Does the organization have a CMM-level? (98)	1	32%	People classifying their organization at level 1, the "free level", often mentioned they were guessing. Both level 5 organizations are from India.
	2	11%	
	3	7%	
	5	2%	
	I don't know	48%	
How do you qualify your experiences with the TPI® model? (109)	Extensive	6%	
	Used several times	26%	
	Used once	39%	
	None	30%	
Assessment			
Were you ever involved in a TPI® assessment? (113)	Yes	37%	
	No	50%	
	In progress	12%	
What was the scope of TPI®? How many people (testers) were involved? (69)	< 10	59%	
	10-20	32%	
	20-100	7%	
	> 100 people	1%	
What was the scope of TPI® in terms of projects and test levels (for instance, system test or acceptance test)? (69)	1 project/1 test level	25%	
	> 1 project/1 test level	20%	
	1 project/> 1 test level	19%	
	> 1 project/> 1 test level	36%	
Has TPI® been combined with SPI (software process improvement)? (71)	Yes	25%	
	No	69%	
	I don't know	6%	
What was the main reason for TPI®?(several answers possible) (116)	Poor software quality	22%	Testing being too expensive is only in 6% of the responses a reason for applying TPI®. If testing is expensive, then spending/investing even more money is not a popular decision.
	Tests too expensive	6%	
	Tests taking too much time	17%	
	Consequence of SPI	9%	

Question	Answer	%	Comments
	Reorganization	7%	
	Investment in improvement	39%	
Has a TPI® assessment been carried out? (71)	Yes	62%	
	No	27%	
	Still running	11%	
Was the person performing the assessment from ... ? (65)	within the team itself	46%	
	within own company	29%	
	outside the company	25%	
How long did the assessment take? (62)	1-2 days	29%	
	3 days to 2 weeks	40%	
	> 2 weeks	31%	
Did the assessment result in improvements being implemented? (66)	Yes	58%	
	No	29%	
	Other	14%	
Implementation			
Has a separate improvement project been set up? (48)	Yes	52%	
	No	46%	
	Not applicable	2%	
How is the improvement process organized? (42)	1 consultant	26%	
	1 change team	43%	
	n change teams	12%	
	Not applicable	19%	
Has a dedicated improvement budget been assigned? (48)	Yes	35%	The investment in TPI® is not often turned into a dedicated budget, making it hard to measure the costs.
	No	58%	
	Not applicable	6%	
How long did the implementation take? (36)	< 1 month	14%	
	1-3 months	14%	
	4-6 months	42%	
	7-12 months	8%	
	> 12 months	22%	
How many people were involved in the implementation? (42)	1	14%	
	2-5	36%	
	6-10	33%	
	11-20	5%	
	20-50	5%	
	> 50	7%	
Has the implementation been...? (44)	Accomplished	11%	
	It is still running	80%	

Question	Answer	%	Comments
	Prematurely aborted	9%	
Did implementation of TPI® have consequences for software quality e.g. failures in production? (35)	Much better	3%	
	Better	63%	
	Same	31%	
	Lot worse	3%	
Did it have consequences for testing coverage? (35)	Much better	3%	
	Better	74%	
	Same	20%	
	Worse	3%	
Did it have consequences for testing control? (36)	Much better	25%	In most cases, people perceive that TPI® leads to better software quality, better coverage and better control!
	Better	56%	
	Same	19%	
Did it have consequences for test duration? (36)	Shorter	31%	When improving a test process, a choice is often made for better testing (higher coverage, better control). Although higher coverage could lead to a longer duration, better control tends to shorten test duration. On average, test duration is shortened.
	Same	53%	
	Longer	17%	
Did it have consequences for test costs? (36)	Cheaper	8%	On average, testing becomes a bit more expensive.
	Same	67%	
	More expensive	25%	
How well founded were these results? (37)	Measurable, facts	22%	In the software industry, measurement is still the exception. In only 1 out of 5 cases does measurement actually take place.
	Demonstrable, obvious to stakeholders	24%	
	Subjective, gut feeling	41%	
	Unknown, other	14%	
What did you measure? (several answers possible) (113)	Testing effort	20%	
	Testing duration	19%	
	Number of defects found during testing	23%	
	Ratio testing effort: total project effort	8%	
	Costs of failures not found by testing	6%	
	Time, milestones of improvement project	12%	
	Nothing!	6%	
	Other (please specify)...	4%	
What is your opinion on the return on the TPI® Investment? (36)	Very good	19%	This is a very good result! An investment in test process improvement is in most cases a (very) good investment.
	Good	69%	
	Neutral	8%	

Question	Answer	%	Comments
	Bad	3%	
What is the opinion of the (majority of) stakeholders on the return on the TPI® investment? (35)	Very good	3%	We have also asked how others viewed the TPI® efforts. Fortunately, they also have a good opinion of TPI®. There are no cases where stakeholders viewed it as a bad investment. (And yes, that was a possible answer ;-)
	Good	57%	
	Neutral	40%	
What were the two main factors that had a positive influence on the implementation? (80)	Clear scope and target	11%	Not surprisingly, clear "winners" are management commitment and involvement of people within the test process. To have a champion improver is not considered an important factor, but maybe the respondents are very modest :-)
	Management commitment	26%	
	Use of a change process	10%	
	Involvement of people within the test process	26%	
	Champions in change team	4%	
	Clear communication	11%	
	Results periodically visible	9%	
	Other (please specify)...	3%	
What were the two main factors that had a negative influence on the implementation? (62)	Unclear scope and target	13%	Unrealistic expectations are enemy number 1 of TPI®. To obtain management commitment, you have to tell what can be achieved. If you promise too much and then can't deliver, you have a problem...
	Lack of management commitment	11%	
	Lack of change process	6%	
	Top down approach ("Thou shalt...")	8%	
	Change team without influence	10%	
	Unclear communication	8%	
	Unrealistic expectations	26%	
	Results unknown for too long a time	13%	
	Other (please specify)...	5%	
The Model			
What is your opinion on the contribution of the model to the improvement process? (62)	Very positive	20%	As subscribers to the TPI®-site, the group of respondents is probably not completely unbiased. Still, we are very pleased and proud of this result.
	Positive	61%	
	Neutral	20%	
What do you think of the model's usability? (62)	Easy to use	48%	
	OK	44%	
	Hard to use	8%	

Question	Answer	%	Comments
What do you think of its level of detail? (63)	Too much detail	3%	
	OK	84%	
	Too little detail	13%	
What do you think of its communicability to testers? (60)	Easy to communicate	40%	
	OK	58%	
	Hard to communicate	2%	
What do you think of its communicability to non-testers? (60)	Easy to communicate	15%	In order to explain the model to non-testers, you have to explain 1) testing and 2) the model. As one respondent remarked: "still hard work - but I wouldn't know how to do it better"
	OK	50%	
	Hard to communicate	35%	
What do you use the model for? (61)	Setting standards	7%	Other uses mentioned are: - supporting decisions - preventing false efforts - hints and tips, prioritizing - discussions
	Improving test processes	69%	
	Finding quick wins	18%	
	Other (please specify)...	7%	

4.2 Initial and Required Test Process Maturity

Besides the questions above, we asked participants to share their assessment results by filling in the TPI®-matrix for the initial and required levels per key area. On average, 25 people filled in their initial situation, 22 people their required situation. We calculated the average level for each key area, as a percentage. The matrix is displayed below, with the initial (light grey) and required (dark grey) situation for each key area. What we can see is that the TPI®-model is quite a strict model, with the average of most initial levels less than the first level A.

	Key area / Scale	0	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Test strategy		A					B				C			D
2	Life-cycle model		A			B									
3	Moment of involvement			A				B				C			D
4	Estimating and planning				A							B			
5	Test specification techniques		A		B										
6	Static test techniques					A		B							
7	Metrics						A			B			C		D
8	Test automation					A			B			C			
9	Test environment				A				B						C
10	Office environment				A										
11	Commitment and motivation		A				B						C		
12	Test functions and training				A			B			C				
13	Scope of methodology					A						B			C
14	Communication			A		B							C		
15	Reporting		A			B			C					D	
16	Defect management		A				B			C					
17	Testware management			A			B				C				D
18	Test process management		A		B								C		
19	Evaluation							A			B				
20	Low-level testing					A		B		C					

People often ask us for one "test maturity" value. Although we have our doubts about the use of such an indicator for an individual situation, we can use it to compare certain cross-sections of responses.

To calculate this number, we don't consider the matrix scales as we did in the matrix above. Otherwise, an organization having achieved a high priority level (for instance Test strategy level A at scale 1) but not a low priority level (for instance Metrics, level A at scale 5) would count as more immature than an organization having achieved vice versa. Therefore, we use very simple arithmetic and calculate level A as 1, level B as 2 and so on, and then take the average.

This gives 0,62 as initial situation, so on average, 62% is initially at level A, while 38% is still at the undefined level. The average required situation gives 1,59, meaning that most required levels are about 1 level higher than the initial level.

4.3 Specific comparisons

Besides the general results, we have also made some specific comparisons. We were interested in comparisons between:

- small organizations versus large ones
- TPI® combined with SPI or not
- Separate functions for testers or not

In the tables the questions having the most distinct differences in answers are shown, followed by a short analysis.

1) Small versus large businesses

Do small businesses have more or less mature test processes compared to large businesses? Does TPI® in a small organization lead to better results or not? These were our questions when making this comparison.

Small businesses, <= 1000 people (60 respondents) Percentage	Large businesses, > 1000 people (50 respondents) Percentage	
IT businesses	42	24
Financial businesses	18	30
Separate test functions	68	80
Separate QA functions	37	64
Scope of TPI® <= 20 people	100	78
TPI® combined with SPI	20	35
Assessments > 2 weeks	17	48
Separate improvement project	40	64
Consequence: (much) better software quality	72	59
Consequence: (much) better coverage	79	75
Consequence: (much) better control	90	71
Consequence: less costs	11	6
Consequence: shorter duration	37	24
Consequences longer duration (!)	21	11
Measurable results	37	6
Hard to communicate to non-testers	27	46
Initial test maturity is slightly lower for small businesses (see above for explanation of this indicator and how it is calculated)	0,43	0,84

Analysis

TPI® for smaller businesses means improving with a smaller scope. Also, the test processes tend to be less formal. The results achieved are slightly better. This can be attributed to the smaller scope, making TPI® easier to control. Also the initial

situation is a bit less mature, possibly making it easier to find improvements. One thing that is hard to explain is the fact that smaller businesses have significantly more measurable results. This seems a bit of a contradiction with the lower maturity. Possible reasons are that the smaller scope makes improvements easier to measure and that smaller businesses are often IT businesses, having software development as their core business.

2) TPI® combined with SPI or not

TPI® in combination with SPI sounds large and complex. On the other hand, improving the test process within the broader frame of improving the software process can make a lot of things go easier. So what are the experiences of the respondents regarding the combination of TPI® with SPI?

TPI® + SPI (18 respondents)		TPI® - SPI (49 respondents)
	Percentage	Percentage
Industry businesses	22	6
Separate test functions	89	71
Separate QA functions	72	37
CMM-level 2-5	29	14
Scope of TPI®: > 1 project and > 1 test level	56	33
Implementation <= 6 months	100	57
Consequence: (much) better software quality	46	80
Consequence: (much) better coverage	58	86
Consequence: (much) better control	69	86
Consequence: less costs	15	5
Consequence: shorter duration	23	33
Measurable results	31	18
Model used for finding quick wins	6	24
Initial test maturity is clearly higher for TPI® in combination with SPI	1,23	0,55

Analysis

TPI® in combination with software process improvement is more popular in industrial organizations. The probable reason for this is the importance of (embedded) software and SPI in these organizations. More formal testing processes are used, and dedicated QA functions are commonly established. Because TPI® is combined with SPI, the scope is often broader. However, the duration of implementation is shorter, a possible reason being that implementation is better controlled. Organizations that combine TPI® with SPI initially have a more mature test process

than organizations that don't. Maybe surprisingly, the results are less positive, perhaps due to the broader scope and already more mature process. A broad scope drastically increases the complexity of implementing improvements. Furthermore improving a process that is already reasonable is not as easy as improving an immature process. As can be expected, measuring is more obvious for the combination of TPI® and SPI.

3) Separate functions for testers or not

Our guess was that an organization recognizing the importance of dedicated testing functions is of higher test maturity. Is improving in these organizations easier and does it lead to better results, because a foundation is already laid?

	Dedicated testing functions (83 respondents) Percentage	No dedicated testing functions (28 respondents) Percentage
US + UK	100	0
Netherlands	25	54
Size of business < 1000	51	68
CMM-level 2-5 (about same)	18	24
Scope of TPI® < 10 people	55	79
Scope of TPI®: 1 project and 1 test level	17	53
TPI® combined with SPI	30	12
Assessor from outside company	18	50
Initial test maturity is higher for organizations with separate testing functions.	0,72	0,42

Analysis

Without dedicated testing functions, the assessor is often from an outside company. The maturity of test processes for organizations with dedicated testing functions is higher and the scope of TPI® is broader. Otherwise, there aren't as many differences as one should expect. For instance, you would think that organizations with a CMM level would more often have dedicated testing functions; the difference is however negligible. Another remarkable fact is that all respondents from the US and UK report to have separate testing functions.

Other comparisons, for instance between the kinds of businesses (Industry, Telecom, Financial, IT) were not performed, as there were too few responses to make the analysis reliable.

4.4 Ideas for improving the model

We also asked what ideas people had for improving the model. A lot of ideas were given. Below you can find some of them:

1. give more examples and explanations;
2. arrange for TPI® assessors to compare experiences;
3. combine key area Static test techniques with Evaluation;
4. make the connection to other process improvement initiatives/models clearer;
5. include application management services;
6. support with tools.

These ideas will be sent to the TPI® Change Control Board for further evaluation.

5 Conclusion

We are very pleased with the outcome of the survey. Not only did a large number of people participate, but also the results are very positive. The majority of responses indicate that improving the test process leads to better testing, and that this can be achieved in the same time with minimal extra costs. This is a first rate reference for test process improvement. This is further supported by close to 90% of the respondents that view the return on the TPI® investment as (very) positive. Of course we are very happy with the opinions on the contribution of the TPI®-model to the improvement process, 80% being (very) positive.

If you are curious how your test process is doing in comparison with other companies, you need to assess your test process (or have it assessed for you) using the TPI®-model. By filling in the TPI®-matrix you can see for yourself. However, please be aware that respondents are from all kinds of countries and organizations, testing all kinds of software. To note the differences is one thing, to analyse them is another. Good luck!

Tim Koomen,
R&D Manager TPI®
Software Control
Sogeti Nederland B.V.

6 Books and website

- Koomen, T., Pol, M. (1999), *Test Process Improvement, a practical step-by-step guide to structured testing*, Addison-Wesley, ISBN 0 201 59624 5
- Koomen, T., Pol, M. (1998), *Test Process Improvement®*, *Leidraad voor stapsgewijs beter testen*, ten Hagen & Stam, ISBN 90-440-0091-8
- Pol, M., Koomen, T. und Spillner, A. (2000), *Management und Optimierung des Testprozesses: ein praktischer Leitfaden für erfolgreiches Testen von Software, mit TPI® und TMap®*, dpunkt.verlag, ISBN 3-932588-65-7.

Internet: at "www.Sogeti.nl/TPI®" several TPI®-products can be viewed and downloaded, changes to the model are published and questions can be asked.

For questions or remarks: please e-mail tpi@sogeti.nl.

Appendix A, The TPI®-model

The model considers the different aspects of the test process, for example the use of test tools, test specification techniques or reporting. By judging the several aspects the strengths and weaknesses of the test process become clear. These aspects are called the **Key Areas**. The TPI® model has 20 key areas. In order to enable insight in the state of the key areas, the model offers **Levels** (from A to B to C etc.). The levels increase in terms of time (faster), money (cheaper) and/or quality (better). For example, for the key area Reporting the levels are:

- a) defects found are reported,
- b) there is also reporting on the progress of the test process and
- c) risks for the system are described and recommendations are given.

Generally, there are three levels for each key area.

All levels and key areas are related to each other in a **Test Maturity Matrix**. This has been done as a good way to express the internal priorities and dependencies between levels and key areas. In the matrix each level is related to a certain scale of test maturity. This results in 13 scales of test maturity.

Scale	0	1	2	3	4	...	13
Key Area							
Testing strategy		A					
Test specification techniques		A		B			
Reporting		A			B		
etc.							

The key areas, levels and matrix are used to identify the strong and weak spots of the current test process and also to help define actions for improvement. By filling in the matrix the improvement proposals can be judged more easily. The matrix works from left to right, so low mature key areas are to be improved first.

The requirements for each level are defined in the form of **Checkpoints**: questions that need to be answered positively in order to qualify for that level. These checkpoints support the classification in levels to be performed in an objective way.

Improvement actions can be defined in terms of desired higher levels. In order to achieve a higher level, the checkpoints render much assistance. Apart from these, the model has other means of support for test process improvement: **Improvement Suggestions**, a list of hints and ideas that helps to achieve the

desired level. Whereas the use of checkpoints is obligatory, the use of improvement suggestions is not.