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Factors Influencing Research Productivity in Higher Education Institutions in India

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This study is an attempt to examine and determine the factors that influence the research productivity of higher education institutions, the study has been done based on the primary data collected from top universities in West Bengal. A total of 303 responses are considered for this study, which are collected from the research scholars, assistant professors, associate professors, and professors of the selected universities. The scale has been formed using the factor analysis method and there are four scale has been formed in which three of them are found valid and significant. Binary logistic regression has been used to show the level of significance of scales in each of the models consisting of research scholars, assistant professors associate professor and professors. Among the four scales, Individual motivational factors and Institutional factors are found significant (significance at <5% level) for the growth of research publications of the institutions under investigation. Whereas, research support, academic environment is still not sufficient to influence the research activities in these universities.

Keywords: Research Productivity; Influencing Factors; Scientific Publication; Institutional Factors; Individual Factors; Universities; India.

1 Introduction

Scientific publications have been correlated with countries' intellectual wealth and economic development (Jaffe et al, 2020). The outcomes of scientific studies, which are published in scholarly journals, might be seen as research performance of any academic institutions. The publications appeared in indexed databases is the most frequently used metric to gauge research productivity, and it is a sign of excellence for institutions of higher education (Heng et al., 2020). To better understand how research performance within the university system could be enhanced, the study of the factors influencing research output has attracted interest on an academic and regulatory level (Bonaccorsi & Secondi, 2017). Many academics have been interested in the topic of research productivity in recent years. They have concentrated on the analysis and distribution of the number of publications as well as the factors that either directly or indirectly affect productivity. However, the findings about the elements influencing the research yield are still inconclusive. The analysis based on the secondary data retrieved from bibliographic database is not able to give clear direction about the influenced factors. To highlight on that this chapter has been introduced.

2 Theoretical Framework

Research productivity refers to creative thoughts and ideas that, after being studied theoretically and practically, published as articles in journals, published as conference papers, as book chapters, books or as patent registration (Hedjazi and Behravan, 2011; (Ransdell, 2001). Zainab (1999) mentions research productivity is the registration or publication of research findings in the form of journal articles, conference papers, reviews, patents. Several influencing factors has been identified based on the previous studies which are basis of the growth of research productivity of any institution's faculty members and research scholars and other academy staffs. These factors are categorised as Individual factors, Institutional factors (Turner and Mairesse, 2003), and some demographic factors are also there.

2.1 Demographic Factors

There are differences of publications has been identified according to the gender of the faculties or researchers, evidence has been there in the study of Turner and Mairesse, 2003 where they were identified that there are significant differences between males and females in terms of number of produced articles. In some other studies it was showed that women are less productive compared to men in scholarly

production (Pfeiffer et al., 2016; Kyvik and Aksnes, 2015). It was noticed that scholars of the highly ranked institutions are more productive compared to a below ranked institution (Long et al., 2009; Amara et al., 2015). The work experience of the researcher and time spent on research both are considered as influential factors to enhance the publication productivity (Dhillon et al., 2015; Swihart et al., 2016; Fursov et al., 2016; Amara et al., 2015). Discipline wise variations has been observed in the production of publication, scientific disciplines always contribute more publication compared to social science, arts and humanities (Obemebe, 2012).

2.2 Individual Factors

It was found that age and experience of the researcher increases the scholarly publications of individuals as well as institutions he/she belongs to (Fursov et al., 2016; Dhillon et al. 2015). Collaborative research works has always a positive and influential impact on research growth of individuals as well as of the country (Gomes et al., 2011; Morris et al., 2011; Mamun and Rahman, 2015), collaborators or mentors always motivates the researchers and as a result of this the growth of publication increases (Ransdell et al., 2001). Apart from, international collaboration opens up the scope of publication for any researchers (Abramo et al., 2011; Fursov et al., 2016) and found it as a significant factor of publication growth (Ibegbulam and Jacintha, 2016). In some other studies it is found that, if the teaching load of the faculty members reduced then it effects in the publication productivity with increasing in numbers (Mamun and Rahman, 2015; Iqbal and Mahmood, 2011). The literatures published by Ibegbulam & Jacintha (2016); (Hoffman et al. (2017) and Isfandyari-Moghaddam et al. (2012) identifies some motivational factors which causes the rate of increasing of research productivity, such of these factors are researcher's own satisfaction to contribute to the field of which he belongs to and the other one is satisfaction by staying current in the field. Curiosity and creativity are also an important motivating factor of the growth of research productivity (Fennewald, 2008). According to a study by Ajegbomogun, F. O., and Popoola, S. O. (2014), candidates' self-efficiency during the hiring process as faculty should be given adequate importance in order to foster a favourable attitude toward boosting the research productivity. Apart from all these individual factors, positivity among the researchers about the research work is also plays a great deal in increasing the scholarly publication.

2.3 Institutional Factors

Institutional factors positively associated with the publication output at individual level, institutional level as well as country level. These factors comprise of library infrastructure to support with relevant information, freely available of internet connections inside the campus, provision of accessing the latest books, journals and e-journals, remote access facility to access the e-resources subscribed by the institutions, scope of attending seminars, scope of publication in university's own journals, recognition for publication (Fig. 1). A Study by Hollister and Schroeder (2015) found that adequate library infrastructure could play a role in increasing the number of publications by providing relevant information according to the researcher's need. Internet facility is also an important support to the researcher to find the e-resources from the subscribed resources of the university (Ajegbomogun and Popoola, 2014).

Provision of getting latest edition of books, journals and e-journals also enhance the research productivity (Iqbal and Mahmood, 2011). Remote access facility is one of the hybrid types of support where users can access the e-resources of the institution's subscribed collections from a remote place which also a supporting tool to enhance the publication productivity of the institution (Rafi, 2019 and Boukacem-Zeghmour et al., 2016). In the same way encouragement for attending seminars/conferences is also helps to increase the number of publication (Obemebe, 2012). Except these facilities, a well-equipped laboratory facility for conduct lab-based research works and recognition for publication in highly impact or indexed journals are also important factors for enhancing the numbers of scholarly publication.

3. Method of Statistical Analysis

3.1 Data Collection and Sampling

The primary data were collected by using an online survey. The total population with full-time faculties and research scholars at the selected six universities are around 5000 (based on the data available in respective university websites, during the survey in the month of March-April 2022). Stratified random sampling with proportional allocation to each

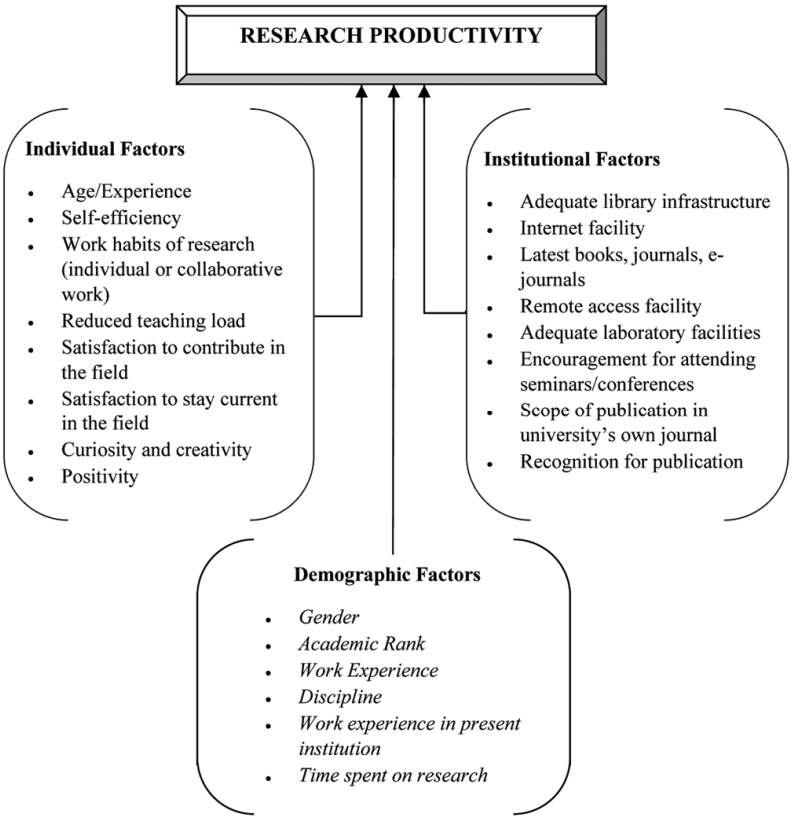

Fig. 1 — Conceptual framework of factors Influencing Research Productivity

university were applied. A total of 1304 emails were sent out and we received 336 responses (the response rate was around 25%). Out of the total 336 responses, 33 responses have been excluded due to incompletion of the questionnaire, criteria like minimum one year completion in the affiliated universities and at least one publication by the respondents were considered for inclusion in the study, finally with all inclusions and exclusions 303 responses has been considered for the study. The faculty emails were obtained randomly from the websites of the selected universities. We obtained informed consent from the participants for their voluntary participation on the condition that the information provided through the form would remain anonymous and will be used strictly for academic purpose. Table 5.2 shows the demographic profile of the final sample.

The following Cronbach's formula has been used for the determination of the sample size.

$$n = \frac{z^2\,(pq)}{e^2}$$

where,
z = 1.96
p = probability in sample (here, Authors with at least 5 publications are assumed to constitute 70% of the total population, hence the value of p = 0.7)
q = 1-p (1-0.7 = 0.3)
e = acceptable sample error (0.05)

According to the formula the actual sample size will be –

$$n = \frac{z^2\,(pq)}{e^2} \qquad n = \frac{1.96^2\,(0.7 - 0.3)}{0.05^2}$$

n = 3.8416*0.21/ 0.0025
n = 0.806736/.0025
n = 322.6944 or 322 (Approx.)

3.2 Survey Instrument

The questionnaire used in the study has been written in English. The questionnaire consists of 31 questions.

The main parts of the questionnaire are Part 1, General and demographic information of the researcher, where questions like name of the affiliated university, gender, academic rank, work experience, discipline etc. Demographic questions are self-explanatory; however, the remaining questions deserve explanation.

Part 2 has two sub sections. In sub section 2.1 there are 10 questions on behavioural characteristics of the researcher, questions on satisfactory level, curiosity about the research were asked for the measurement of individual factors influencing research productivity. In sub section 2.2 there are 9 questions on institutional level metrics are presented which are associated to the measurement of the factors influencing the research productivity. All these part 2 questions are designed on a five-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5).

In section 3 few close and open-ended questions (opinion and suggestions) are given to gather the view of researcher's and faculty's about the facilities and infrastructures to increase the rate of research productivity. The individual items in each scale can be found in Table 1.

Cronbach's α coefficient has been applied prior to data analysis to check the reliability of the instrument (questionnaire). Overall, the scales have been found to be reliable as the value of Cronbach's α coefficient are above 0.6, indicating an acceptable level of reliability.

3.3 Determination of Indices using Factor Analysis

Reliability and Validity of Constructed Scales: Cronbach's Alpha for each of the used scales demonstrates an acceptable level of internal consistency (correlation among the items), establishing dependability, assuming that 0.6 is the acceptable lowest value of internal consistency for scales with fewer than 20 items (Dall'Oglio, et al. 2010) (Table 1). Additionally, each agency dimension's factor loadings in principal component analysis (PCA) shows that the underlying data match the proposed model reasonably well (Table 1).

However, the factor loadings on individual motivational factors scale, Institutional factors scale and Research support scale are more reliable as compared to Academic environment scale.

The above table describes the individual instrument of each of the scales formed using the Factor Analysis Method. Among the 19 questions asked to the respondents 16 found to be fit in four scales. The scale of institutional factors found as most significant than the other scales with the value of Cronbach's α coefficient of 0.869. The scale is formed with six components, viz. adequate library infrastructure, accessibility and utilization of internet resources in the campus, accessibility to the latest books, journals and e-journals, remote access facility to the e-resources etc. The second most significant scale is research support scale (Cronbach's α coefficient of 0.709), where questions like scope of publishing of

Table 1 — Validity and Reliability Statistics of Various Scales

Scale Items	*Factor Loadings From PCA*	*Cronbach's Alpha*
Individual motivational factors		.655
Satisfaction to researchers own need to contribute to the field is important	.794	
Satisfaction to researchers own need to stay current in the field is important	.772	
Curiosity and creativity of the researcher produces more research	.620	
Positivity among the researchers to do well for the society with their research work is an important motivating factor	.621	
Academic environment		.397
Academic Rank of the institution plays key role in research	.716	
Work Habits (Individual or Collaborative nature of work) of the researcher is important for research output	.657	
Discipline wise scope of publishing research articles is a factor for high rate of production	.654	
Institutional factors		.869
Your University Library has adequate infrastructure for supporting Research	.808	
Accessibility and Utilization of Internet Resources in the campus is sufficient	.746	
Your university has provision for access to the latest books, journals and e-journals	.860	
Remote access facility to the university's e-resources is adequate	.769	
Adequate laboratory facilities to conduct research are present	.798	
University encourages to attend Seminars/Conferences	.679	
Research support		.709
There is provision to publish the research work in university's own journals	.760	
University provides ample scope for collaborative research work	.830	
University provides recognition for publication in high impact/UGC-Care listed journals	.802	

research in university's own journal, provision of collaborative research and recognition for publication were there. The third most significant scale is the Individual motivational factors scale (Cronbach's α coefficient of 0.655), where questions on satisfaction for researcher's own need of contributing in the field and to stay current on the field, questions on curiosity, positivity was also there.

3.4 Binary Logistic Regression

Binary logistic regression is one of the most widely used method in different fields, commonly for dichotomous dependent variables. Also, in higher education this method has been applied numbers of times to determine various aspects related to qualitative or quantitative issues. The determinants of the several dimensions of factors influencing research productivity have been estimated using binary logistic regressions.

The basic form of the binary logistic regression used is:

$$\text{Log } (p/1\text{-}p) = b0 + b1*x1 + b2*x2 + b3*x3 + b3*x3+... bk*xk$$

Where,

b0 is the constant

b1, b2, b3... bk are the coefficients of the independent variables

x1, x2, x3.... xk. P is the estimated probability of the dependent variable assuming a value of 1.

A dichotomous dependent variable was created from the continuous variable 'number of publications', such that 5 and above publications for the respondent has been coded as '1' and below 5 publications has been coded as '0'.

4. Results and Discussion

4.1 Description of Sample Variables

The complete demographic characteristics of the primary samples collected for the study has been described in Table 2. Among the total 303 responses considered for the analysis 66% response is from male faculties and research scholars. Academic discipline wise distribution of the responses recorded, from Science, the most with 43.56 % of the total response has been received, followed by Social Science (23.1%), Arts and Humanities (19.8%), Engineering & Technology (9.9%) and Interdisciplinary (3.63%).

Among the universities most number of responses recorded from Jadavpur University followed by University of Burdwan and University of Calcutta. Response rate of the rest of the universities is very less compared to others. The designation wise distribution shows that most number of respondents are recorded from the pursuing doctoral and post-doctoral level scholars of these universities, total 106 scholars record has been included, with this 83 professors, 82 assistant professors and 32 associate professors from different domains has been responded. Among all the respondents 61.39% completed at least or more than 5 years in the present institution and 62.38% out of the 303 respondents published at least 10 or more articles.

4.2 Scale wise respond rates

Table 2 — Sample Characteristics

	Frequency	Percentage (%)
Gender		
Men	200	66
Women	103	34
Academic Discipline		
Science	132	43.56
Engineering & Technology	30	9.9
Social Science	70	23.1
Arts and Humanities	60	19.8
Interdisciplinary	11	3.63
Affiliated Institution of the Respondents		
Jadavpur University	127	41.91
University of Calcutta	50	16.5
University of Burdwan	51	18.83
University of Kalyani	28	9.24
University of North Bengal	25	8.25
Presidency University	22	7.26
Designation of the Respondents		
Professor	83	27.39
Associate Professor	32	10.56
Assistant Professor	82	27.06
Research Scholar	106	34.98
Years completed in the Institution		
>10 years	104	34.32
5years-10years	82	27.06
<5 years	117	38.61
Minimum Publications		
>50	83	27.39
10-50	106	34.98
<10	134	44.22

Table 3 — Response percentage in individual indices

Constructed Indices	Agree	%	Disagree	%
Index of Individual motivational factors	164	54.1	139	45.9
Index of Academic environment	167	55.1	136	44.9
Index of Institutional factors	169	55.8	134	44.2
Index of Research support	142	46.9	161	53.1

Table 3 presents scale wise response rates of factors influencing the productivity of a higher education institution. Out of the four scales three of them agreed by more than 50% of the total respondents. The scale of Institutional factors received the highest number of positive responses where 169 (55.8%) of the total 303 respondents agreed that this factor plays influential role on the growth of the productivity. Whereas, the scale of Research support has not found as an important factor of enhancing the productivity of research among the scholars and faculties of higher education institutions.

4.3 Response rate of indexed materials

Table 4 — Components wise Response Rate in each of the Index Materials

Index Materials	1 (strongly disagree)	2	3	4	5 (strongly agree)	Total*value
Individual motivational factors						
a. Satisfaction to researcher's own need to contribute to the field is important	-	4	27	97	175	1352
b. Satisfaction to researcher's own need to stay current in the field is important	3	3	29	107	161	1329
c. Curiosity and creativity of the researcher produced more production	1	1	16	62	223	1414
d. Positivity among the researchers to do well for the society with their research work is an important motivating factor	4	6	33	98	162	1317
Total	5412					
(Average degree of response rate of agree/disagree to each indexed component- 4.47)						
Academic environmental Factors						
a. Academic Rank of the institution plays key role in research	23	35	108	84	53	1018
b. Work Habits (Individual or Collaborative nature of work) of the researcher is important for research output	-	06	23	90	184	1361
c. Discipline wise scope of publishing research articles is a factor for high rate of production	1	9	58	126	109	1242
Total	3621					
(Average degree of response rate of agree/disagree to each indexed component- 3.98)						
Institutional factors						
a. Your University Library has adequate infrastructure for supporting Research	13	39	81	101	69	1083
b. Accessibility and Utilization of Internet Resources in the campus is sufficient	7	22	63	107	104	1188
c. Your university has provision for access to the latest books, journals and e-journals	12	32	62	111	86	1136
d. Remote access facility to the university's e-resources is adequate	25	35	74	113	56	1049
e. Adequate laboratory facilities to conduct research are present	13	43	98	97	52	1041
f. University encourages to attend Seminars/Conferences	8	35	69	101	90	1139
Total	6636					
(Average degree of response rate of agree/disagree to each indexed component- 3.65)						
Factors related to Research support						
a. There is provision to publish the research work in university's own journals	98	67	55	47	36	827
b. University provides ample scope for collaborative research work	24	44	99	71	65	978
c. University provides recognition for publication in high impact/UGC-Care listed journals	39	47	80	72	65	970
Total	2775					
(Average degree of response rate of agree/disagree to each indexed component - 3.05)						

Note: Scale ranging from "strongly disagree" (1) to "strongly agree" (5)

The table below (Table 4) describes the degree of response rate of agree/disagree to individual instrument of each of the scales formed using the Factor Analysis Method. Every instrument in a scale is measured by the given value of 1 to 5 using Likert Scale where 1 denotes to the strongly disagree and 5 denotes to strongly agree. The calculation found that the value of the instruments in the scale of Individual motivational factors got the highest average value of 4.47 per respondents, which means that the respondents strongly agreed that each of the factors in this scale has very much important for the growth of the research productivity of the universities. Components of Academic environmental factors also received the response rate of 3.98 on average by every respondent, whereas the components of Institutional factors scored 3.65 on average per respondents. The lowest average score measured for the components in the scale of Research support where only 3.05 average score is recorded by the respondents indicating the less importance than the other scales.

4.4 Significant factors influencing research productivity: Results of Binary Logistic Regression Analyses

A Binary logistic regression analysis was conducted to test the significance of the determinants of factors influencing research productivity in different models. Table 5 presents the results of the binary logistic regression analyses for different dimensions of factors associated with enhancing the research publications at institution level.

Model-I (for Research Scholars): Model-I refers to research scholars, where work experience of the researchers found most significant factor for enhancing the publication, the value of the regression found significant for individual motivational factors (significance at <10% level) and research support (significance at <10% level). Other general variables like gender, time spent on research and among all the indices academic environment, institutional factors are not found to have any significant association with the publication productivity of the researchers. Some other factors are also there for enhancing the numbers of publication.

Model-II (for Assistant Professors): In case of assistant professors the result of binary logistic regression indicates that variable like work experience has significance role on increasing the publication of the faculties, but factors like gender, time spent have not found significant in this regard. Among the four indexes constructed as par the factors loading using principal component analysis (PCA), the index of academic environment found to be most significant (significance at <5% level) for enhancing the publication of the faculties.

Model-III (for Professor and Associate Professor): In Model-III results has been shown for Professors and Associate Professors, where the regression analysis shows that work experience is more effective than any other factors to increase the publications and it is significant at <1% level. Among the four indexes Individual motivational factors and Institutional factors are also found significance at <5% level. Scale of academic support and research support are not found to have any significance role on increasing the publications. Though these factors are measurable, except these some other constants are also there which have some positive impacts on enhancing the publications

Table 5 — Determinants of factors influencing research productivity

Variables	*Model-I* Exp (β)	*Model-II* Exp (β)	*Model-III* Exp (β)	*Model-IV* Exp (β)
Gender	0.51	0.4	0.43	0.49*
Work experience	1.57***	1.38***	1.32***	1.47***
Time spent on research	0.99	1.00	1.56	.99
Index 1: Individual motivational factors	2.95*	0.91	0.01*	1.53**
Index 2: Academic environment	0.51	7.34**	1.00	1.69
Index 3: Institutional factors	0.64	0.57	0.62*	0.66**
Index 4: Research support	2.52*	1.3	1.42	1.28
Constant	0.05***	0.22	0.18***	0.14***

Note: *** indicates significance at <1% level; ** indicates significance at <5% level; * indicates significance at <10% level;

Model-I Research Scholar; Model-II Assistant Professor; Model-III Professor and Associate Professor; Model-IV: Overall research productivity of institution

among the professors.

Model-IV (Overall research productivity of institution): Finally, the model-IV presents the results for the determinants of research productivity at institutional level which comprises research scholars, assistant professors, associate professors, and professors. The result of binary logistic regression shows that among the individual variables gender and work experience have significance role on enhancing the productivity of the individuals as well as of the institutions for which he/she works for. The other individual variable, i.e. time spent on research has not found significant according to the result.

The four indexes formed which together consists with 16 individual questions associated with the number of publications of any higher education institutions. The scale on individual motivational factors have found significance (level of significance at <5%) for increasing the numbers of publications. Also, the institutional factors consists by items such as adequate library and laboratory facilities, internet services in the campus, access to latest books, journals, e-journals etc. are also found significance (level of significance at <5%) for enhancing the number of publications. Despite of these two scale, the scale of academic environment and research support have not found significant role in the matter of increasing the numbers of research of any institution.

5. Findings

Data analysis reveals that several factors have a substantial impact on the rise of publication productivity among the research scholars and faculty members of Universities in West Bengal. In Model-I, which is associated with the Research Scholars, where work experience of the researchers found most significant factor for enhancing the publication, the value of the regression found significant for individual motivational factors (significance at <10% level) and research support (significance at <10% level). The Model-II describes the factors for the Assistant Professors, where the result found that work experience has significance role on increasing the publication of the faculties, but factors like gender, time spent have not found significant in this regard. Among the four indexes constructed as par the factors loading using principal component analysis (PCA), the index of academic environment found to be most significant (significance at <5% level) for enhancing the publication of the faculties of this level.

The Model-III associated with the factors influencing for the growth of productivity among the Associate Professors and Professors, where the regression analysis shows that work experience is more effective than any other factors to increase the publications and it is significant at <1% level. Among the four indexes, Individual motivational factors and Institutional factors are also found significance at <5% level. Scale of academic support and research support are not found to have any significance role on increasing the publications. Though these factors are measurable, except these some other constants are also there which have some positive impacts on enhancing the publications in all the models described.

The overall research productivity of institutions is described in Model-IV and the result found that among the individual variables gender and work experience have significance role on enhancing the productivity of the individuals as well as of the institutions for which he/she works for. The other individual variable, i.e. time spent on research has not found significant according to the result (Fig. 2).

Based on the results of the Binary Logistic Regression the proposed framework has been developed describing the significant factors influencing Research productivity among the scholars and faculty members of Universities in West Bengal.

The four indexes formed which together consists with 16 individual questions associated with the number of publications of any higher education institutions. The scale on individual motivational factors have found significance (level of significance at <5%) for increasing the numbers of publications. Also, the institutional factors consist by items such as adequate library and laboratory facilities, internet services in the campus, access to latest books, journals, e-journals etc. are also found significance (level of significance at <5%) for enhancing the number of publications. Despite of these two scales,

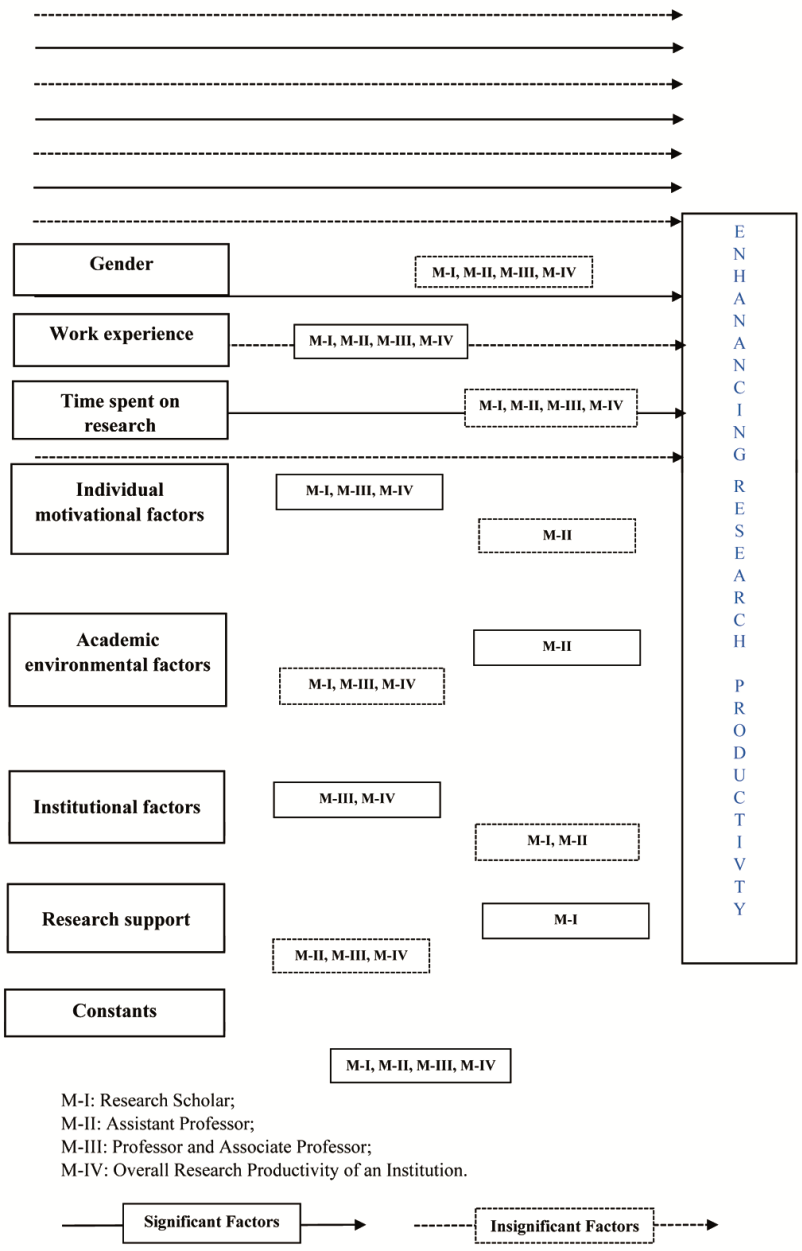

Fig. 2 — Significant Factors Affecting Research Productivity in Different Models

the scale of academic environment and research support have not found significant role in the matter of increasing the numbers of research of any institution.

Conclusion

The factors influencing research performance has been analysed based on the primary data and it is found that the individual variables, viz. gender and work experience have significance role on enhancing the productivity. With this, Individual motivational factors and Institutional factors are also found significant (significance at <5% level) for the growth of research publications of an institution. The results also found that research support, academic environment is still not sufficient to influence the research activities in these universities. To overcome the problems more funding should be granted from the governments to this kind of top universities of the states.

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