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Factors and determinants affecting research productivity of academicians of technical institutes in Gujarat

Dr. Krishnaba Vaghela

Assistant Professor at Graduate School of Management Studies, Gujarat Technological University

Corresponding author email: krishnavaghela710@gmail.com

Dr. Kaushal Bhatt

Associate Professor at Graduate School of Management Studies, Gujarat Technological University

Abstract---Research is vital and necessary part of modern university education; universities are expected to provide such opportunities to academicians for creating new knowledge. In ancient India, Universities played same role to provide new knowledge to the society. The role of universities, academicians and students is little but different from the 19th century; the demands of the 21st century are enormously higher. Faculties at new capacity-building institutions along with new scopes and self-boundary in higher education in India are subjected to strong individual engagement to participate in academic research productivity. Research highlights may be new problems or old problems with new solutions collects data or information, either process available data and get new information and may draw conclusions and make recommendations. Research Productivity is part of research but one step ahead in research where individual research has some impact or contribution to the society as well as researcher. Can we measure research productivity of faculties? Is it as simple task as it seems to be? Some of the parameters have been studied and upto some extent accepted as Measuring the research productivity of faculty but a complex issue because of many contributing factors, in this paper Author has tried to find out the factors affecting research Productivity among academicians of technical institutes in Gujarat. On the basis of past researches by various research scholars, 4 main factors as parameters were developed for the study namely Knowledge, Research inclination, Institutional support, and work environment. The purpose of this study was to determine the factors that explain the research productivity of academicians of various technical institutes in Gujarat

Keywords---research productivity, knowledge, research inclination, institutional support, work environment.

Introduction

"If the core activity of the scholarly and academic professions is the advancement of knowledge, the criterion for determining who belongs to these professions is research productivity".

Is research continue process? Or Research has always coma, not a full stop. Research is, in which a researcher searches for truth or tries to reach near the reality. Research may highlight new problems, or new solutions to already solved problems, may collect data or information about those problems and try to draw conclusions and make recommendations. The researcher needs to investigate data carefully, analyze data, explain data and verify the facts again and again from various perspective, research corrects the mistakes and in most of the cases, the researcher adds and advance the knowledge. Knowledge gained through research is always objective, subjective and scientific. Research-based knowledge is mostly logical, rational and based on experience. Rashid (2001), Research is a conscious effort to collect information, verify the information and to analyse the information. Research is an organized effort to solve the complex and teasing problems. While Research Productivity is combination of two words "Research" and "Productivity. "Research" means very careful, observant, and vigilant study or investigation of phenomena, particularly to search and find out new particulars, information and facts from unknown to known or known to unknown. While "Productivity" means production or output, produced in duration of time. Here timeline is also important factor which needs to be considered. Both the words means different to different people in different situation. Although a few scholars find that academics' research does not bring any benefits to teaching quality (Feldman, 1987; Thomas & Harris, 2000), many studies indicate that a combination of teaching and research can enhance teaching quality because teaching quality is a desirable aim of all universities (Brew, 2003; Brew & Boud, 1995; Hattie & Marsh, 1996; Jenkins, Blackman, Lindsay, & Paton-Saltzberg, 1998). According to Brew & Boud (1995, p. 264), teaching and research are related to each other through the act of learning from each other: "Doing research is not likely to enhance pedagogical skills, but it is likely to enhance a teacher's knowledge, interest in and enthusiasm for the subject" With reference to higher education if you asked this question to any academicians' research productivity means, first reply will be publications of papers in professional journals, in shape of books or presentation of research papers in conference proceedings. To work on research projects, publication of monographs, development of experimental designs, innovation, production of artistic or creative works. Research productivity and research activity are interdependent and interrelated on each other. Research means to conduct research, collecting data, analyzing data, while productivity means writing, reading and publication of research reports in professional referred journals, displaying on the web or to make it known to public through any other mean, in shape of books or making its presentation on the television or radio and ultimately to be needful to the betterment of society. According to Creswell (1986), Research Productivity includes research

publications in professional journals and in conference proceedings, writing a book or chapter, gathering and analyzing original evidence, working with post-graduate students on dissertations and class projects, obtaining research grants, carrying out editorial duties, obtaining patents and licenses, writing of monographs, developing experimental designs, producing works of an artistic or creative nature, engaging in public debates and commentaries.

Defining and Measuring Research Productivity

“Research productivity” is the output of a research process.” Measuring the research productivity of faculty is a complex issue as many contributing factors affecting directly or indirectly and differently implied on person to person. Productivity has been measured at a variety of levels, including at the level of individual faculty, at the unit level like joint research projects (for example, the department), and at the institutional level (Dundar and Lewis 1998). Research productivity has been measured as the quantity and/or quality of the artifacts produced by faculty scholarship (Athey&Plotnicki, 2000; Brocato& Mavis, 2005; Dennis et al., 2006; Dundar& Lewis, 1998; Meho&Spurgin, 2005; Park & Riggs, 1993). The criteria that have been used in measuring productivity vary by institution and discipline, and faculty promotion and tenure is typically based in part on those criteria. (Bunton & Mallon, 2007; Dennis et al., 2006; Youn& Price, 2009).

Every profession has a well define process and system which help them to evaluate their members. Specially In higher education, past and recent studies have proven that research productivity plays a vital role in attaining success in academia as it relates to promotion, for extension of tenure, salary hicks, and the fringe benefits of the profession. Studies have also shown that research productivity varies widely from institution to institution and individual to individual depending on the emphasis that is placed on, environment providing to the faculties for research, various resources, personal inclination and efforts to put in for interested area or domain.

These faculty members whose inclination towards research are generally seen as more powerful educators and often serve as a frame of reference or benchmark through setting example for junior faculty members or others who are getting inspired for their own research agenda (Levine, 1997). The factors influencing faculty research productivity have been studied for decades (Lotka, 1926). University generated ideas based on research are important in promoting innovations for economic growth and competitiveness of industrialized economies (Jaffe, 1989; Mansfield, 1991).

Literature Review

For a majority of academicians, research productivity is a lifelong or on going process with a distinct life-cycle in their profile. It sharply increases to a peak early in life and then gradually declines (Stephan & Levin, 1992). Research productivity has been measured as the quantity and/or quality of the artifacts produced by faculty scholarship (Dundar & Lewis, 1998; Meho & Spurgin, 2005). According to Raston, 1998, it can be measured in a variety of publishing outputs

such as refereed journal articles, thesis, books and chapters in books, and patents. Publication is the key channel of intellectual products that disseminate new knowledge or extend existing knowledge to the world, so it is very important to the academicians, students and society. Faculty members serve a key role in the academic success of their students, advancement of knowledge throughout society, and their professional achievements. Their skills and experience significantly contribute to the mission and purpose of higher education, to advance learning and promote human knowledge. Faculty work encompasses multiple interrelated activities of teaching, research, and service (Fairweather, 1993, 2002; Paulsen & Feldman, 1995). During the past few decades, considerable attention has been devoted to the topic of faculty research productivity (Blackburn & Bentley, 1993; Bland, Center, Finstad, Risbey, & Staples, 2005). Such attention is warranted since productivity is often used as an index of departmental and institutional prestige and is strongly associated with an individual faculty member's reputation, visibility, and advancement in the academic reward structure (Creamer, 1998). Indeed, for many faculty, the pure number of publications is far more influential in shaping one's career. At present, research productivity, in particular the publishing outputs, becomes a criterion in recruiting, offering tenure, getting promotion, and maintaining tenure at all research universities globally, which ensures that the newly recruited academics will become productive academic researchers in the future to serve the research goals of the universities (Cummings & Shin, 2014; Perry, Clifton, Menec, Struthers, & Menges, 2000). Lucertini, Nicolo and Telmons (1995) urge schools to seek relevant benchmarks to search, measure, and compare their processes to the best practices that their external competitors have developed. Previous studies have provided three types of benchmarks for research productivity: (i) qualitative rank of related journals, (ii) quantitative measures of total and average research productivity of faculty, and (iii) quantitative measures of total and average research productivity according to where faculty earned their doctoral degrees. In various discipline, the publication types used for measuring research productivity are different.

Factors and Determinants affecting Research Productivity

Two trends report on the research productivity of academics in higher education. The first trend looks at the influences of motivations to research such as intrinsic motivation and second is extrinsic motivation Chen et al. (2006). This theory has been adopted by many researcher and they found positive correlation. The motivations can also be referred to as 'research rewards'. According to research of chen,gupta, hoshewer(2017) the five most important rewards from publication productivity are receiving or having tenure, being full professor or receiving promotion, pay raises, satisfying personal creativity/curiosity, and staying current in that order. The emphasis on a type of research motivation determines research behaviours and performance of academics. The second trend examines background factors of academics and institutional factors of a university that influence the research productivity of individuals. self-efficacy, age, research support, teaching load, faculty size and culture (Zhang 2014) also can be considered. Academic performance would lead to the some rewards (Chen et al. (2006). In research productivity attaining tenure is also playing important role. Research productivity of academics was influenced by their academic rank, time

spent on research, and administrative tasks. Early career academics were very productive but they became less productive over time until retirement (Goodwin and Sauer (1995)). In the findings Blackburn, Bieber, Lawrence, and Trautvetter (1991) showed that research self-efficacy, research self-competence, financial support for research, and research grants were the significant predictors of the allocation of effort to research. The benefits of a research environment where academics can receive support from their peers and collaborate with each other have positive impact on research productivity (Blackburn et al. 1991). Teodorescu (2000) also found a high correlation between the availability of library resources and research equipment, and the research productivity of academics. Those research references employed several indicators measuring institutional and departmental supports for researchers. The most important indicators were institutional policy that encouraged instructors to do research, institutional library budget and computing facility. (Panthupa, 1997; Dundar & Lewis, 1998; Kotrlik et al., 2002; Ratanit, 1993)

Factors were divided into two groups: personal factors (persistence, initiative, intelligence, creativity, learning capability, concern for advancement, professional commitment) and institutional factors (resource adequacy, access to literature, stimulative leadership, and external orientation). These factors, to some degree, are similar to those found by Bland and Ruffin (1992). Satisfaction of good pay, promotion, or the interesting working environment. (Locke, 1969). Research motivation and Research competency significantly affect Academia knowledge creation process, and perceived research opportunity was proved have significant effects toward research motivation and research competency (Sondari 2018)

Research Methodology

The research was performed using single cross-sectional descriptive research design. Academician from technical institutes which are AICTE approved of Gujarat were considered as sampling units. Convenience sampling method was adopted to reach the respondents. 136 valid questionnaire were taken in to the study. On the basis of past researches by various research scholars, 4 main parameters were developed for the study namely Knowledge, Research inclination, Institutional support, and work environment.

Data Analysis

Multicollinearity

The issue that needs careful consideration during the data screening process is multicollinearity, defined as the condition in which “intercorrelations among some variables are so high that certain mathematical operations are either impossible or the results are unstable because some denominators are close to zero” (Kline 1998, p.77). SMC (Squared multiple correlations) were carried out to identify the any evidence among the variables. The SMC Scores which are shown in table are below cut of point 0.90 which reveals the lack of multicollinearity among the variables.

Table 1 Squared Multiple Correlations										
Estimate	we1	we2	we3	we4	is1	is2	is3	is4	is5	is6
	0.6			0.5	0.5	0.7	0.4	0.8	0.5	
	6	0.78	0.69	9	4	1	1	2	1	0.88
	ri1	ri2	ri3	ri4	ri5	ri6	ri7	knw1	knw2	knw3
	0.6			0.5	0.4	0.7	0.6	0.8	0.6	
	9	0.58	0.63	9	8	5	5	4	8	0.46

Outliers

Outliers are the extreme value that inversely affects the analysis and draw the wrong conclusion. For the assessment of the multivariate outliers Mahalanobis Distance test was performed. This statistic measures the distance in standard deviation units between a set of scores for one case and the sample means for all variables. P1 value below 0.05 indicate that particular cases are the potential multivariate outliers. Table shows that nine cases found values below 0.05 which are removed from the further analysis.

Table 2 Mahalanobis Test			
Observation number	Mahalanobis d-squared	p1	p2
21	71.371	0	0
11	62.321	0	0
62	57.684	0	0
64	55.114	0	0
57	47.717	0	0
39	47.016	0.001	0
23	43.225	0.002	0
20	42.269	0.003	0
75	40.904	0.004	0

Construct Reliability

Reliability is defined as the level of the consistency between the measurable items of a variable's scale. Three methods were used in this study to evaluate internal consistency of the scale; Cronbach's alpha, item to correlation and inter item correlation. Cronbach's alpha is generally used to measure the internal consistency of the entire scale of the construct. The standard value of the standard value of coefficient alpha is 0.7; above 0.7 indicate the higher reliability. In this study four scales were used and coefficient alpha of that scale are 0.918, 0.849, 0.908, 0.892 which all are above the cutoff point. Inter item correlation and item to total correlation also found more than their cutoff point 0.3 and 0.5 respectively which also indicate the good reliability of the scales.

Confirmatory Factor Analysis

The constructs were subjected to confirmatory factor analysis (CFA) to verify that the manifest variables load upon the proposed constructs and are indeed indicative of these constructs. The combination of CFA and construct validity

assessments allows the researcher to evaluate the quality of their measures within a measurement model prior to testing the structural model. Maximum likelihood estimation procedures are used to estimate the parameter of the full measurement of the model. Figure provides the graphical presentation of the full measurement model. It consist of the 4 latent variables and 21 indicators.

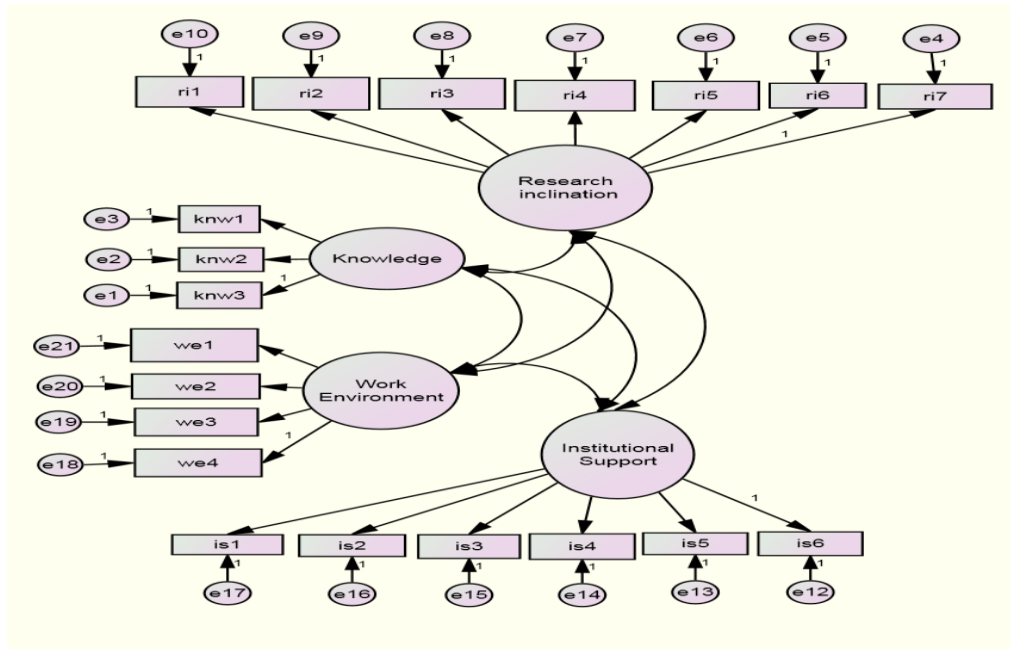


Figure 1

Measurement Model Validity

To assess the fit between data and the model the measurement model is run in the Amos software. Not only chi square but one incremental fit index and one absolute fit index researcher should provide for the evidence of the model fit. Table provides the summary of the key measurement of fit for the model.

Table 3				
CMIN/DF	GFI	NFI	CFI	RMSEA
4.115	0.7	0.727	0.776	0.152

All the fit indices provide the poor fit for the model. CMIN/DF known as Normed chi-square value below 2 indicate good fit and between 2 and 5 also acceptable, in our case it is 4.115 which is acceptable but other fit indices GFI, CFI and NFI are very low from their cutoff point 0.9 and RMSEA also very high from its standard value 0.08 so it is poor fit. Modification indices and different estimation like correlation and covariance estimation are closely examines and it provides the evidence of the misspecification of the model. One latent variable (Knowledge) is creating problems in the model. Closely review of the literature also provide the evidence that experience or the qualification like prior PhD and post PhD has impact on the research productivity but not as direct. In our study Knowledge is

refers to as the subject and research knowledge which is very strongly correlate to the experience and the qualification. So removing it from model the full measurement model is run again. It improves the fit index but yet not well for the model fit. Modification indices how many discrepancies go down if two particular variables correlated with each other and standardized residual covariance matrix also is helpful in the model fit. Covariance between two variables one or more indicate the poor fit of the variable in the model. These two modification indices and standardized residual covariance matrix indicate poor fit of the some of the indicator in the model which are removed from the model.

The measurement of the fit indices of the final model of the research productivity measurement are shown in the below table.

Table 4					
CMIN/DF	GFI	NFI	TLI	CFI	RMSEA
2.002	0.91	0.907	0.933	0.95	0.078

Normed chi-square is 2.002 which is acceptable. The RMSEA fit assessment remains significant and indicated the acceptable fit of the model. In the incremental fit all the GFI, TLI, NFI, CFI measurement above cut of 0.9 which provides the evidence for the acceptable fit. All the fit measurement provides the supports for the model fit.

Construct Validity

Reliability refers to the accuracy of the internal consistency where the construct validity refers to “how they should be interpreted?” The reliability of the constructs was addressed previously and is a necessary condition for validity; however a construct whose scale is reliable does not automatically make it a valid construct. Content validity refers to an analysis “of the correspondence of the variables to be included in a summated scale and its conceptual definition” (Hair et al. 2010, p. 125) and is conducted through a subjective assessment rather than an empirical test. The pilot survey from the highly qualified and experience professor was done which provide the face validity evidence. In confirmatory factor analysis, convergent validity is apparent when there is a high degree of shared common variance among the indicators of a construct (Hair et al. 115 2010). Tables show the unstandardized regression weights as well as their associated standard errors and critical ratios. Given that all of the p-values are less than 0.001, the unstandardized factor loadings are statistically significant.

Table 5 Regression Weights: (Group number 1 -Default model)

			Estimate	S.E.	C.R.	P
ri4	<--	Research_Inclination	1			
ri5	-	Research_Inclination	0.888	0.10	8.61	***
ri6	<--	Research_Inclination	1.044	0.09	11.08	***

	-			4	7	
ri7	<--	Research_Inclination	1.002	0.09 8	10.24 1	***
is6	<--	institutional_support	1			
is4	<--	institutional_support	1.021	0.06 3	16.13 3	***
is1	<--	institutional_support	0.777	0.06 9	11.19 4	***
we1	<--	Wrok_envionment	1			
we2	<--	Wrok_envionment	1.056	0.10 3	10.26 4	***
we4	<--	Wrok_envionment	0.937	0.10 1	9.255	***

The standardized factor loading of the each indicator in the model is used to determine the convergent validity. The ideal cut off value of the factor loading is 0.7, but 0.5 also provides the sufficient evidence of the convergent validity. The factors loading for the each scale are shown in table .the minimum factor loading is 0.706 which is higher than the minimum value. All the factors loading are above the cut off value which indicates the acceptable degree of convergent validity. Even though the factor loading provides the strong supports for the convergent validity, two additional assessments AVE and CR are conducted to provide the further evidence. The average variance extracted (AVE) is the average of how much variation in a scale is explained by the latent variable and Construct reliability (CR) measure the same but also takes into account the error variance for the construct.

Table 6 Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
ri4	<---	Research_Inclination	0.8
ri5	<---	Research_Inclination	0.706
ri6	<---	Research_Inclination	0.872
ri7	<---	Research_Inclination	0.813
is6	<---	institutional_support	0.932
is4	<---	institutional_support	0.921
is1	<---	institutional_support	0.749
we1	<---	Wrok_envionment	0.776
we2	<---	Wrok_envionment	0.901
we4	<---	Wrok_envionment	0.778

Table provides the reports of the both AVE and CR measure the three construct in the model.

Table 7 Average Variance Extracted and Construct Reliability		
Variables	AVE	CR
Research_Inclination	0.64	0.88

institutional_support	0.76	0.90
Wrok_envionment	0.67	0.86

The inspection of the AVE score and CR analysis indicate that all the loadings are exceeding the cut off value 0.5 and 0.7 respectively. All the measurement provides the substantial evidence of convergent validity.

Discriminant validity

Discriminant validity refers to the degree in which a construct being measured in the study is not similarly measured under a different construct and is therefore unique from other constructs. To provide evidence of this type of validity, researchers typically conduct a comparison of squared values of the estimated correlations between the constructs and the average variance extracted (AVE) from each construct. If the variable's AVE value is higher than the square of the estimated correlation between it and another variable, then there is evidence to support an acceptable degree of Discriminant validity between these variables. The overall results from comparing AVE estimates to their corresponding inter-construct squared correlation estimates were indicative of Discriminant validity among these variables.

Table 8 Discriminant Validity			
Variables	AVE	squared interconstruct correlation	
Research_Inclination	0.64	0.34	0.40
institutional_support	0.76	0.34	0.22
Wrok_envionment	0.67	0.40	0.22

Nomological Validity

The correlation among constructs should be grounded in and remain consistent with existing theoretical research. This consistency is generally referred to as nomological validity and can be determined by an assessment of the correlation values between constructs within the CFA model that has set the constructs' variance to 1.0 (Hair et al. 2010).

Table9 Correlations:			
			Estimate
Research_Inclination	<-->	institutional_support	0.585
Research_Inclination	<-->	Wrok_envionment	0.636
institutional_support	<-->	Wrok_envionment	0.469

The correlations among the variables are positive and significant which provides the strong evidence of the nomological validity.

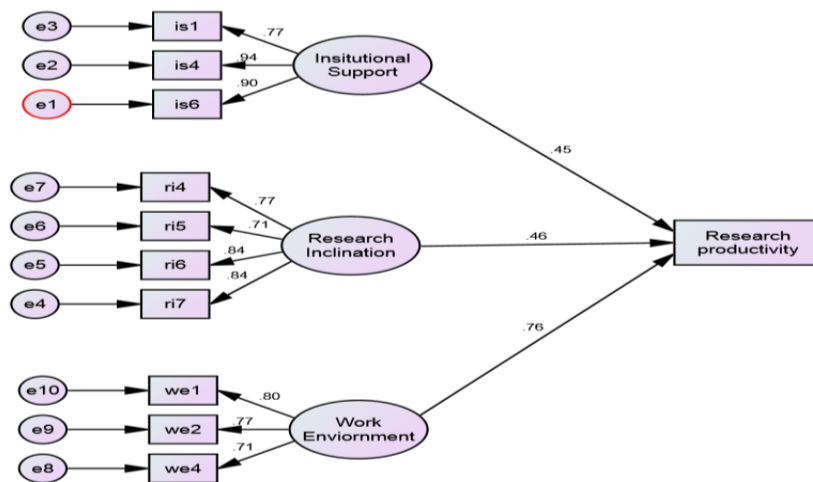


Figure 2 Path analysis

The path analysis model in figure 1 shows the standardized regression coefficients which depicts the amount of impact one latent variable has on research productivity. Institutional support, research inclination and work environment all three variables were influencing positively and significantly on the research productivity. Impact of the work environment was founded more significant compare to the other two variables.

Conclusion

Research is endless process where one end will give the new beginning. This study was proposed to find out the factors affecting research productivity in inclination with academicians of technical institutes in Gujarat. On the basis of past researches by various research scholars, 4 main factors as parameters were developed for the study namely Knowledge, Research inclination, Institutional support, and work environment. As result shown Institutional support, research inclination and work environment all three variables were influencing positively and significantly on the research productivity. Impact of the work environment was founded more significant compare to the other two variables. These three parameters gives positive impact on research productivity while on parameter named knowledge is not statically positive in this research.

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