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## When Funding Matters: Research Grants and PhD publication Productivity in Emerging Research Systems

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**ABSTRACT** In emerging research systems, doctoral publication requirements often outpace the support available to early-career researchers. This study examines whether funded project participation is associated with publication productivity among doctoral students and doctoral graduates in Kazakhstan, and whether particular support forms are more closely linked to international and domestic outputs. The analysis uses an anonymous 2025 survey of 808 respondents from six scientific fields and estimates negative binomial models for Scopus/Web of Science and domestic recommended-journal publication counts. Respondents with any project support reported higher raw mean Scopus/WoS output than unsupported respondents (2.05 vs. 1.11 publications). In adjusted models, any project support was associated with 58% higher expected Scopus/WoS publication counts (IRR = 1.58, 95% CI [1.35, 1.86],  $p < .001$ ), while the association with domestic publications was marginal (IRR = 1.13,  $p = .057$ ). Salary support and equipment/software support were significant predictors of Scopus/WoS output; field variation was descriptive rather than statistically significant. The findings suggest that project participation matters most when it supplies time, financial stability, and research infrastructure, not merely formal inclusion in funded grants.

**Keywords:** doctoral education, grant support, publication productivity, research capacity, higher education policy

### INTRODUCTION

Doctoral education is increasingly evaluated not only by degree completion but also by the capacity of doctoral students and recent graduates to contribute to visible research outputs. In many research systems, publication productivity has become a key indicator of doctoral training (Höhmänn, 2023), academic career readiness (Clement et al., 2020), and institutional research performance (Jackson, 2013). Yet doctoral students do not enter publication processes under equal conditions. Their ability to produce publishable research depends partly on access to time, supervision, infrastructure, research networks, and financial support. For this reason, funding is not merely a background condition of doctoral study; it may shape the material and organizational circumstances under which doctoral researchers participate in academic knowledge production. A growing body of

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research has examined the relationship between funding and doctoral or early-career research outcomes. Studies have generally shown that funded doctoral students and early-career researchers often report stronger research outcomes than unfunded peers, although the size and form of this relationship vary. [Horta et al. \(2018\)](#), for example, found that PhD funding was positively associated with publication productivity and citation visibility among doctorate holders in Portugal. Similarly, [Smirnov \(2025\)](#) reported that doctoral students who received grant support in Russia were more likely to defend their dissertations and demonstrated higher publication activity during doctoral study. These findings suggest that funding can create conditions that support research productivity, especially when it reduces financial uncertainty and enables closer engagement with research activity.

However, the relationship between funding and publication productivity is not straightforward. [Bol et al. \(2018\)](#) found that early-career grant winners gained subsequent advantages in grant acquisition and academic career progression, but did not show a clear publication or citation advantage at the funding threshold. Funding arrangements differ in both what they require and what they enable, with PhD grants and project-based research grants associated with different doctoral and career research outcomes ([Horta et al., 2018](#)), external fellowship funding linked to autonomy, flexibility, conference participation, research identity, and possible trade-offs in apprenticeship-based mentoring ([Graddy-Reed et al., 2018, 2021](#)), and publication-linked reward schemes creating both incentives and performance pressures for doctoral students ([Lei, 2019](#)). Doctoral fellowships, research assistantships, teaching assistantships, institutional scholarships, public or private funding, and research project grants may all provide financial support, but they differ in their implications for time use, skill development, advisor interaction, research autonomy, and publication opportunities ([Borrego et al., 2019](#); [Denton et al., 2025](#); [Grote et al., 2021](#); [Muscio & Shibayama, 2023](#)). Research assistantships, for instance, may strengthen research-related skills and project involvement, whereas teaching assistantships may provide financial security while reducing time available for research ([Borrego et al., 2019](#); [Grote et al., 2021](#)). Fellowship funding may also shape doctoral students' agency by increasing flexibility, access, and external validation ([Denton et al., 2025](#)).

The issue is especially relevant in Kazakhstan, where doctoral education is embedded in a developing research system with strong expectations for publication in internationally indexed outlets. Prior work suggests that publication requirements can increase output indicators while raising concerns about research quality, pressure, and uneven support conditions ([Kuzhabekova, 2025](#)). Doctoral candidates and recent PhD graduates in Kazakhstan may also face linguistic, methodological, financial, organizational, and psychological barriers to publishing in Scopus- or Web of Science-indexed journals ([Zeinollakizi, 2026](#)). In this context, participation in funded research projects may be an important source of research capacity. Yet it remains unclear whether project participation itself is associated with higher publication productivity, which forms of project support matter most, and whether these associations differ across scientific fields.

Existing literature points to two related gaps. First, doctoral funding studies often compare broad categories such as funded versus non-funded students, PhD grants versus project-based research grants, or fellowship recipients versus non-recipients, while giving less attention to the specific forms of support embedded in research projects, such as mentoring, research infrastructure, writing support, collaboration opportunities, and time allocation ([Graddy-Reed et al., 2018, 2021](#); [Horta et al., 2018](#)). This matters because prior studies indicate that different funding arrangements are associated with different doctoral and career outcomes, yet they also call for more research into the mechanisms through which funding affects productivity, including workload, mentoring, project dynamics, and access to research resources ([Horta et al., 2018](#); [Munkácsy et al., 2022](#)). Second, although studies in doctoral publication contexts show that students may face strong international publication requirements while lacking sufficient journal access, data sources, laboratory facilities, publication workshops, or field-specific writing support, less is known about how project-level

research support shapes publication productivity among doctoral students and recent graduates in emerging research systems (Horta & Santos, 2016; Shamsi & Osam, 2022).

This study examines the association between funded research project support and publication productivity among doctoral students and doctoral graduates in Kazakhstan. It addresses three research questions:

**RQ1.** Is participation in a funded research project associated with higher research productivity?

**RQ2.** Which forms of support from research grants are associated with higher research productivity?

**RQ3.** Do associations between grant-support forms and publication productivity differ across scientific fields?

The remainder of the article is organized as follows. The next section reviews literature on doctoral funding, project-based research support, and publication productivity, with particular attention to how different funding arrangements may create different research opportunities. The Methods section describes the survey data, variable construction, and negative binomial regression strategy. The Results section presents descriptive patterns, regression estimates for any project support, models for specific support forms, and field-level interaction results. The Discussion interprets the findings in relation to prior research on doctoral funding and research capacity, and the final section outlines policy implications for grant design, doctoral education, and research support in emerging research systems.

## LITERATURE REVIEW

Existing research on research grants and doctoral productivity treat funding as a condition that can shape doctoral students' and early-career researchers' time, research opportunities, access to infrastructure, relationship with supervisors, career development, and eventual publication outcomes. Although studies differ in how they define research performance, common indicators include publication output, citation visibility, dissertation completion, research impact, later grant success, and career progression (Bol et al., 2018; Churchill et al., 2021; Horta et al., 2018; Horta & Santos, 2016; Kamler, 2008; Shamsi & Osam, 2022; Smirnov, 2025).

Funded doctoral students and early-career researchers often demonstrate stronger research outcomes than their unfunded peers. Horta et al. (2016), using data on Portuguese doctorate holders, found that PhD funding was positively associated with research productivity and visibility both during doctoral study and later in the career. Their study measured productivity through annual publication output and visibility through citations, showing that funded researchers outperformed self-funded researchers across several indicators. An examination of the RFBR grant programme for doctoral students in Russia revealed that grant recipients were more likely to defend their dissertations and exhibited higher publication activity during their doctoral studies (Smirnov, 2025). At the same time, prior research suggests that the relationship between funding and publication productivity should not be assumed to be automatic. Bol et al. (2018), for example, found that early-career grant winners gained later advantages in securing additional grants and obtaining senior academic positions, but did not show a clear increase in publications, citations, or H-index at the funding threshold.

A further complication is that funding takes different forms. Prior studies distinguish among PhD grants, research project grants, research assistantships, teaching assistantships, fellowships, public scholarships, private scholarships, federal support, and institutional research income. These mechanisms are not interchangeable. Horta et al. (2016) found that PhD grants and research project grants were associated with different outcomes, with research project grants showing weaker associations with visibility and later career performance than PhD grants. The authors suggest that

project-based funding may involve pressures, uncertainty, administrative tasks, or fragmented research agendas that differ from the conditions created by individual doctoral grants. Evidence shows that acquiring and managing project-based funding frequently exposes researchers to substantial administrative workloads, high compliance costs, and personal stress that significantly detract from the time available for core scientific inquiry (Herbert et al., 2014; Woelert, 2023).

Research on doctoral funding mechanisms similarly shows that different forms of support create different opportunities for skill development and research engagement. For STEM doctoral students, the perceived development of research, teamwork, project management, mentoring, and communication skills has been shown to vary depending on their primary funding type (Grote et al., 2021). Research assistantships were generally more strongly associated with research-related skill development than fellowships or teaching assistantships, while teaching assistantships were more strongly associated with peer training and mentoring (Grote et al., 2021). Borrego et al. (2019) likewise found that doctoral students viewed research assistantships and fellowships as more supportive of research progress than teaching assistantships, which provided financial security but often reduced time for research. These findings suggest that the productivity effects of funding depend not only on whether support exists, but also on what the support requires students to do. While stable funding can provide doctoral students with peace of mind, reduce financial uncertainty, and allow greater focus on academic work (Borrego et al., 2019), scarcity or instability in funding can sharply constrain agency, especially when students face funding gaps or are required to take on work that slows research progress. Denton et al. (2025) similarly found that fellowship funding shaped engineering doctoral students' agency through flexibility, access, and validation. Fellowships sometimes allowed students to choose advisors, pursue independent projects, access networks, and gain confidence through external recognition.

Some studies challenge the assumption that more funding or more research input is always better. Theoharakis and Batsakis (2026), examining UK business schools, found inverted U-shaped relationships between research environment inputs and output or impact quality. Moderate increases in research income and doctoral degrees awarded per faculty member were associated with stronger outcomes, but beyond certain thresholds, additional inputs appeared to create coordination, supervision, and administrative inefficiencies. While knowledge diversity in funded social science proposals does not significantly increase publication counts, citations, or journal quality, greater intellectual proximity between researchers' prior work and funded proposals is associated with stronger academic impact (Ding & Moreira, 2026). These findings point to an important limitation in linear accounts of research support: resources, interdisciplinarity, and project complexity may be beneficial only under conditions that allow researchers to use them effectively.

Funding structures, research practices, and publication expectations may vary across disciplines. Chang et al. (2019) found substantial disciplinary differences in federal funding exposure among doctoral recipients, with higher levels of federal support in physical sciences, agriculture/biology, and computer/mathematical sciences, and much lower levels in social sciences and humanities. Smirnov (2025) also found field differences in publication activity among doctoral students, with natural, medical, and technical sciences showing higher odds of belonging to higher publication categories than humanities. Academic outcomes and research production functions are highly context-dependent, varying significantly across social science divisions, broader disciplines, and institutional settings (Ding & Moreira, 2026; Theoharakis & Batsakis, 2026).

There are several limitations in the existing literature on impact of funding on research productivity of PhD students. Much prior research examines broad funding categories, such as funded versus unfunded status (Horta & Santos, 2016; Smirnov, 2025), public versus private scholarships (Muscio & Shibayama, 2023), PhD grants versus research project grants (Horta & Santos, 2016), or assistantship versus fellowship mechanisms (Borrego et al., 2019; Denton et al., 2025; Grote et al., 2021). However, there is lack of research on how specific forms of support

embedded within grants affect research productivity. Project support may include salary, equipment, supplies, services, and conference funding, each of which may influence publication productivity through different pathways.

Existing studies often focus on doctoral funding, fellowships, or institutional research income rather than project-level participation among doctoral students and graduates. [Horta et al. \(2018\)](#) identify important differences between PhD grants and research project grants, but also note that the mechanisms behind these differences require further investigation. [Smirnov \(2025\)](#) similarly calls for future research on how different forms of financial support affect doctoral outcomes. [Grote et al. \(2021\)](#) and [Denton et al. \(2025\)](#) also suggest that future studies should collect more detailed information on funding circumstances and compare different funding mechanisms more directly. These calls point toward the need for research that disaggregates grant support and examines how specific forms of support relate to productivity.

## METHODS

### *Data collection and sample*

This study uses survey data collected by the National Academy of Sciences of the Republic of Kazakhstan from doctoral students and doctoral graduates in Kazakhstan. Respondents were recruited through both institutional and direct channels. First, the survey link and invitation letters were sent to higher education institutions, postgraduate education institutions, and research organizations, which were asked to distribute the survey among eligible respondents. Second, invitations were sent directly to doctoral students and doctoral graduates using email addresses identified from academic journal publications or provided by research organizations. The authors received formal authorization to use the dataset and were granted full access for research purposes.

The survey was administered online through SurveyMonkey between July 20 and August 11, 2025. The survey was anonymous. No direct personal identifiers were collected, and demographic information was used only for classification and aggregate analysis.

The original dataset contained 846 survey responses. Before analysis, the data were screened for inconsistent support responses, unclear project-support status, and extreme publication values. Respondents were excluded if they selected both “no project support” and one or more specific forms of project support, because these responses created contradictory project-support classifications. Publication-count variables were also screened for extreme values. Because the study focuses on doctoral students and recent doctoral graduates, publication counts above 20 in either publication outcome was treated as extreme outliers and excluded from the analytic dataset. After applying these cleaning rules and excluding a very small scientific-field category of military sciences and national security that has very different publication requirements, the final sample included 808 respondents from six scientific fields: technical sciences, humanities and arts, natural sciences, social sciences, medical and health sciences, and agricultural and veterinary sciences.

### *Variables*

#### *Outcome variables*

The analysis examines two publication-count outcomes. The first outcome is the number of publications indexed in Scopus or Web of Science, which captures internationally indexed publication productivity. This outcome is referred to as Scopus/WoS publications. The second outcome is the number of publications in journals recommended by the Committee for Quality Assurance in Science and Higher Education in Kazakhstan. This outcome is referred to as domestic recommended-journal publications. Both outcomes are non-negative count variables.

#### *Project-support variables*

The main explanatory variable is access to project or grant support. Respondents were asked whether they had received different forms of support from a project or grant. Five binary indicators

were constructed: salary from project, equipment or software support, supplies or materials support, payment for services, and conference participation support. Each indicator equals 1 if the respondent reported receiving that form of support and 0 otherwise. Because respondents could receive more than one form of support, these variables are treated as multiple-response indicators.

For the first set of models, a general measure of project support was constructed. The variable “any project support” equals 1 if the respondent reported at least one of the five support forms and 0 if the respondent reported no project support.

#### *Control variables*

The models include controls for PhD status, entry cohort, gender, scientific field, PhD institution, and place of work. PhD status captures whether the respondent is a current doctoral student, has completed doctoral studies but not yet defended the dissertation, or already holds a PhD or equivalent doctoral degree. Entry cohort is grouped as 2018 or earlier, 2019–2020, 2021–2022, 2023, and 2024–2025. Gender is coded as female, male, and prefer not to say. Scientific field controls for disciplinary differences in publication norms and funding opportunities. PhD institution refers to the institution where the respondent is studying or obtained the PhD; Place of work refers to the respondent’s current research or employment organization. Reference categories for categorical variables are reported in a supplementary file.

#### *Empirical strategy*

The analysis proceeds in two stages. First, descriptive statistics are used to summarize publication productivity by project-support category and the distribution of project-support forms across scientific fields. These descriptive results show differences in support access and publication productivity before adjusting for covariates.

Second, negative binomial regression models are estimated for the two publication-count outcomes. Negative binomial regression is used because the dependent variables are non-negative counts and exhibit overdispersion. Results are reported as adjusted incidence rate ratios. An adjusted incidence rate ratio greater than 1 indicates a higher expected publication count, while a value below 1 indicates a lower expected publication count, holding other variables constant. The empirical analysis estimates three sets of models corresponding to the research questions.

#### *Model 1: Any project support and publication productivity*

The first model estimates the association between any project support and publication productivity. Separate models are estimated for Scopus/WoS publications and domestic recommended-journal publications.

$$E(Y_i|S_i, X_i) = \exp(\alpha + \beta S_i + X_i' \gamma)$$

In this equation,  $Y_i$  is the publication count for respondent  $i$ ,  $S_i$  is an indicator equal to 1 if the respondent received any project support, and  $X_i$  is the vector of control variables. The coefficient of interest is  $\beta$ . After exponentiation,  $\beta$  is interpreted as the adjusted incidence rate ratio comparing respondents with any project support to respondents with no project support, holding controls constant.

#### *Model 2: Specific forms of project support*

The second model replaces the general project-support indicator with five specific support-form indicators. These indicators are entered jointly, so each estimate represents the association between a given support form and publication productivity while holding the other support forms and controls constant.

$$E(Y_i|P_{1i}, P_{2i}, P_{3i}, P_{4i}, P_{5i}, X_i) = \exp(\alpha + \beta_1 P_{1i} + \beta_2 P_{2i} + \beta_3 P_{3i} + \beta_4 P_{4i} + \beta_5 P_{5i} + X_i' \gamma)$$

Here,  $P_{1i}$  through  $P_{5i}$  represent salary support, equipment/software support, supplies/materials support, services payment, and conference participation support.

### *Model 3: Project support and scientific field*

The third model examines whether the association between project support and publication productivity differs across scientific fields. This model includes an interaction between any project support and scientific field.

$$E(Y_i|S_i, F_i, Z_i) = \exp(\alpha + \beta S_i + \delta F_i + \theta(S_i \times F_i) + Z_i'\gamma)$$

In this equation,  $F_i$  represents scientific field,  $S_i \times F_i$  is the interaction between project support and scientific field, and  $Z_i$  includes the remaining control variables. Because interaction coefficients in nonlinear count models are difficult to interpret directly, the results are reported as adjusted predicted publication counts by scientific field and project-support status.

### *Estimation and reporting*

All models are estimated separately for Scopus/WoS publications and domestic recommended-journal publications. Robust HC0 standard errors are used. Regression results are reported as adjusted incidence rate ratios with 95% confidence intervals and p-values.

The estimates are interpreted as conditional associations rather than causal effects. The survey data are observational, and project support was not randomly assigned. Although the models adjust for respondent, educational, field, and institutional characteristics, unobserved differences may still be associated with both access to project support and publication productivity.

## RESULTS

### *Descriptive results*

The analytic sample included 808 respondents. Of these, 415 respondents reported receiving at least one form of project or grant support, while 393 reported no project support. Table 1 presents descriptive statistics for publication productivity by project-support category.

*Table 1. Research productivity by project/grant support form*

Support category	N	% of analytic sample	Scopus/WoS mean	Scopus/WoS SD	Domestic mean	Domestic SD
Full analytic sample	808	100.0	1.59	2.17	2.62	2.71
Any project support	415	51.4	2.05	2.53	2.85	2.99
Salary from project	198	24.5	2.66	2.85	3.33	3.29
Equipment/software support	169	20.9	2.55	2.93	3.20	3.36
Supplies/materials support	135	16.7	2.76	3.22	3.29	3.41
Services payment	71	8.8	2.63	2.62	3.54	3.57
Conference participation support	191	23.6	1.83	2.11	2.68	2.70
No project support	393	48.6	1.11	1.58	2.38	2.36

Respondents with project support reported higher average publication productivity than respondents without project support. The mean number of Scopus/WoS publications was 2.05 among respondents with any project support, compared with 1.11 among respondents without project support. A similar, although smaller, difference was observed for domestic recommended-

journal publications: respondents with project support reported an average of 2.85 domestic publications, compared with 2.38 among respondents without project support.

Among specific forms of support, salary support, equipment/software support, supplies/materials support, and services payment were associated with higher raw publication means than the full analytic sample. Respondents receiving salary support reported an average of 2.66 Scopus/WoS publications and 3.33 domestic publications. Respondents receiving supplies/materials support had the highest mean Scopus/WoS publication count among the support-form categories, at 2.76. Conference participation support showed a weaker descriptive association with publication productivity than the other forms of support.

Table 2 shows the distribution of project and grant support across scientific fields. Access to project support varied substantially by field. Any project support was most common in agricultural and veterinary sciences, where 75.0% of respondents reported at least one form of support, followed by natural sciences at 69.0% and technical sciences at 56.5%. Support was less common in humanities and arts, at 39.5%, and social sciences, at 29.2%. These descriptive differences indicate that project-support exposure is unevenly distributed across fields, supporting the inclusion of scientific field as a control variable in the regression models.

Table 2. Project/grant support forms by scientific field

Scientific field	N	Any support (%)	Salary (%)	Equipment/software (%)	Supplies/materials (%)	Services payment (%)	Conference support (%)
Technical sciences	271	56.5	26.2	28.8	19.2	10.0	23.6
Humanities and arts	157	39.5	17.2	6.4	5.1	5.7	21.7
Natural sciences	113	69.0	37.2	29.2	23.0	11.5	35.4
Social sciences	113	29.2	9.7	5.3	4.4	2.7	17.7
Medical and health sciences	102	49.0	20.6	18.6	18.6	9.8	22.5
Agricultural and veterinary sciences	52	75.0	50.0	44.2	48.1	17.3	19.2

Note. Percentages are calculated within each scientific field. Project-support forms are multiple-response indicators; therefore, percentages across support forms do not sum to 100%.

### Project support and research productivity

The first research question examined whether receiving any project or grant support was associated with publication productivity. Table 3 reports negative binomial regression models predicting Scopus/WoS and domestic recommended-journal publication counts. Results are reported as adjusted incidence rate ratios. Values above 1 indicate higher expected publication counts, while values below 1 indicate lower expected publication counts, holding other variables constant.

The models adjust for PhD status, entry cohort, gender, scientific field, PhD institution, and place of work. PhD institution refers to the institution where the respondent is studying or obtained the PhD, while place of work refers to the respondent's research or employment organization. Full control-variable estimates are reported in Appendix Table A1.

Project support was positively associated with Scopus/WoS publication productivity. In the model predicting Scopus/WoS publication counts, respondents who received any form of project support had 58% higher expected publication counts than respondents without project support, net of controls (adjusted IRR = 1.58, 95% CI [1.35, 1.86],  $p < .001$ ). For domestic recommended-journal publications, the association was smaller and only marginally statistically significant: project support was associated with 13% higher expected publication counts (adjusted IRR = 1.13, 95% CI [1.00, 1.29],  $p = .057$ ).

These results provide strong evidence that project support is associated with higher Scopus/WoS publication productivity. The evidence for domestic recommended-journal productivity is weaker and should be interpreted as suggestive rather than conventionally statistically significant.

Table 3. Any project support and research productivity

Predictor	Outcome	Adjusted IRR	95% CI	p-value
Any project support	Scopus/WoS	1.58***	[1.35, 1.86]	< .001
Any project support	Domestic recommended journal	1.13+	[1.00, 1.29]	.057

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

### Specific forms of project support

The second research question examined whether different forms of project or grant support were differently associated with publication productivity. Table 4 replaces the general project-support indicator with five specific forms of support: salary support, equipment/software support, supplies/materials support, services payment, and conference participation support. Because respondents could receive multiple forms of support, the coefficients represent the association of each support form with publication productivity while holding the other support forms and controls constant.

Table 4. Forms of project support and research productivity

Predictor	Scopus/WoS adjusted IRR	95% CI	p-value	Domestic adjusted IRR	95% CI	p-value
Salary from project	1.41***	[1.17, 1.69]	< .001	1.16+	[0.99, 1.35]	.065
Equipment/software support	1.21*	[1.02, 1.44]	.029	1.09	[0.93, 1.28]	.277
Supplies/materials support	1.21+	[0.97, 1.51]	.085	1.02	[0.83, 1.25]	.860
Services payment	1.10	[0.85, 1.42]	.483	1.11	[0.89, 1.39]	.345
Conference participation support	1.03	[0.83, 1.27]	.792	0.95	[0.82, 1.09]	.432

In the model predicting Scopus/WoS publication counts, salary support was the strongest and most consistent predictor. Respondents who received salary support from a project had 41% higher expected Scopus/WoS publication counts than respondents who did not receive salary support, holding other support forms and controls constant (adjusted IRR = 1.41, 95% CI [1.17, 1.69],  $p < .001$ ). Equipment/software support was also positively associated with Scopus/WoS productivity (adjusted IRR = 1.21, 95% CI [1.02, 1.44],  $p = .029$ ). Supplies/materials support showed a positive but marginal association (adjusted IRR = 1.21, 95% CI [0.97, 1.51],  $p = .085$ ). Services payment and conference participation support were not statistically significant predictors of Scopus/WoS publication counts. The support-form variables were jointly significant in the Scopus/WoS model,  $\chi^2(5) = 39.615$ ,  $p < .001$ .

In the model predicting domestic recommended-journal publications, none of the support forms reached conventional statistical significance at the 5% level. Salary support showed a marginal positive association with domestic publication counts (adjusted IRR = 1.16, 95% CI [0.99, 1.35],  $p = .065$ ), but equipment/software support, supplies/materials support, services payment, and conference participation support were not statistically significant. The joint Wald test for all support forms in the domestic model was not statistically significant,  $\chi^2(5) = 7.029$ ,  $p = .219$ . Prior to estimating the support-form models, multicollinearity among the five project-support indicators

was assessed. Variance inflation factors (VIFs) ranged from 1.06 to 1.42, well below the standard threshold of 5.0

Overall, these results indicate that specific forms of support are more clearly associated with Scopus/WoS publication productivity than with domestic recommended-journal productivity. Salary support appears to be the most robust support mechanism, while equipment/software support is also associated with higher Scopus/WoS publication counts.

### *Differences across scientific fields*

The third research question examined whether the association between project support and publication productivity differed across scientific fields. To address this question, negative binomial models were estimated with an interaction between any project support and scientific field. Because interaction coefficients in nonlinear count models are difficult to interpret directly, Table 5 reports adjusted predicted publication counts by scientific field and project-support status. The models adjust for PhD status, entry cohort, gender, PhD institution, and place of work.

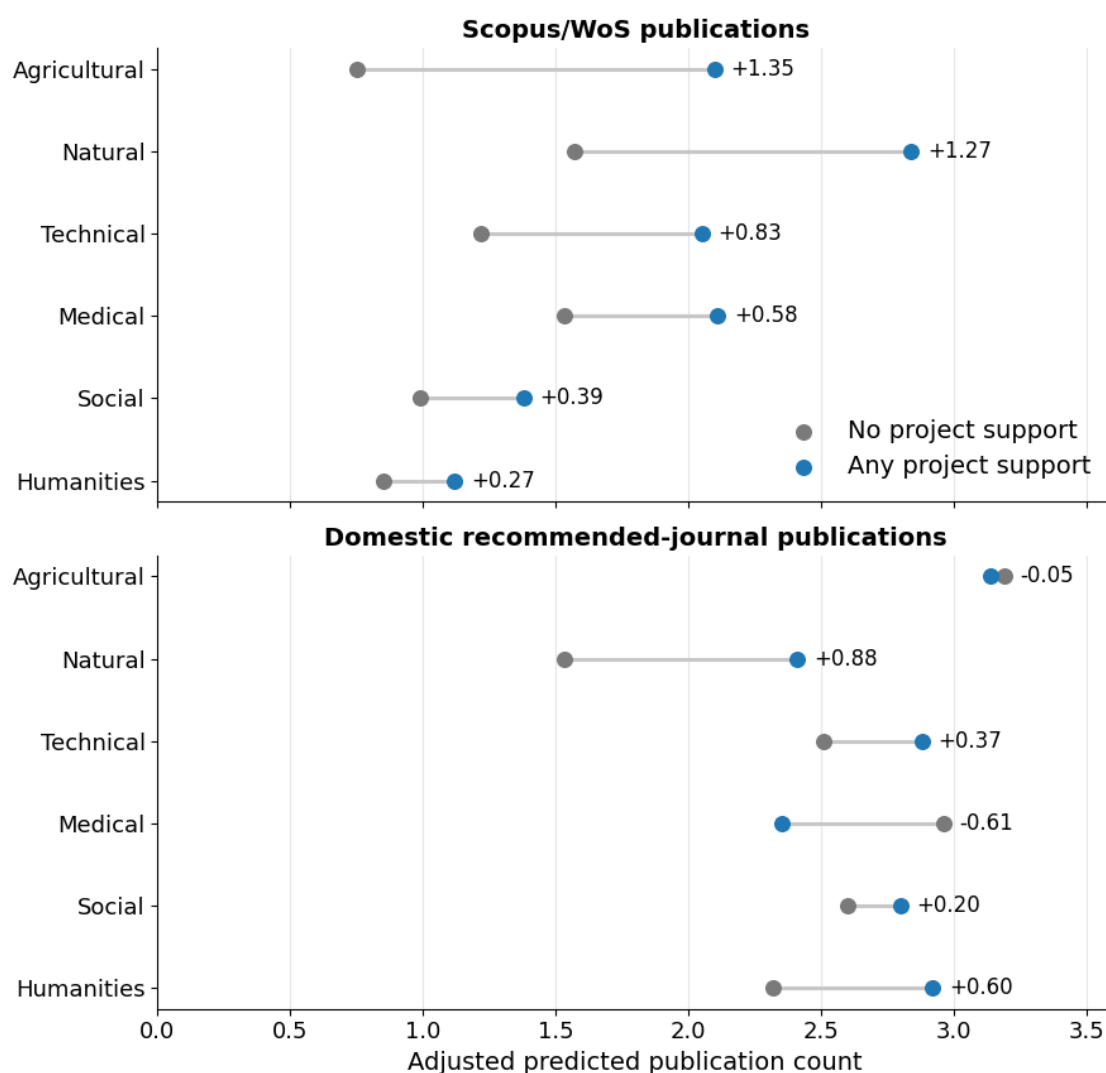
*Table 5. Adjusted predicted publications by project support and scientific field*

Scientific field	N	Domestic: no support	Domestic: any support	Domestic difference	Domestic % difference	Scopus/WoS: no support	Scopus/WoS: any support	Scopus/WoS difference	Scopus/WoS % difference
Technical sciences	271	2.51	2.88	0.37	14.67	1.22	2.05	0.83	67.73
Humanities and arts	157	2.32	2.92	0.60	25.82	0.85	1.12	0.27	32.31
Natural sciences	113	1.53	2.41	0.88	57.89	1.57	2.84	1.27	81.05
Social sciences	113	2.60	2.80	0.20	7.87	0.99	1.38	0.39	38.70
Medical and health sciences	102	2.96	2.35	-0.61	-20.75	1.53	2.11	0.58	37.68
Agricultural and veterinary sciences	52	3.19	3.14	-0.05	-1.68	0.75	2.10	1.35	181.72

The adjusted predictions suggest that the size of the support-productivity difference varies descriptively across fields. For Scopus/WoS publications, the largest predicted differences were observed in agricultural and veterinary sciences, natural sciences, and technical sciences. In agricultural and veterinary sciences, the predicted Scopus/WoS publication count was 0.75 among respondents without project support and 2.10 among respondents with project support, corresponding to a predicted difference of 1.35 publications. In natural sciences, the corresponding predicted counts were 1.57 and 2.84, a difference of 1.27 publications. In technical sciences, the predicted counts were 1.22 and 2.05, a difference of 0.83 publications.

For domestic recommended-journal publications, the descriptive pattern was less consistent. Predicted domestic publication counts were higher among supported respondents in technical sciences, humanities and arts, natural sciences, and social sciences, but lower among supported respondents in medical and health sciences and agricultural and veterinary sciences. The largest positive predicted difference was observed in natural sciences, where respondents with project support had 0.88 more predicted domestic publications than respondents without project support.

Figure 1. Adjusted difference in predicted publication counts associated with project support, by scientific field



However, the joint interaction tests were not statistically significant for either outcome. For Scopus/WoS publications, the project support  $\times$  scientific field interaction was not significant,  $\chi^2(5) = 4.443$ ,  $p = .488$ . For domestic publications, the interaction was also not statistically significant,  $\chi^2(5) = 8.334$ ,  $p = .139$ . Therefore, although the adjusted predictions show descriptive variation across fields, the models do not provide strong statistical evidence that the association between project support and publication productivity differs systematically by scientific field.

## DISCUSSION

The main contribution of this article is to move the discussion of doctoral funding beyond broad comparisons between funded and unfunded students. prior research has examined broad funding categories, including funded versus unfunded status (Horta & Santos, 2016; Smirnov, 2025), public versus private scholarships (Muscio & Shibayama, 2023), PhD grants versus research project grants (Horta et al., 2018), and assistantship or fellowship mechanisms (Borrego et al., 2019; Denton et al., 2025; Grote et al., 2021), rather than the specific forms of support embedded within funded research projects. This study disaggregates project support into specific forms of assistance embedded within funded research projects: salary, equipment/software, supplies/materials, payment for services, and conference participation support.

The study also contributes to the literature by focusing on Kazakhstan, an emerging research system in which doctoral education is closely linked to international-indexed publication expectations. [Kuzhabekova \(2025\)](#) shows that Kazakhstan's PhD publication requirement increased publication numbers but was also associated with lower research impact, suggesting that output-oriented policy may increase productivity indicators without necessarily strengthening research quality. PhD candidates and recent PhD graduates in Kazakhstan face substantial barriers to publishing in Scopus/WoS-indexed journals, including linguistic, methodological, organizational, financial, and psychological challenges, alongside uneven institutional and supervisory support ([Zeinollakizi, 2026](#)). The present study adds a quantitative funding perspective to this Kazakhstan-specific literature by examining whether concrete forms of project support can support doctoral students and graduates in matching publication requirements.

The results related to the first research question show a clear association for Scopus/WoS publications than for domestic recommended-journal publications. This pattern is consistent with prior studies showing that funded doctoral students and early-career researchers often demonstrate stronger research outcomes than unfunded peers, including higher publication activity and visibility ([Horta & Santos, 2016](#); [Smirnov, 2025](#)). However, the weaker association for domestic recommended-journal publications maybe due to higher requirements for publishing in Scopus/WoS indexed journals that require more time and support. If doctoral students are expected to publish in internationally indexed outlets, then project support may matter not only as a funding category but as part of the research capacity that allows students to produce such outputs.

The second research question examined whether specific forms of project support were differently associated with publication productivity. Salary from a funded project was the strongest and most consistent support form in the Scopus/WoS model (Table 4). Equipment/software support was also positively associated with Scopus/WoS publication counts, while supplies/materials support was only marginally significant. Services payment and conference participation support were not statistically significant predictors. For domestic recommended-journal publications, none of the specific support forms reached conventional statistical significance.

These findings indicate that the productivity relevance of project support depends on what the support provides. Salary support differs from other forms of project assistance because it can directly affect the time and financial conditions under which doctoral students conduct research. [Nisticò \(2018\)](#) findings indicate that adequate funding allows students to spend significantly less time working part-time or taking on non-academic jobs to survive. In the Kazakhstan doctoral context, this is especially important because publication expectations may coexist with limited or uneven institutional support ([Zeinollakizi, 2026](#)). Doctoral students usually receive tuition support and modest stipends and often need additional employment to sustain themselves or their families. Many doctoral students are not only early-career researchers but also adults likely to face family or household obligations. In 2021, the mean age at marriage in Kazakhstan was 25.2 for women and 27.9 for men, while the OECD mean age of enrolled doctoral students, new entrants, and graduates was around 32 (Organisation for Economic Co-operation and Development, n.d.). Therefore, project salary may be a critical bridge between formal doctoral enrolment and actual research capacity.

Against this background, salary support from projects may be one practical way to reduce the gap between publication expectations and the material conditions needed to conduct publishable research. Even when doctoral students have tuition-fee grants or stipends, such support may not be sufficient to remove the need for additional paid work, especially for students with family responsibilities. Project salary may therefore be important not simply as additional income, but as a form of research-enabling support that helps make doctoral research participation practically sustainable.

Studies of assistantships, fellowships, and grants suggest that different support arrangements create different opportunities for research engagement, skill development, advisor interaction, and

degree progress (Borrego et al., 2019; Denton et al., 2025; Grote et al., 2021). The current findings add to this literature by focusing on the components embedded within project or grant participation. The positive association for equipment/software support also deserves attention, although it should not be overstated. Equipment and software may enable data collection, analysis, experimentation, or technical work needed for publishable research, depending on the field. The null findings for services payment and conference participation support should also be interpreted cautiously. These results do not show that such forms of support are unimportant. They show only that, in these models and with these measures, they were not statistically significant predictors of publication counts after accounting for other support forms and controls. Conference participation, for example, may contribute to networking, visibility, feedback, or future collaboration in ways that are not captured by immediate publication counts.

The third research question asked whether the association between project support and publication productivity differed across scientific fields. The adjusted predictions in Table 5 show descriptive variation. For Scopus/WoS publications, the predicted difference between supported and unsupported respondents was larger in agricultural and veterinary sciences, natural sciences, and technical sciences than in several other fields. For domestic recommended-journal publications, the pattern was less consistent, with positive predicted differences in some fields and negative predicted differences in others. However, the interaction tests were not statistically significant for either outcome. This means that the study should not claim that scientific field systematically moderates the association between project support and publication productivity.

## POLICY RECOMMENDATIONS

The results have implications for grant agencies, government bodies, universities, doctoral supervisors, and research funding organizations in Kazakhstan and similar emerging research systems. A central implication is that doctoral participation in funded research projects should be assessed not only formally, but substantively. In other words, it is not sufficient for PhD students to be listed as members of a grant team. Their participation is more likely to support publication productivity when it provides concrete conditions for sustained research engagement, especially salary support, access to research infrastructure, and meaningful involvement in publishable research tasks.

### *For government and funding agencies*

For government agencies responsible for science and higher education policy, the findings suggest the need to clarify rules governing PhD student participation in funded research projects. If grant competitions require or encourage the involvement of doctoral students, application guidelines should specify what counts as substantive participation. This may include paid research roles, access to project data, use of equipment or software, participation in analysis and writing. Evaluation criteria for grant applications should therefore assess not only whether PhD students are included as it is currently a case in Kazakhstani context, but also what roles, resources, and outputs are planned for them. Grant impact assessments should similarly include indicators of doctoral involvement, such as whether PhD students received salary support, contributed to publications, gained access to research infrastructure, or advanced dissertation-related research through project participation.

Government agencies and research funding bodies should also consider whether current grant periods are long enough to support meaningful doctoral participation. Where research grants are limited to relatively short project cycles, such as three years, doctoral students may not have enough time to move from project involvement to data analysis, manuscript preparation, peer review, and publication. Extending some research grant periods from three to five years could help make student involvement more productive. Longer project periods may be particularly important when funded projects are expected to support both research outputs and doctoral capacity building.

For international and local funding bodies, the findings suggest that grant design should include dedicated budget lines for doctoral research participation. These could include salary support, research assistantship roles, software licenses, fieldwork expenses, laboratory access, data acquisition, and publication-related training. Conference participation may still be useful, but it should not substitute for more substantive forms of research support.

#### *For universities and supervisors*

For universities, the findings highlight the importance of institutional research infrastructure. Universities should ensure that PhD students have access to shared facilities that allow them to participate meaningfully in research projects. This includes not only laboratories, equipment, data resources, and specialized software, but also basic physical infrastructure such as cubicles, workspaces, and safe, convenient places to conduct research. Universities should view doctoral access to research infrastructure as part of publication-capacity building, not merely as an administrative or logistical issue.

Universities can also strengthen the link between funded projects and doctoral training by monitoring the quality of student involvement. Graduate schools, research offices, or doctoral program committees could require project leaders to describe how PhD students will be involved in research tasks, what resources they will receive, and how project participation will support dissertation progress or publication development. Such monitoring would help prevent doctoral students from being included only symbolically or assigned mainly administrative work that does not contribute to their research productivity.

Doctoral supervisors and project leaders also have an important role. Supervisors should actively encourage PhD students to participate in research projects, but this participation should be aligned with the student's dissertation topic, skills, and publication goals. The strongest arrangement may be one in which PhD students are selected or recruited in connection with ongoing funded projects that already fit their research interests. In such cases, the project can provide not only funding, but also data, infrastructure, supervision, and a clearer pathway toward publications.

Overall, the policy priority should be to move from formal inclusion of PhD students in funded projects toward substantive research-enabling participation. In emerging research systems, where doctoral students face rising publication expectations but uneven access to research resources, grant-based participation can support publication productivity only when it provides time, financial stability, infrastructure, supervision, and genuine opportunities to contribute to publishable research.

#### *Limitations*

Several limitations should guide interpretation. First, the study uses observational survey data, so the findings are associational. Project support was not randomly assigned, and unobserved characteristics may be related both to receiving support and to publication productivity. For example, students with stronger supervisors, better institutional networks, prior publication experience, or higher research motivation may be more likely to join funded projects and more likely to publish. Although the models adjust for several respondent, field, and institutional characteristics, residual confounding remains possible.

Second, the analysis relies on self-reported publication counts and project-support indicators. The study distinguishes between Scopus/WoS and domestic recommended-journal publications, but it does not assess publication quality, authorship position, journal rank, citation impact, or whether publications were directly connected to the funded project. Similarly, the support variables identify whether respondents received particular forms of support, but not the amount, duration, timing, intensity, or conditions attached to that support.

## CONCLUSION

Overall, this study shows that the relationship between project support and doctoral publication productivity is more specific than a simple supported-versus-unsupported comparison suggests. Project support is more clearly associated with Scopus/WoS productivity than with domestic recommended-journal productivity, and salary from a project appears to be the most robust support form in the models. The findings point to the importance of designing grant-based doctoral participation in ways that provide meaningful research conditions, not merely formal inclusion in projects. They also show the need for future evaluation of grant policies that require PhD student involvement, especially to determine whether salary-supported project roles improve research time, publication productivity, doctoral progress, and research integrity.

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