



Organizational Culture is Important in Software Productivity

Bruce Taylor

Introduction

If you wanted to dramatically improve the productivity of a software development team, what would you do? Well, you might start by providing training to improve their skills; then you might improve the tools they work with; and finally you might improve their software process. Is that all? Can you do anything else to make them more productive?

I've been convinced for a long time that there is more you can do beyond the obvious technical improvements: you can improve the culture in which the team works. But it's very difficult to show that this "warm and fuzzy" improvement can have an effect on measured productivity, and this difficulty leads managers to ignore cultural improvements because they think it's impossible to demonstrate a return on investment.

Actually, nothing could be further from the truth. Changing the culture of a working organization is not only possible – it's fairly straightforward. The difficult part is to decide what kind of culture you want to create, and how that culture will effect your productivity and profitability. This paper came out of my conviction that a respectful, open, supportive working environment dramatically improves programmers' productivity and can dramatically improve the quantity and quality of the software the produce.

The Study

I decided to investigate a simplified version of the question: "Does the culture of the team members, the team manager, and the company affect the productivity of individuals and the team?" Specifically, I made the following hypothesis: "Personal and team productivity are affected most by the culture of the team, somewhat by the attitudes of the team's manager, and weakly by the culture of the company."

For the study, I operationalized "productivity" as three components:

1. efficiency: how much software is produced per unit time
2. quality: how many errors does the product contain?
3. schedule: how faithfully was the schedule followed?

And I operationalized "culture" as:

1. respect: are people treated with respect?
2. honesty: is information shared accurately and freely?
3. support: do people support each other when needed?

I decided to measure productivity at the personal, team, and corporate level, and to measure culture in the team, for the team's manager, and for the company.

The Survey

I created an on-line survey with three sections. The first section collected demographic information about the respondent:

1. experience in software development
2. size of their team
3. size of their company
4. kind of employment (full time, part time, consultant)
5. level in organization (individual contributor, team leader, manager, executive)
6. roles in the development process.
7. country (from GeoIP analysis of responder's IP address)

The second section investigated productivity by asking the following questions for self, team, and company. All questions were answered using a five-point Likert scale ranging from "Strongly Agree" (5) to "Strongly Disagree" (1)

1. "(I/my team/my company) work(s) very efficiently."
2. "(I/my team/my company) produces a very high quality product."
3. "(I/my team/my company) rarely miss schedule deadlines."

The final section asked about culture of the team, the manager, and the company, using the same Likert agreement scale.

1. "My (team/manager/company) always treats me with respect."
2. "My (team/manager/company) always supports me when I need help."
3. "My (team/manager/company) is always honest with me."

A word of caution is in order here. Because important terms like "efficiently" and "respect" were not explicitly defined in the

How long have you been working in software development?	
1-10 years	46%
11-20 years	26%
21-30 years	18%
31 years or more	9%
How many total employees does your company have?	
1-20 employees	22%
21-100 employees	23%
101-500 employees	18%
501-1000 employees	7%
1001 or more employees	30%
How many total people are in your immediate project?	
1-5 people	50%
6-10 people	27%
11-15 people	10%
15-20 people	1%
21 or more	12%
What is your level in the organization?	
Individual Contributor	66%
Team Leader	19%
First Level Manager	4%
Middle Manager	1%
Director	3%
Vice President	1%
Executive	6%
Table 1: Sample Demographics	

survey, there may be a difference of interpretation among the respondents. However, the consistent sentence structure and the use of intensifiers like "always" and "very" minimizes this variation.

The Sample

I solicited participants in the Usenet groups dedicated to active software developers: comp.lang.*. 155 people responded to the survey, but only 116 surveys were completed. This sample carries the usual biases of self-selected samples: these are representative of programmers who are willing to answer surveys and have access to the Usenet groups. Table 1 summarizes the demographics of the sample.

Table 2 shows the geographic analysis of respondents, as determined from the IP address of their response. Because the responses are predominantly from North America and Europe, the results of this study are valid only within this sample, and should not be used to predict results in, for example, the Japanese or Chinese programming community.

COUNTRY	Total	COUNTRY	Total
UNITED STATES	50	AUSTRIA	1
UNITED KINGDOM	17	CROATIA	1
GERMANY	9	CYPRUS	1
AUSTRALIA	4	DENMARK	1
CANADA	4	FINLAND	1
FRANCE	3	GREECE	1
ARGENTINA	2	ICELAND	1
BELGIUM	2	ISRAEL	1
INDIA	2	NETHERLANDS	1
NEW ZEALAND	2	PHILIPPINES	1
NORWAY	2	PORTUGAL	1
SLOVENIA	2	ROMANIA	1
SWEDEN	2	RUSSIAN	1
UNKNOWN	1	FEDERATION	1
		SPAIN	1

Table 2: Sample Geographic Distribution

Correlations

A correlation matrix of the productivity measures showed a high correlation among all three measures of productivity for self, team, and company, so I created three composite variables (SELFPROD, TEAMPROD, COMPPROD) by adding the quantities. Similarly, the components of culture (respect, support, honesty) were so highly correlated that I combined them into three composite variables (TEAMCULT, MNGRCULT, COMPCULT). Table 3 shows the correlations among the variables:

	SELF PROD	PROJ PROD	COMP PROD	PROJ CULT	MNGR CULT	COMP CULT
SELF PROD	1.00					
PROJ PROD	0.56	1.00				
COMP PROD	0.33	0.52	1.00			
PROJ CULT	0.33	0.55	0.38	1.00		
MNGR CULT	0.28	0.47	0.52	0.59	1.00	
COMP CULT	0.23	0.47	0.68	0.45	0.65	1.00

Table 3: Corellation Matrix
(all correlations significant at $p=.05$)

The shaded cells of Table 3 show the correlations between personal, team, and company productivity and respective cultures of the team, manager, and company. The correlations show moderate support for the hypothesis that personal, team, and corporate productivity is related to the cultures created by the project, the manager, and the company.

Regression Analysis

To analyze the dependencies further, I regressed individual and team productivity against corporate culture and a variety of other variables. Table 4 shows the regression analysis for individual productivity

(PERSPROD, adjusted $R^2=0.11$) and team productivity (TEAMPROD, adjusted $R^2=.39$).

Personal Productivity (PERSPROD)		Team Productivity (TEAMPROD)	
<i>Factors Coefficients</i>		<i>Factors Coefficients</i>	
PROJCULT	0.17	PROJCULT	0.40
MNGRCULT	0.06	MNGRCULT	0.05
COMPCULT	0.02	COMPCULT	0.18
EXPERIENCE	0.37	EXPERIENCE	0.19
COMPSIZE	-0.09	COMPSIZE	0.08
TEAMSIZE	0.14	TEAMSIZE	-0.48

Table 4: Regression Analysis of Productivity

The most striking features of the PERSPROD regression analysis are that only 11% of personal productivity is explained by the variables listed, and the strongest component of that variance is explained by the EXPERIENCE variable. In short, cultural issues have very little to do with personal productivity, compared to the programmer's years of experience.

But the story for team productivity (TEAMPROD) is quite different. Notice that 39% of the team productivity is explained by the variables in the analysis, and that two of the variables, PROJCULT and TEAMSIZE dominate the variance. Team productivity is moderately sensitive to other variables, but almost all the variance comes from project culture and from team size. Team productivity increases dramatically with a positive project culture, and with a small team size.

Conclusion

I started this study to show that "soft factors" of culture are an important component of productivity, and that investing in cultural traits is good not only for the employees, but

also for the company. And incidently, the study does show that soft qualities like culture can be quantified, measured and related to business outcomes like any other measure of productivity.

I was surprised to find that individuals' productivity doesn't depend very much on cultural issues, but I confirmed that team productivity is strongly influenced by the cultural attributes of respect, support, and honesty among the team members. So if you want to improve the productivity of an individual programmer, you would concentrate on training, tools and other technical factors. But to improve the productivity of a team, the most important thing you can do is to reduce the team size, and to create a team culture of respect, support, and honesty.

About Bruce Taylor



Bruce Taylor is the principal of ManagingProgrammers.com, an executive coaching firm located near Boston, Massachusetts. Bruce helps software organizations of all sizes to create low-stress, supportive, adaptable working environments, so that the engineers, leaders, and managers can work as effectively as possible. He provides executive coaching for senior managers who are creating superior organizations, management coaching for technical leaders who are adapting to new agile practices, and individual coaching for engineers who are upgrading their skills. Bruce has a Masters in Computer Science from Duke University, a Masters in Community Psychology, and a Certificate in Job Stress and Healthy Workplace Design, both from the University of Massachusetts.