

# Faculty Publication Productivity and Collaboration in Pakistan: Using Mixed Methods to Compare Foreign and Domestic Doctoral Degree Holders

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**Abstract.** In higher education research, publication productivity and collaboration of foreign doctoral degree holders have been thoroughly examined in developed countries. However, they have been given less attention in developing countries such as Pakistan, despite their growing visibility and significance in HEIs. The purpose of this study was to examine faculty publication productivity and collaboration differences between foreign and domestic doctoral degree holders. The theoretical premise of the study was based on knowledge recombination theory and mobility approaches, and the study used a convergent parallel mixed methods design. The empirical data consist of 232 faculty members and 17 semi-structured interviews with university administrators collected from 14 public universities. The findings of the study revealed that foreign doctoral degree holders had not produced a greater total of refereed journal articles than their domestic doctoral holder colleagues. Qualitative findings also supported the quantitative findings of the study, as well as made a theoretical contribution to knowledge recombination theory and mobility approaches. Our findings suggested that mobility helps knowledge flows and knowledge gained from distant sources is significantly more creative when compared to domestic knowledge. Additionally, analysis demonstrated that certain foreign doctoral holders are particularly productive and could have benefited from unique knowledge not accessible to their domestic doctoral colleagues. The findings also recognized that those who move internationally and opt for foreign study could be beneficial for home countries and undoubtedly help institutions achieve their research excellence goals. Further discussion and implications are provided.

**Keywords:** publication productivity, collaboration, mobility, foreign doctoral degree holders, domestic doctoral degree holders, Pakistan

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## Introduction

Foreign doctoral degree holders are becoming “highly visible symbols of the changing face of the faculty population” (Manrique & Manrique, 1999) in Pakistani HEIs (Baloch et al., 2020). However, they have been largely neglected in HE literature, and remarkably receive limited empirical attention examining their publication productivity and collaboration differences at Pakistani public universities. Although recruitment of foreign or domestic doctoral degree holder is common in Pakistani universities, no one has asked how foreign doctoral degree holders differ in their publication productivity and collaboration patterns compared to their domestic doctoral holder colleagues. To expand the existing literature on faculty publication productivity and collaboration in developing countries, this study examines publication productivity and collaboration differences between foreign and domestic doctoral degree holders at Pakistani public universities.

HE quality has developed into a primary agenda throughout the world because it is one of the prerequisites of progress for any nation. HEIs are considered to be the originators of social change through knowledge creation, new ideas, and dissemination, particularly in the context of globalization. The present globalized environment is characterized by rapidly developing science and technology, a knowledge-based economy, ICT improvements, and the accelerating flow of international knowledge products, services, capital, and labor. Mobile students and academics are no longer only the “knowledge carriers” but more profoundly have become an instrument for quality enhancement in higher education (Knight, 1997), and a key part of policy concern around region-building through exchange and academic cooperation (Neubauer, 2012). Obviously, developing countries are particularly eager to pursue economic growth in the emerging knowledge-based economy and society, evident in greater outbound mobility rates in the pursuit of knowledge in developed countries (Guruz, 2011). The Higher Education Commission (hereafter HEC) of Pakistan has been sending and awarding faculty and students scholarships through its different overseas PhD scholarships, and HEIs, particularly universities under the umbrella of HEC authority, are recruiting and retaining foreign doctoral degree holders to bring international expertise to Pakistani universities, enhance scientific innovation, impart high-quality education to students and beef up national and international competitiveness. Academics, whether possessing foreign or domestic doctorates, are essential for HEIs’ reputation, productivity, and quality (Altbach & Yudkevich, 2017). In this context, the following research questions drive this study:

1. Do foreign doctoral degree holders differ in their publication productivity and collaboration compared to their domestic doctoral holder colleagues at Pakistani public universities?
2. To what extent and in what ways do semi-structured interviews with key stakeholders from various public universities serve to provide a more comprehensive and nuanced understanding of differences in publication productivity and collaboration between foreign and domestic doctoral degree holders, according to mixed methods analysis at Pakistani public universities?

## **The Pakistani HE context**

The Pakistani Higher Education system has expanded significantly. The country has welcomed more innovative approaches to mass higher education initiatives and witnessed spectacular growth and expansion in the number of universities and degree awarding institutions (DAIs), both in the public and private sectors. Pakistani universities have almost quadrupled in number from 52 accredited universities in 2001 to 163 universities today, of which 94 are in the public sector and 69 in the private sector, respectively (HEC, 2016). Higher education enrolment increased from only 331,745 in 2002 to 1.9 million in 2018. However, Pakistan's gross enrolment ratio remains extremely low, at only 9% in 2018, compared with 29% in India and 21% in Bangladesh (HEC, 2016; Hunter, 2020). Moreover, the HE system of Pakistan consists of two sectors: public and private. The public sector is dominant in both universities/DAIs, so Pakistani higher education is public in nature (World Bank, 2017). Institutions which are accredited by provincial or federal governments can be either public or private, based on HEC recommendations (Hunter, 2020). The total percentage of faculty holding a PhD is 27.39% of the total population, but the public sector has a higher number (8052) of PhD holding faculty than the private sector (2068) (HEC, 2016).

Research and development had remained neglected until the HEC's establishment in 2002. Over the past fifteen years, the publication productivity of HEIs has notably increased (Herciu, 2015), as evidenced by the increase from under 800 research articles in 2001 to 12,000 in 2015 (HEC, 2016). Scientometric analysis of the research output of South Asian countries conducted by Uddin and Singh (2014) revealed a progressive research output in these countries. In the past decade, India published around 700,217 research articles. Next to India, Pakistan was the second-largest publisher of research articles at 69,783. Reforms of the HEC have been recognized and followed (Kumari, 2017; Riaz et al., 2017) and earnestly repositioned research from an anecdotal and relatively minor activity into a major function of universities (Haque et al., 2018).

An extensive review of universities' performance and publication productivity confirms the important and interventionist leadership role of the HEC. However, it also suggests that there should be a shift in focus with respect to quality publication productivity and revived innovation and collaboration within university sector (Kumari, 2017) which could empower the country to meet the diversified demands of the knowledge-based economy domestically and globally (Baloch et al., 2020). In addition, over the years, research funding has regularly been raised for the enhancement of universities and faculty publication productivity (Nauman, 2017). Despite this fact, Pakistan still spends less than 0.3% of its GDP on R&D, which is very low relative to India which spends 0.9%, China which spends 1.6%, and South Korea which spends 3.4% of much larger GDPs (Haque et al., 2018; Rahman, 2018).

## Literature review

In higher education research, publication productivity and collaboration of foreign-born and foreign doctoral degree holders have been thoroughly examined. Many researchers took interest in foreign-born researchers' publication productivity (Webber, 2012; Mamiseishvili & Rosser, 2010; Corley & Sabharwal, 2007; Shin & Cummings, 2010; Marvasti, 2005), investigating their contributions to U.S. scientific enterprise. There are also numerous examples of studies on foreign and domestic doctoral holders' publication productivity and collaboration in the literature, particularly in developed countries (Allison & Stewart, 1974; Kwiek, 2016, 2020), but relatively few of those studies examine differences between foreign and domestic doctorate holders in developing countries (Postiglione & Jung, 2013; Shin et al., 2014).

Using the Changing Academic Profession (CAP) data (2007-08), Shin et al. (2014) selected three HE systems of East Asia and examined foreign degree holders' publication productivity differences with their domestic doctoral colleagues. They found that foreign doctoral degree holders had produced less than domestic doctoral colleagues, including refereed journal articles, books, and book chapters authored/co-authored and edited/co-edited. They found that foreign doctoral degree holders were slightly less productive than their domestic doctoral colleagues in Korea, and that foreign doctoral degree holders in Malaysia had not produced more research in the hard sciences than domestic doctoral colleagues. Moreover, Postiglione and Jung (2013) drew data from the CAP survey in four Asian countries, investigating the most highly productive researchers' publication productivity. They concluded that academics with higher research production had emphasized basic/theoretical research and spent more time on research than teaching in comparison with the rest of academic researchers.

A significant body of studies comparatively analyzed the international research collaboration of foreign and domestic doctoral degree holders according to their country of origin (Baruffaldi & Landoni, 2012; Murakami, 2014; Wang et al., 2012, 2013). Baruffaldi and Landoni (2012) examined the collaboration of foreign-born faculty members in two European countries. They found that foreign-born faculty publication productivity had significantly raised in the host countries. Through investigation of co-authorship in Chinese journal articles, Wang et al. (2013) reported that 75% of Chinese-Singaporean collaboration was completed by Chinese-Singaporean researchers, while 65% of Sino-US collaboration was carried out by China-USA researchers. Murakami (2014) analyzed Japanese scholars' collaborative behavior after their return from the US, arguing that returnees had tended to collaborate with those scholars who were accustomed to collaborating with researchers in Japan. Furthermore, they found that scholars were inclined to sustain collaborative links with US scholars with whom they had already collaborated during their stay in America.

Extant studies reported the contributions of returnees, focusing on their behavior with respect to international collaboration and specifically their bridging activities between the host country and the

source country (Zweig et al., 2004; Ynalvez & Shrum, 2011; Jonkers & Cruz-Castro, 2013; Jonkers & Tijssen, 2008). Jonkers and Tijssen (2008) studied collaboration among Chinese returnees in the life sciences, and found that they had shown greater propensity to collaborate with academics in foreign countries. Zweig et al. (2004) reported that returnees had helped in establishing international projects in Chinese economic zones (31% versus 10% among other researchers who never went abroad for higher study). They further concluded that foreign doctoral degree holders were worth more than domestic doctoral degree holders in terms of technology transfer and in their capacity to bring benefits to their universities. Saxenian (2005) concluded that foreign degree holders played a significant part in the technological advancement and economic development of China. Ynalvez and Shrum (2011) also claimed that faculty who had experience in Western countries transformed the structure of Filipino scientific networks by bringing more collaboration from foreign countries.

Many studies on profoundly skillful returnees consider academic researchers, scientists, entrepreneurs, and engineers (Zucker & Darby, 2007; Chellaraj et al., 2008; Baruffaldi & Landoni, 2012; Wang et al., 2012). Zucker and Darby (2007) stated that, in the past, many scientists in biotechnology from Taiwan, China, and Brazil came back home from the U.S. and played a part in the establishment of high-end technology firms. Wang et al. (2012) conducted a study on Sino-US collaborations, finding that the majority of collaborations in nanotechnology were conducted by Chinese-American scholars who had returned from America. Jonkers and Cruz-Castro (2013) analyzed Argentinian returnee scholars' international collaboration and reported an increased international publishing ratio and rate of publication in high-impact journals.

This review of literature indicates that the publication productivity and collaboration patterns of foreign and domestic doctoral degree holders have been thoroughly examined (Allison & Stewart, 1974; Fox, 1983; Corley & Sabharwal, 2007; Mamiseishvili & Rosser, 2010; Webber, 2012; Shin & Cummings, 2010; Wang et al., 2012, 2013; Baruffaldi & Landoni, 2012; Xian, 2015; Kyvik & Aksnes, 2015; Kwiek, 2016, 2020). However, until now, no study has examined faculty publication productivity and collaboration differences between foreign and domestic doctoral holders in the Pakistani context. Thus, to deepen our understanding of whether and how foreign and domestic doctoral degree holders differ in their publication productivity and collaboration, this study employed a self-administered questionnaire and semi-structured interviews with key stakeholders from various public universities in Pakistan.

## **Theoretical framework**

The theoretical framework of this study is based on theories which have direct implications for the phenomena explained in the present study. Previous literature shows that several approaches support the prediction that researchers who move internationally are commonly more productive than those who do not move. Knowledge recombination theory emphasizes that mobility helps knowledge

flows, and knowledge gained from distant sources is significantly more creative compared with domestic knowledge (Fleming, 2001). Tacit knowledge embedded in researchers who move between countries put them in a position of 'ideas arbitrage,' where they can benefit from sets of unique knowledge not accessible to immobile researchers (Saxenian, 2005).

At present, international mobility is considered an important part of researchers' academic career. Edler et al., (2011) characterized "International mobility as a way to increase the professional network of a scientist and the available resources, hence augmenting scientific and technical human capital of a scientist (p.792)." Scientific and technical human capital is "the sum of scholars' technical knowledge and skills, professional network ties, and resources (Bozeman & Corley, 2004, p.636)." Moving towards the scientific center for advanced learning is thus believed to be essential for semi-peripheral countries' academics and scientists. Many researchers believe that more mobility in the form of brain circulation does not merely result in individual scientists developing a better career, but also leads to overall knowledge exchange and benefits regarding the expansion of knowledge production (Edler & Georghiou, 2007; Edler et al., 2011).

Mobility has recently emerged as more vital than ever, as scientists—and mainly doctoral students and postdoctoral fellows—attain experience abroad and return to their home country utilizing the knowledge achieved in their host country. However, the mobility of students, researchers, and well-trained professionals is increasingly temporary rather than permanent (Teferra, 2016; Gaillard & Gaillard, 1997). Therefore, scholars' mobility develops networks, advances careers, and provides a foundation for better global knowledge flow, well-suited job opportunities through worldwide job search and more chance for employers to find unique or rare sets of skills (Regets, 2007; Williams, 2007), and also facilitates transmission of knowledge and skills and enhances research production (Jonkers & Tijssen, 2008).

Capital theories (Becker, 1964; Bourdieu, 1985) view mobility as an attempt to enhance research productivity at the individual-level. The professionalization and socialization processes of studying in academically developed countries provide academic capital benefits (Bess, 1978). Transnational capital accumulated helps returned scholars to perform better when they are back in their parent institutions (Zweig et al., 2004; Wiers-Jenssen, 2008). Well-skilled individuals' mobility could be advantageous with regards gaining more knowledge compared to that available at home, rapid human capital accumulation, improved productivity, supplementing initial human capital and later potential improvement in knowledge flow, skills, and networks (OECD, 2008, 11). Apparently, the longer a scholar spends in an academically advanced research system, the broader the stock of that scholar's human and social capital, which will be mirrored in research productivity.

Extant research has shown that both returnees' "human capital" and "social capital" increase through overseas experience (Jonkers & Tijssen, 2008; Edler & Georghiou, 2007, Edler et al., 2011). Returnee scholars might benefit their domestic institutions in two main ways: First, the knowledge and skills acquired outside the country may promote quality improvement and expansion in research areas

at these institutions. Second, an institution may be provided with access to international academic networks and materials by returnees, who act as a bridge between domestic institutions and academic networks at an international level (Velema, 2012). Since the start of 21<sup>st</sup> century, growing numbers of overseas Pakistani students and researchers have been returning from different parts of the world and accommodated in Pakistani HEIs, and are considered to be an essential driver of publication productivity increases and research quality in Pakistan (Rahman, 2012). Therefore, it is increasingly recognized that those who opt for foreign study could be beneficial for home and host countries and can undoubtedly help developing institutions achieve their research excellence goals (Li et al., 2015).

## **Methodology**

Researchers, most often, choose approaches, variables, and units of analysis which are most appropriate for chosen research questions (Tashakkori & Teddlie, 1998). Reflecting the research questions of this study, a mixed methods research approach was adopted to examine publication productivity and collaboration differences between foreign and domestic doctoral degree holders. A mixed methods research design provided a more confident and comprehensive understanding of the research problem and questions (Cohen et al., 2000; Creswell & Clark, 2017).

### *Data collection and sampling*

The data used in this study were collected for a PhD project from 14 Pakistani public universities between August to November 2016. The ethics committee of the researcher's university approved this study, which was conducted with full ethical considerations.

The data collection process occurred simultaneously. First, universities were purposefully selected from the HEC's "University Ranking 2015", categorized as general, engineering & technology, agriculture & veterinary, etc. (HEC University Ranking, 2016). From each category, one public university was chosen from each province, including Islamabad, the capital city of Pakistan. Two universities were chosen in Islamabad, where the agriculture category lacked. Second, a systematic random sampling method (Hibberts et al., 2012) was used for faculty members to have an equal chance of being chosen, whether a foreign or domestic doctoral degree holder. Only tenured/tenure-track foreign and domestic doctoral degree holders were included with minimum post-PhD experiences of three years. Faculty with less than 3-years' post-PhD experience or employed on a contract basis at sampled universities were not part of this study. All faculty members were visited individually at their offices or in departments and invited to participate. A total of 241 foreign and domestic doctoral degree holders participated in this study.

Due to the mixed methods nature of the study, additional information regarding differences in publication productivity and collaboration was collected via semi-structured interviews with university

administrators using the purposive sampling method. According to Cohen et al. (2000), the quality of a study not only stands or falls by its methodology and instrumentation's appropriateness, but also by the suitability of its sampling strategy. The chosen sites or individuals were special or unusual in some way (Mertens, 2014), which is why participants were sought not only from different academic areas and backgrounds, but also those administrative cells, and offices related to and dealing with faculty research activities, including Quality Enhancement Cells (QEC), Quality Assurance Offices (QAO), and Offices of Research, Innovation, and Commercialization (ORIC). The related university administrators were chosen because they were suitable candidates for this study and interviews. Data collected through interviews added depth to the quantitative data and offered a more complete understanding, thereby helping to answer the research questions and understand the context of faculty publication productivity and collaboration differences better between foreign and domestic doctoral degree holders. Finally, the researchers stopped asking for additional interviews having reached the data saturation point. In total, 17 semi-structured interviews were collected from 7 public universities across all categories.

Interview questions were developed based on previous literature and results of the faculty questionnaire. Interviews were conducted in person, scheduled at the interviewee's convenience to generate suitable data (Martin et al., 2020). The researcher took a list of questions to cover but did not deal with them all in each interview (Gray, 2004). Each interview in this study lasted approximately 30 to 45 minutes, and the average length was 40 minutes. Example interview questions were: 'How do you describe the differences in publication productivity between foreign and domestic doctoral degree holders?' And how do you describe the differences in research collaboration between foreign and domestic doctoral degree holders?'

### *Data analysis*

The Changing Academic Profession (CAP) questionnaire was adapted for this study. To capture suggestions for modification and further refinement, the adapted questionnaire was piloted in August 2016 among 10 educational experts and faculty members. The researcher then modified the questionnaire according to Pakistani HE system's specific characteristics and distributed the self-administered questionnaire to 300 foreign and domestic doctoral degree holders. Returned questionnaires totaled 241, among which 232 (119 foreign and 113 domestic respectively) were completed and used for analysis.

The descriptive statistics and independent samples t-test were conducted using SPSS version 20.0. Means were compared to examine differences in publication productivity between foreign and domestic doctoral degree holders, and a t-test was conducted to understand if these differences in publication productivity were significant. Furthermore, logistic regression analysis was conducted to examine the effects of demographic and individual factors on faculty publication productivity.



### Logistic regression model and variables

We developed the following analytical model to examine the effects of demographic and individual factors on faculty publication productivity, following the example of past studies on faculty publication productivity in other contexts (Nafukho et al., 2019; Kweik, 2018; Shin et al., 2014; Postiglione & Jung, 2013; Jung, 2012; Webber, 2012; Shin & Cummings, 2010; Mamiseishvili & Rosser, 2010):

$$LOGIT [Y(FDDHs = 1)] = \beta_o + \beta_1(Gender) + \beta_2(Age) + \beta_3(Rank) + \beta_4(Discipline) + \delta_1(NCol) + \delta_2(ICol) + \mu_1$$

Where  $Y$  is the dependent variable (total refereed journal articles) and foreign doctoral degree holders (FDDHs) is the independent explanatory variable, and where  $\beta_o$  is intercept term and  $\beta_i, \delta_i$ , are the independent variables' regression coefficients.

**Table 1. Dependent and independent variables in the logit model**

<b>Dependent variable</b>	<b>Measurement</b>
Total refereed journal articles (Y)	Total published refereed journal articles in the last three years
<b>Independent variables</b>	
<b>Demographics</b>	
Gender	Female = 0 (ref.)
Age	46 and above = 0 (ref.)
Rank	Assistant Professor = 0 (ref.)
Discipline	Sciences = 0 (ref.)
<b>Individuals</b>	
Nationally Collaborating	No = 0 (ref.)
Internationally Collaborating	No = 0 (ref.)

As shown in Table 1, the selected dependent variable was the total number of published refereed journal articles by faculty in the last three years, based on self-reported data. Demographic and individual level variables, including gender, academic rank, and discipline, were included to control for the effects of these variables on the dependent variable (Shin et al., 2014). Individual level variables also included whether the participants were nationally and internationally collaborating. Academic discipline was classified as sciences, social sciences, and engineering/ICT/computer sciences, to examine productivity differences according to disciplines. In addition, logistic regression analysis was applied rather than binominal regression analysis, because the dependent variable (publication productivity) did not exhibit a skewed distribution (Nafukho et al., 2019). The logistic regression analysis was, therefore, appropriate for the relatively small number of groups in this study.

Among foreign and domestic doctoral degree holder participants, 83.2% and 77% were males and

16.8% and 23% were females, respectively. In terms of academic rank, 11.8% and 23.0% of foreign and domestic doctoral holders were professors, and 27.7% and 33.6% of foreign and domestic doctoral holders were associate professors, respectively. While 58.8% and 40.7% of foreign and domestic doctoral holders were assistant professors, 1.7% and 2.7% of foreign and domestic doctoral holders were lecturers. The analysis also showed that age, post-PhD experience, discipline, and marital status of the sample were well-distributed across the different categories.

**Table 2. Demographic information of interviewed participants**

<b>Coded Names</b>	<b>Gender</b>	<b>Qualification</b>	<b>Experience</b>	<b>Position</b>
Dean1	Male	PhD	More than 7	Dean
Administrator1	Male	PhD	More than 3	Director (QEC)
Administrator2	Male	PhD	More than 2	Director (ORIC)
Dean2	Male	PhD	More than 10	Dean: Social Sciences
Administrator3	Male	Master	1 year	Dy; Director (QEC)
Administrator4	Male	M.Phil	7 years	Dy; Registrar Academic
Administrator5	Male	PhD	2 years	Director (QEC)
Administrator6	Female	PhD	More than 3	Director (FTDC)
Administrator7	Male	PhD	More than 1	Director (QAO)
Administrator8	Male	MS	4 years	Dy; Director (ORIC)
Administrator9	Male	PhD	More than 2	Dy; Director (ORIC)
Administrator10	Male	M.Phil	More than 4	Dy; Director (QEC)
Administrator11	Male	Master	2 years	Dy; Director (QEC)
Dean3	Male	PhD	More than 15	Dean
Administrator12	Male	PhD	More than 6	Director (QEC)
Administrator13	Male	PhD	3 years	Asstt: Director (ORIC)
Administrator14	Male	PhD	4-5 years	Director (QEC)

Data collection with university administrators was conducted via semi-structured interviews, consisting of a one-to-one, face-to-face interviews. Interviews were conducted in English or Urdu, according to the preference of the participants. All interviews were audio-recorded (with prior permission), prepared and transcribed verbatim, and then analyzed inductively (Creswell & Clark, 2017). The analysis was undertaken through an iterative process. Interview transcripts were read and re-read, to build familiarity with major patterns, meanings, and discrepancies. Nevertheless, in qualitative data analysis, the intrusion of researcher bias is inevitable (Shenton, 2004). Thus, an external audit was completed to restrict the influence of bias when interpreting the interview transcripts (Creswell & Clark, 2017; Cheung et al., 2018). Furthermore, several steps were taken to check for the accuracy and validity of the findings of the current study. Efforts were made to ensure validity by using best practices for the interview process, and ensuring they were implemented throughout the research process according to the research design. Field notes, during and after interviews, were gathered by the researcher to address the incomplete, partial, or selective nature of transcriptions. To further enhance the study's validity, triangulation methods were used (Shenton, 2004). The different data sources were converged and triangulated. Member checking was conducted on the transcriptions of interviews, to gather feedback from participants on the accuracy of

the identified categories and themes, and to ensure that they provided a thick and rich description to support the conclusions of the study (Creswell & Clark, 2017).

A sample of 17 stakeholders who had varied administrative experiences was interviewed. Interviewed participants' profiles, including details of degrees, years of experience, and positions they held, are shown in Table 2. Interviewed participants' experience ranged from 1 to 10 years. Table 2 also shows that the sample included deans and administrators in different positions at the selected public universities. Moreover, Table 2 displays the anonymity of interviewees. Participants were afforded pseudonyms—Dean 1, ..., Administrator 1, etc.—to ensure confidentiality.

## Results

### *Research collaboration*

Findings in Table 3 show that the majority of both foreign (60.5%) and domestic (77.9%) doctoral degree holders reported that they did not have collaborators in any of their research projects. Only 39.5% and 22.1% reported that they had international collaborators in any of their research projects in the past three years. Furthermore, a majority of both groups reported that they had been working individually, or without collaboration, on their research projects (Table 3). Indeed, foreign and domestic doctoral degree holders' reported rates of collaboration within and between institutions were 75.6% and 66.4% respectively, suggesting that collaboration had been limited to publication rather than conducting research projects. In relation to forms of collaboration, interviewees indicated that most collaborations were limited to paper publication rather than projects. Interviewees referred to the situation in the following comments:

So, collaboration with other colleagues within the faculty domain exists. If our faculty carry or secure any project, they would not be collaborating even with his/her colleagues nor involve in their research work. To be very much honest, faculty collaboration is not based on projects but is limited to only publications. Even though, we failed to promote a collaboration culture. (Dean Interviewee 2; Administrator Interviewee 4)

Findings indicated that faculty members with foreign doctoral degrees (61.3%) reported higher levels of research collaboration with international colleagues than their domestic doctoral colleagues (36.3%). The percentage of domestic doctoral degree holders having had no collaboration with international colleagues was overwhelmingly high, at 63.7%. Qualitative findings seemed to support the quantitative results. Interviewed participants identified that foreign doctoral holders had a higher tendency to engage in international research collaboration. One interviewed administrator reported that foreign doctoral degree holders show a greater propensity towards international collaboration compared to domestic doctoral holders.

The portion of both foreign and domestic doctoral degree holders reporting collaboration with industry was small (Table 3). A noteworthy portion of interviewees reflected on this dismal situation and revealed that research activities and collaboration between academia and industry is missing in Pakistan, despite its importance. The findings showed that faculty members and universities are not closely connected with firms and industry, and neither is industry interested in collaboration with academia. Most interviewed participants' responses suggested that coordinated efforts are extremely weak and public-private partnership does not exist, with even low-level cooperation with industry being absent.

**Table 3. Frequency statistic for research collaboration**

Statements	Foreign = 119		Domestic = 113	
	Yes	No	Yes	No
	Freq (%)	Freq (%)	Freq (%)	Freq (%)
1. Individually/without collaboration working on your research project	46(38.7)	73(61.3)	76(67.3)	37(32.7)
2. Having collaborators in any of your research project internationally	47(39.5)	72(60.5)	25(22.1)	88(77.9)
3. Collaborating with other persons at other institutions in your country	90(75.6)	29(24.4)	75(66.4)	38(33.6)
4. Collaborating with international colleagues	73(61.3)	46(38.7)	41(36.3)	72(63.7)
5. Collaborating with industry in the country	25(21.0)	94(79.0)	16(14.2)	97(85.8)

### *Publication productivity*

Table 4 indicates that foreign doctoral holders, in general, did not produce more publications than their domestic doctoral colleagues. Statistical inferences show that foreign and domestic doctoral degree holders did not significantly differ in the count of their refereed journal articles—11.53 and 12.56, respectively—published in the last three years. However, the analysis showed that foreign doctoral holders (7.97) had produced significantly more publications in refereed journals with impact factors than domestic doctoral colleagues (6.52). On the other hand, the average number of foreign doctoral degree holders' publications in without impact factor journals (3.67) was lower than their domestic doctoral colleagues (6.08). These findings imply that foreign doctoral degree holders tended towards publishing more research articles in refereed journals with impact factors, in comparison with their domestic doctoral colleagues.

In terms of the quantity of research publications, neither quantitative nor qualitative analyses showed any difference between foreign and domestic doctoral degree holders in Pakistan. Most interviewed participants noted that both groups' scholarly publications do not differ quantitatively, but differences exist regarding quality. One dean interviewee reported that foreign doctoral degree holders are more careful about quality, since they think that publications without an international standard are useless. They are more disposed towards innovation and good journal publications, as

articulated in the following response:

Well, when we come to quantity, these two sorts of communities are the same. But the difference exists, when it comes to quality. And the foreign faculty is more inclined toward innovation or better research so that they get published in good journals. While the domestic doctoral faculty are not that much ambitious and the only publication is the sort of target. (Dean Interviewee 2)

**Table 4. Bi-variate analyses of publication productivity by FDDHs versus DDDHs**

(Numbers in past three years)	FDDHs = 119		DDDHs = 113		p
	Mean	SD	Mean	SD	
Total published refereed journal articles	11.5294	6.56883	12.5575	6.88935	.246
Published papers in HEC recognized national & international journals with Impact Factors	7.9664	5.69408	6.5221	5.41014	.049
Published papers in other national & international journals without Impact Factors	3.6723	3.44474	6.0796	4.14285	.000
Published papers with international colleagues	2.1092	2.55379	.8938	1.76455	.000
Authored or co-authored books nationally	.2017	.57607	.1770	.50409	.729
Authored or co-authored books internationally	.3025	.71964	.0708	.37121	.002
Edited or co-edited books nationally	.1261	.57570	.1062	.40889	.763
Edited or co-edited books internationally	.0672	.38469	.0354	.22871	.447
Written book chapters nationally/internationally	.5462	1.32606	.2832	.64737	.058
Presented papers nationally at a scholarly conference	1.4958	1.97816	1.9735	2.29308	.090
Presented papers internationally at a scholarly conference	1.6102	2.44262	.7080	1.27252	.001
Carried out research projects/ works with international colleagues	.5714	1.00483	.2655	.70733	.008
Written research reports/ monographs for funded projects	.5798	1.00419	.5044	.91733	.552
Written computer programs for public use	.1092	.40735	.0796	.42556	.589

The findings in Table 4 also indicated that foreign doctoral degree holders had published significantly more papers with international colleagues (2.109) compared to their domestic doctoral hoder colleagues (.893). Foreign doctoral degree holders also presented more papers (1.610) at international scholarly conferences than their domestic doctoral colleagues (0.718). This implies that domestic doctoral degree holders were less active in collaborating with international colleagues and presenting overseas in comparison to their colleagues with foreign doctorates.

**Table 5. Logistic regression analysis**

<b>Variables</b>	<b>Coefficient</b>	<b>Std. Err.</b>	<b>Z-Statistics</b>
<b><i>Demographics</i></b>			
Male	.8479454	.08832	2.34*
Age 25-30	-2.164591	.10457	-4.46***
35-40	1.911755	.11493	3.79***
41-45	1.672952	.1089	3.42***
Professor	-.272339	.14567	-0.46
Associate professor	-.1690482	.09521	-0.44
Social sciences	-.0729279	.08809	-0.21
Eng:/ICT/Computer sciences	1.402413	.08191	3.95***
<b><i>Individual variables</i></b>			
Nationally collaborating	.0890526	.08986	0.25
Internationally collaborating	-1.172845	.07284	-3.91***
No. of obs = 232			
LR chi2(10) = 56.11			
Prob > chi2 = 0.0000			
Log likelihood = -132.71957		Pseudo R2 = .01745	

Notes: Coefficient (Standard error); \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

With regard to differences in other scholarly written publications, such as books and edited books, publications with international colleagues, and international scholarly conference presentations, both quantitative and qualitative analyses showed differences between the two groups. Most interviewees reported that foreign doctoral holders engaged more in collaboration with international colleagues and scholarly conference paper presentations at international level, compared with domestic doctoral holders. With regards to collaboration, scholarly gatherings and conferences, one interviewed participant referred to:

Well, when it comes to competency and other gatherings, again the foreign, you know, the credit goes to foreign qualified faculty members. Because once they are pursuing their PhD studies anywhere in the world, they got to collaborate, to interact with the specific scholarly community in which he/she belonged. The foreign qualified faculty with this impression when he comes back, he or she wants to interact more and more with the remaining sort of members, academic domain. Therefore, he/she wants to be at conferences more often than their domestic colleagues. (Administrator Interviewee 9)

Most interviewed participants perceived that those who opted for foreign studies and carried out their studies in a foreign country or remained abroad have had more exposure and interaction with different cultures of research. They reflected that foreign doctoral holders are well-aware of international standards of conducting research and know how to be part of a scholarly community with different research groups. For example, one administrator reported that returned scholars come from a research-intensive environment and are more familiar with the politics of publishing at international

level than domestic doctoral degree holders. He articulated in detail in the following response:

I see the foreign qualified faculty difference from others, is that they had their supervisors who made them learn the politics of publishing. Through their supervisors, they got to know the politics of publishing internationally. I can say that those faculty members have foreign PhD who did their PhD abroad or in foreign universities publish papers more in impact factor journals than domestic PhD degree holders. (Administrator Interviewee 8)

### *Regression analysis*

Table 5 indicates that the logistic regression analysis revealed no difference in publication productivity between foreign and domestic doctoral degree holders. In terms of total number of refereed journal articles, our regression model showed that demographic variables like gender, age, and discipline were statistically significant. For example, female faculty generally published less refereed journal articles than their male colleagues. Age was also a significant variable that influenced faculty publication productivity. Older foreign and domestic doctoral degree holders published more than their younger colleagues (30-35). Specifically, the regression results showed that faculty aged between 36 and 45 were likely to publish more than their colleagues who were over 46. Moreover, academic discipline was found to be a significant variable as expected, and faculty members in engineering/ICT and computer sciences published more refereed journal articles than their colleagues in sciences and social sciences (Table 5). Individual variables such as internationally collaborating were statistically significant and influenced faculty publication productivity. According to the analysis, both foreign and domestic doctoral holder faculty who lacked collaboration published a smaller sum of articles in refereed journals in the last three years compared with those who had internationally collaborated.

### **Discussion and implications**

Faculty engagement in research and collaboration activities is essential to the enhancement of publication productivity and the optimization of individual and institutional advancement. The purpose of this study was to examine faculty publication productivity and collaboration differences between foreign and domestic doctoral degree holders serving at Pakistani public universities. Statistical inferences indicated that foreign and domestic doctoral degree holders had not significantly differed in the count of total refereed journal articles that they had published in the last three years. However, a significant difference was identified with regards to the research quality, that is, foreign doctoral holders significantly published more research papers in internationally-indexed journals with impact factors. On the other hand, foreign doctoral degree holders made significantly fewer publications in journals without impact factors in comparison with their domestic doctoral colleagues. This finding implies that foreign doctoral degree holders are more likely to be disposed toward high-

quality research publications, influencing their emphasis on exporting research by publishing in journals indexed internationally with impact factors. These findings are in line with the findings of past research which revealed that a high proportion of returnee scholars increased the ratio of international publishing and publishing in high-impact journals (Jonkers & Cruz-Castro, 2013). This finding has implications for policy and decision-making bodies that could incentivize SCI, SSCI, and A&HCI publications to increase domestic doctoral holders' publication visibility at the international level. Publishing internationally can help faculty to become recognized and accepted internationally, as well as contribute to the improvement of Pakistani HEIs' productivity and reputation in national and international league tables (Xu et al., 2019; Xu, 2019). Furthermore, productive faculty members not only expand knowledge in their professional fields by integrating their findings with those of others through scholarly publications circulated around the world, but they also bring visibility and prestige to themselves and their affiliated institutions.

Another significant difference was found between foreign and domestic doctoral degree holders regarding international co-publishing. The analysis showed that foreign doctoral degree holders published significantly more papers with colleagues internationally than their domestic doctoral colleagues did. Established practice suggests that research publications' visibility at the international level and their consequent citations are generally used as key criteria in university rankings globally, and as indicators of HEIs' level of internationalization (Hazelkorn, 2015). In line with these practices, the HEC and university authorities could nurture a culture of prolific publishing and emphasize the export of research by publishing in journals indexed internationally to enhance Pakistani sciences and social sciences research to a 'world-class' level. In addition, the government could incorporate incentive schemes for faculty members to publish internationally into their internationalization strategies. Incentivization of international publications is essential for universities to develop into "world-class" institutions. Public universities could encourage faculty, particularly domestic doctoral degree holders, to publish in international journals to achieve their pursuit of becoming a 'world-class' university. It is also an integral way for universities to enhance their impact and improve research quality at national and international level.

An important difference also emerged between the two groups in relation to research collaboration with international colleagues. Foreign doctoral degree holders were more active in collaborating with international colleagues compared to domestic doctoral colleagues, implying that foreign doctoral holders were more involved in international research collaboration and placed more emphasis on collaborative work than individual. Researchers have confirmed that social relations and collaborations help to raise the research ability of faculty (Lee & Bozeman, 2005; Landry et al., 1996), and international collaboration, in particular, creates genuine and exceptional outcomes in research groups' scientific performance (Barjak & Robinson, 2008; Martín-Sempere et al., 2002). As a result, research policies should focus on nurturing international collaboration in Pakistan. This could help to increase faculty members, particularly domestic doctoral holders' awareness of



internationalization, and thus help faculty members to engage in collaboration and knowledge exchange internationally. Government and university-level policymakers should establish internationalization of research at the center of their research policies, to internationalize faculty research activities and collaboration and strengthen national and international competitiveness, while increasing the international visibility of Pakistani knowledge production. Faculty members, and domestic doctoral holders in particular, are required to expand their research collaboration at the international level to enhance effective knowledge production and increase their publications' international visibility and impact. Collaboration that begins with generous funding often continues after that funding cycle ends (Kwiek, 2020). Therefore, if the HEC and university authorities aim to improve faculty publication productivity and achieve a wider social impact and competitiveness in the global rankings game via research outputs, they should provide funding, effective incentives, and resources to faculty members. Thus, the international competitiveness of universities not only relies on teaching quality of faculty members but also their research performance.

The analysis of this study also revealed that only a small fraction of faculty members collaborate with industry in Pakistan. The findings showed that neither faculty members nor universities are closely connected with industry, and industry is not interested in collaboration with faculty and universities, thus suggesting that collaborative efforts are extremely weak and public-private partnership is very limited in Pakistan. Therefore, the HEC should employ certain strategies to develop research collaboration between universities and industry in the country. These collaborations can produce readily applicable knowledge, fuel innovation, and help universities to better establish links with industry while also creating a high-quality research environment. This could encourage faculty members to collaborate with industry and encourage more research grants from industry, in turn, which will help to further incentivize academic research and to materialize policies and initiatives of public/private sectors.

The current study's contribution to HE research is both theoretically and practically significant. On the theoretical level, the study expands the stock of existing literature examining the publication productivity and collaboration differences between foreign and domestic doctoral degree holders by using knowledge recombination theory and mobility approaches. The findings made a theoretical contribution to knowledge recombination theory and mobility approaches and justified the framework's relevance for the current study. The findings confirmed that mobility helps with knowledge flows and that knowledge gained from distant sources is significantly more creative when compared to domestic knowledge (Fleming, 2001). The qualitative findings also revealed that foreign doctorates are commonly more productive, and that the quality of their publications compares favorably to their domestic doctoral colleagues (Kim et al., 2011; Mamiseishvili & Rosser, 2010), and additionally, they could have benefited from sets of unique knowledge that are not accessible to their domestic doctoral colleagues (Saxenian, 2005). The empirical evidence suggests that mobility as a method of brain circulation not only develops professional networks, increases the available resources,

and augments the scientific and technical human capital of a scholar (Edler et al., 2011), but also leads to better global knowledge flows, exchanges and benefits regarding the expansion of knowledge production, career advancement, and the opportunity for employers to find unique or rare sets of skills (Regets, 2007; Edler & Georghion, 2007).

At the practical level, the findings of the current study indicate that those who move internationally and opt for foreign study could be beneficial for home countries and undoubtedly help to support institutions in achieving their research excellence goals (Li et al., 2015). The findings suggest that foreign doctoral degree holders and returned scholars might benefit domestic institutions in two main ways: First, the knowledge and skills acquired outside the country may promote quality improvement and expansion in research areas at these institutions. Second, an institution may be provided with access to international academic networks and materials by returnees, who act as a bridge between domestic institutions and academic networks at an international level (Velema, 2012). This also suggests that foreign doctoral degree holders are a valuable resource with the potential to transform universities into more diverse, effective, and globally competitive institutions (Altbach & Yudkevich, 2017). Consequently, they should be viewed as change agents by both national governments and HEIs, who can kick start reform at a systemic or institutional level (Altbach & Yudkevich, 2017), and could be an essential driver of increased publication productivity and quality of the research effort in developing countries such as Pakistan (Rahman, 2012).

Despite its contributions, this study has some limitations. However, a study's limitations allow readers to decide on its usefulness (Marshall & Rossman, 2011). First, this study was restricted to those faculty members with a minimum three-year post-PhD experience and who were serving at public universities. Due to this, the findings of the study should be generalized to the population with caution. Although the study still provides valuable information, a more comprehensive sample, and the ability to generalize findings more broadly would have strengthened the study. Second, the current study does not focus on a specific research field. Thus, future studies may specify these analyses to the main academic fields, for instance, natural sciences, engineering and computer sciences, and social sciences, etc. Finally, a longitudinal component would complement the snapshot provided by the current study.

### *Conclusion*

Despite foreign doctoral degree holders' increasing visibility and significance in HEIs (Osama et al., 2009) they have generally been neglected in Pakistani higher education literature and received limited empirical attention with regards their publication productivity, quality and collaboration (Rahman, 2009, 2012). This study aimed to address this gap to expand the stock of existing literature by examining publication productivity and collaboration differences between foreign and domestic doctoral degree holders in Pakistan.

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