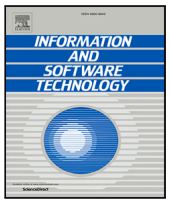
Information and Software Technology 197 (2026) 108196

Contents lists available at ScienceDirect

Information and Software Technology

journal homepage: www.elsevier.com/locate/infsof



Both personality and social identity predict perceived software team productivity: A survey study

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ARTICLE INFO

Dataset link: https://zenodo.org/records/20034765

Keywords:
Software team productivity
Personality
Social identity
Big five
Collective self-esteem
Regression

ABSTRACT

Context: Prior work has studied how personality or social identity separately relate to software team productivity, but no study has compared them as predictors within the same model.
Objective: We investigate which factors from personality (Big Five) and social identity (Collective Self-Esteem) best predict perceived team productivity in software development, and whether both constructs contribute.
Method: We surveyed 71 software professionals, measuring Big Five personality traits (Mini-IPIP), Collective Self-Esteem (Luhtanen and Crocker scale), and self-assessed team productivity. We used multiple linear regression with backward elimination.
Results: Predictors from both constructs survived backward elimination. Agreeableness was the strongest predictor of perceived team productivity, followed by Public Collective Self-Esteem and Membership Esteem, with Neuroticism predicting productivity negatively. Intellect/Openness sat near the inclusion threshold and should be read as tentative given the lenient alpha. The retained model explains roughly a third of the variance in perceived team productivity.
Conclusion: Personality and social identity are complementary predictors of software team productivity. The three strongest predictors come from both constructs, suggesting practitioners should attend to both individual traits and group identification when composing and managing teams.

1. Introduction

Team productivity is a central concern in software engineering, where collaborative work is the norm [1,2]. As Trendowicz and Münch [3] argue, investing in people yields more benefit than investing in tools alone. Two psychological constructs have independently been linked to team productivity: *personality* and *social identity*.

Personality, commonly operationalized through the Big Five model [4], has been shown to relate to team effectiveness in general [5] and to software team structures specifically [6]. *Social identity* — the extent to which individuals define themselves through group membership [7] — has been linked to group productivity [8] and to software developer behavior [9].

However, these constructs have been studied in isolation. Prior work examines either personality *or* social identity, but no study has placed them in the same predictive model to determine their relative and joint contribution to software team productivity. This is a significant gap because, in practice, both individual traits and group dynamics operate simultaneously. If both contribute independently, then focusing on only one construct provides an incomplete picture for practitioners.

We address this gap by surveying software professionals and building a regression model that includes both Big Five personality traits and Collective Self-Esteem (CSE) dimensions as predictors of perceived team productivity. Our research question is:

RQ: To what extent do personality traits and social identity factors jointly predict perceived team productivity in software development?

2. Background

The Big Five personality model comprises Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Intellect/Openness [4]. Barrick et al. [5] found Agreeableness and Conscientiousness particularly relevant for team performance. In software engineering, Yilmaz et al. [6] found that teams with high Agreeableness, Extraversion, and Emotional Stability were more productive.

Social Identity Theory [7] posits that people derive part of their self-concept from group memberships. Luhtanen and Crocker [10] developed the Collective Self-Esteem (CSE) scale, measuring four dimensions: Membership Esteem (self-evaluation as a group member), Private

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https://doi.org/10.1016/j.infsof.2026.108196
Received 18 March 2026; Received in revised form 5 May 2026; Accepted 12 May 2026
Available online 13 May 2026
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CSE (personal evaluation of one's group), Public CSE (perception of how others evaluate the group), and Importance to Identity (how central group membership is to self-concept). Worchel et al. [8] showed that stronger group identification predicted higher productivity. In software engineering, Bäckevik et al. [9] found that social identity aspects affect developer behavior.

3. Method

3.1. Participants and procedure

We distributed an online survey through five open-source software (OSS) project developer mailing lists: Apache OpenOffice, Mozilla (web, general, and extension development), Eclipse, Python-dev, and VirtualBox. This is a convenience sample of active OSS contributors; we did not apply a probabilistic sampling frame. Findings therefore apply most directly to distributed OSS development and may not transfer cleanly to in-house corporate teams. We did not record country of residence.

We received 71 complete responses: software developers (50.7%), project managers (22.6%), team/tech leads (14.0%), and UX/UI designers (12.7%). The skew toward developer roles follows from the sampling frame.

3.2. Measures

Personality was measured using the Mini-IPIP [11], a 20-item scale (four items per Big Five trait) rated on a 5-point Likert scale.

Social identity was measured using the Collective Self-Esteem scale [10], with 16 items (four per CSE dimension) rated on a 5-point Likert scale.

Team productivity was operationalized as the mean of three self-assessed items: "The team delivers software on time", "The team delivers software with high quality", and "We are an effective team" (5-point Likert scale). Self-assessed productivity, while imperfect, is an established component of developer productivity measurement [1].

Psychometric properties. Donnellan et al. [11] report Cronbach's α between .68 and .86 for the Mini-IPIP traits and correlations above .90 with longer Big Five instruments. Luhtanen and Crocker [10] report CSE subscale reliabilities between .73 and .83 with factor-analytic support for the four-factor structure. Due to our small sample in this current study and diverse set of items, we do not provide sample-specific reliabilities.

3.3. Analysis

We used multiple linear regression with all nine predictors (five personality traits, four CSE dimensions) entered simultaneously, followed by backward elimination at $\alpha = .10$. We use the more lenient threshold rather than the conventional $\alpha = .05$ because this is an exploratory short-communication study with a small sample ($n = 71$); a stricter cut-off risks discarding theoretically meaningful but borderline effects. Predictors near the threshold should be read as tentative. We verified assumptions of no multicollinearity (VIF), no autocorrelation (Durbin-Watson), homoscedasticity (residual plots), and normality (Q–Q plots). We report standardized coefficients (β) for cross-construct comparison, as these are scale-independent.

4. Results

The initial model with all nine predictors was significant ($F(9, 61) = 4.51$, $p < .001$, adjusted $R^2 = .311$). Four predictors had $p > .10$ and were removed by backward elimination: Importance to Identity, Private CSE, Extraversion, and Conscientiousness. The final model retains five predictors at $\alpha = .10$ (Table 1).

All VIF values were close to 1 (max 1.10), indicating no multicollinearity. The Durbin-Watson statistic was 2.04, indicating no autocorrelation. Residual plots confirmed homoscedasticity, and Q–Q plots confirmed approximate normality.

Critically, the five significant predictors come from *both* constructs: three from personality and two from social identity. Ranked by standardized coefficient magnitude, they alternate between constructs: Agreeableness (personality, $\beta = .319$), Public CSE (social identity, $\beta = .290$), Membership Esteem (social identity, $\beta = .277$), Neuroticism (personality, $\beta = -.223$), and Intellect (personality, $\beta = .183$). The two social identity predictors rank second and third.

5. Discussion

The central finding is that personality and social identity are *complementary* predictors of perceived software team productivity. Neither construct alone captures the complete picture. When both are included, the model explains roughly a third of the variance in perceived productivity—a meaningful amount given the complexity of team productivity as a construct [1].

Theoretical contribution. Placing Big Five traits and CSE dimensions in the same model shows that the two literatures — individual-differences research on personality and group-level research on social identity — account for partially non-overlapping variance in the same outcome. Team productivity is jointly shaped by who team members are *and* by how they locate themselves in the team. Studies restricted to one construct are under-specified and likely mis-attribute variance that belongs to the other.

Agreeableness emerged as the single strongest predictor ($\beta = .319$). This aligns with Barrick et al. [5], who found Agreeableness most predictive in collaborative work settings. In software teams, agreeable individuals likely foster positive interactions that improve coordination and reduce friction—both critical in iterative, collaborative development [12].

Public CSE and Membership Esteem — two social identity factors — were the second and third strongest predictors. Public CSE captures how individuals perceive outsiders' evaluation of their team; Membership Esteem captures individuals' self-evaluation as group members. Both reflect identification with and valuation of one's team, extending Worchel et al.'s [8] general findings to the software engineering context. This suggests that fostering team identity — through shared goals, team branding, or stable team composition — could be as important as selecting for personality traits.

Neuroticism showed a negative relationship with productivity, consistent with the general literature [13]. **Intellect/Openness** was near the threshold ($p = .070$), suggesting a tendency for open-minded team members to perceive higher productivity; given the lenient α, we read this as tentative.

5.1. Implications for practice

Our results suggest that managers should consider both personality composition and team identity when forming and managing software teams. Selecting for Agreeableness may be beneficial, but equally, investing in team cohesion and a positive team image (Public CSE) could improve perceived productivity. These are actionable through team-building activities, stable team membership, and organizational recognition of teams.

5.2. Threats to validity

Internal validity: All variables were collected via self-report on the same instrument, so common method bias may inflate the observed relationships. Productivity was self-assessed, which is an established but

Table 1
Final regression model (backward elimination). Dependent variable: team productivity.

Construct	Predictor	B	SE	β	t	p
	(Intercept)	1.317	0.600		2.19	0.032
Personality	Agreeableness	0.354	0.112	0.319	3.17	0.002
Social identity	Public CSE	0.152	0.052	0.290	2.91	0.005
Social identity	Membership Esteem	0.155	0.057	0.277	2.70	0.009
Personality	Neuroticism	−0.154	0.071	−0.223	−2.18	0.033
Personality	Intellect/Openness	0.145	0.079	0.183	1.85	0.070

Adjusted $R^2 = 0.329$; $F(5, 65) = 7.86$, $p < 0.001$; max VIF = 1.10; Durbin-Watson = 2.04.

imperfect measure [1]. Social desirability may affect both personality and CSE responses.

Construct validity: Team productivity was measured at the individual level as each respondent's perception of their own team. This is not a team-level measure. Within-team perceptions can diverge, and aggregation to the team requires multiple respondents per team and a test of within-team agreement (e.g., ICC, r_{wg}), neither of which our design supports. Our results therefore predict *individual perceptions* of team productivity, not team-level productivity. The Mini-IPIP is also brief; a longer instrument might explain more variance.

External validity: Recruitment through OSS mailing lists yields a convenience sample biased toward active open-source contributors and distributed development. Findings may not extend to in-house corporate teams. The sample of 71 is sufficient for the final model but limits generalizability, and the role distribution skews toward developers. Respondents were not known to share teams, which rules out team-level aggregation or multilevel modeling.

6. Conclusion

We compared personality (Big Five) and social identity (Collective Self-Esteem) as predictors of perceived software team productivity in a single regression model. Both constructs contributed significant predictors, with factors from each interleaved among the top-ranked predictors by effect size. This suggests that personality and social identity are complementary lenses for understanding team productivity, and that neither should be studied in isolation. Future work should replicate with larger samples, objective productivity measures, and team-level data.

CRediT authorship contribution statement

Karim Abdeldayem: Writing – original draft, Project administration, Methodology, Investigation, Data curation. **Karam Khatib:** Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation. **Lucas Gren:** Writing – review & editing, Supervision, Formal analysis, Data curation, Conceptualization.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the author(s) used Claude Code with Opus 4.7 in order to improve and proofread the text and write LaTex code. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This work was supported by the Swedish Transport Administration (Trafikverket), grant/project number TRV 2025/26918.

Data availability

The survey average data are available here https://zenodo.org/records/20034765.

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