

Assessment of Academic Research Utilization for National Development in Field of Environment

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Abstract

Last few years has shown increased interest of researchers in knowledge and technology transfer. However facts show poor utilization of research into practice. This article focuses on assessment of academic research produced by highly qualified academicians working in universities in Sindh offering degrees in field of Environmental Sciences and Environmental Engineering. The article presents a methodology for assessment of academic research utilization for national development based on various criteria including purpose of research, funding bodies of research, relevancy of research with environmental issues, development mode of research, end users of research, mediator source for research utilization and intellectual property rights for research. This research is based on analysis of semi-structured interviews by using case study approach. Findings show that researchers have produced and published papers at larger number but very few of academic research have been utilized for national development. Academic research has been utilized by different national & international organizations (EPA, IUCN, WWF, SIDA, KDA). The research is utilized in the form of PhD thesis reports and other project reports funded by HEC, Universities and other national and international organizations. The outcomes of research utilization are either in form of new developed processes, services or policy guidelines under protection of copyrights. The findings also revealed co-operation of academicians with other stakeholders. However, none of the research has been utilized in the development of new Product or new technology under protection of industrial designs or patents.

Keywords: Academicians, Academic Research, Utilization, National Development

1. Introduction

The knowledge becomes an increasingly important part of innovation, universities as a knowledge producing and disseminating institutions plays a larger role in the national development. There is empirical evidence that identifying, creating and commercializing intellectual property have become institutional objectives in various academic systems (Etzkowitz et al., 2000). Research in itself is a response to man's unending quest for knowledge. On similar grounds, the analysis of the research output of a country determines its progress in various fields (Mushtaq et al., 2013). Denny (2001) reported that developing countries consider there is rather a need for studies on immediate everyday problems than curiosity – driven research; it is more appropriate for industrialized and rich than poor countries. Edward et al., (2012) argue that production of knowledge depends on knowledge infrastructures which comprised as “Robust networks of people, artifacts, and institutions that generate, share, and maintain specific knowledge about the human and natural worlds”. It can be said that lack of basic research leads to a poor knowledge and expertise capacity of the nation.

It is assumed that the concept of targeted research has emerged more recently: unifying basic research and applied research, it arises from social needs and is commissioned to resolve a concrete issues, it is called mode-2 science (Joumard & Boughedaoui, 2011, Gibbons, 2000) or post-normal science. The aspect of research does not necessarily refer solely to the human and social sciences; research on emissions of atmospheric pollutants by road transport has in the past 20 years highlighted essential parameters such as vehicle operating conditions (speed, gradient, ambient temperature, etc.) and the composition of vehicle fleets. In the field of rail safety, research has shown the importance of maintenance procedures and their optimization, evaluated in terms of overall transport-system efficiency and not only of short-term profitability. In the environment field, work on the hierarchy of the physical and chemical causes of declining ecological quality of watercourses will allow better organization of the measures needed for watercourse restoration and the health of local populations (Joumard & Boughedaoui, 2011).

Focusing on the role of academic institutions, this research assesses the utilization of academic research done by highly qualified faculty members with PhD qualification working in universities offering degrees in the field of environment in Sindh, Pakistan for national development. Article answer the research question: How to assess the utilization academic research contributions of local expertise for national development? To answer this question; thorough review of literature is done to develop methodology for assessment of academic research utilization for national development. Developed methodology is refined using interview findings conducted with selected sample by making practical implications of proposed methodology developed for the assessment of

utilization of academic research for national development in the field of environment. Research paper comprised of different sections of discussion, starting with introduction of research following the review of previous work done related to research area and development of methodology, methods and techniques used in this research to achieve the desired results, analysis of data and obtained results with final conclusion and recommendations are discussed in detail. Following section comprised of detailed literature review related to assessment of research utilization.

2. Review of Literature

Utilization of research for the practical purpose is not a new concept. Defining from the literature Mastrilli, P. (2012) says that there is considerable confusion surrounds the definition and use of terms that describe the process of putting research knowledge into action. When researchers have attempted to create a search filter, they identified more than 90 terms that signified the use of research knowledge in health care. Commonly used terms included implementation science, research utilization, dissemination and diffusion of knowledge, research use, knowledge transfer and exchange, and knowledge translation. McKibbin (2010) and her colleagues also noted differences in how terms were used among publications from the United States, Canada, the United Kingdom, and Europe. In the Canadian literature, the terms knowledge transfer and exchange (KTE) and knowledge translation (KT) have been commonly used to signify the process of incorporating scientific findings into health care practice.

Knowledge transfer is defined as a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system. Descriptive studies in this field have indicated that the KT phenomenon may involve many complex interrelated factors and processes. Several theoretical frameworks have emerged in the literature to enhance our understanding of this complex phenomenon. In most of these models, the use of research knowledge in practice occurs in the implementation phase of the KT process (Grimshaw, 2012).

Knowledge utilization pertains to the dissemination and use of research results by researchers in subsequent investigations, and by practitioners in applications. Ilves (1982) examined one aspect of knowledge utilization by studying the interaction of MIS researchers with prior research efforts based on references attached to MIS journal articles. By making addition in the literature this study examines other aspect of knowledge utilization by practitioners exploring different developmental approaches and its intellectual property rights. Knowledge transfer can be defined as the means by which expertise, knowledge, skills and capabilities are transferred from the knowledge-base (for example, universities, research centers or research organization) to those in need of that knowledge; for example, industries, social enterprises or nonprofit organization (Ardakani et al., 2011). Knowledge transfer strategy with five questions provide an organizing framework for knowledge transfer starting with question: What should be transferred to decision makers (the message)? To whom should research knowledge be transferred (the target audience)? By whom should research knowledge be transferred (the messenger)? How should research knowledge be transferred (the knowledge transfer process and supporting communications infrastructure)? With what effect should research knowledge be transferred (evaluation)? (Levis et al., 2003).

Knowledge utilization focused on five key questions; what is the message? Such messages could include credible facts, data, findings, conclusions, and body of evidence that can be expressed in actionable idea. Who is the audience? What can be transferred? Messages should be developed with particular audiences in mind that is likely in a position to use the research based information for decision making purposes. Who is the messenger? Attention to messages is enhanced if the audiences regard the messenger as a credible spokesperson. What is the transfer method? Transfer methods need to be carefully considered in light of a number of factors, including the nature and size of the audience and available resources devote to dissemination. What is the expected outcome? The dissemination plane should consider what impact the proposed activities will achieve before it is implemented. (Gagnon, 2011). By making addition in literature, article makes empirical study to answer these questions by making exploration of current practices of knowledge utilization status in field of environment at Sindh, Pakistan. Article answers the above discussed questions by developing research utilization assessment methodology in detail discussed below.

3. Methodology for Assessment of Academic Research Utilization

This research assesses the utilization of research contributions of selected sample of PhD faculty members in the universities in Sindh offering degrees in environmental engineering and environmental sciences. By exploring additional knowledge in the questions to assess the academic research utilization from the producer perspective universities are selected as a research producer. Proposed research utilization methodology shown in figure 1. comprised of five key stages which are designed based on these questions as; 1. What was the type of transferred research knowledge to end users? Empirical research on the “types” of research that influence decision making

justifies this approach. Research on managerial and policy making is mostly utilized in form of “ideas” not data which influences the decisions making (Lavis et al., 2003). State of research produced in the academic environment is influenced by academic purposes, funding bodies. In academic environment such messages could include Self PhD Thesis, PhD thesis of student, Self Masters’ Thesis, Thesis of students and Research project reports. Literature revealed that high level of importance is accorded by academic researchers to the use of refereed publications as a method through which to disseminate their research (Cherney et al., 2012). This research also explores about funding agency of utilized research to assess either utilized research is funded by the Parent University, industries, national educational organization as higher education organization, self funded research by researcher and other national and international resources of research funding.

Lavis et al (2003), articulate that research organizations should transfer actionable messages from a body of research knowledge, not simply a single research report or the results of a single study Message includes the developmental states of utilized research as idea, experimenting and prototype. 2. Who were the end users of research? It is evaluated that the key question in the promoting better utilization of research knowledge is to sort out whether knowledge translation process differ according to types of users, and if so what are the nature of processes at hand (Chagnon et al., 2010). The research literature makes clear that a message’s target audiences must be clearly identified and the specifics of a knowledge transfer strategy must be fine tuned to the types of decisions they face and the types of decision making environments in which they work. Research produced in the universities can be utilized by different national and international organizations working in different areas of environment such as water, air, land, transport, policy etc. Article explores problems solved by the academic research and its end user organizations.

3. Who were the messengers? Research knowledge is transferred through different sources to end users there are different mechanisms through which research knowledge is transferred to end users. Cherney et al., (2012) argues that greater collaboration between academic research producers and users is seem as one way of addressing the dissonance between knowledge production and its transfer or translation to policy and practitioner contexts. Different research transfer mechanisms were identified such as through personal links, through technology transfer offices, through national programs initiated by national level organizations such as higher education commission of Pakistan, Pakistan engineering council, through media, through workshops, seminars, conferences and trainings. 4. How academic researches were utilized by end users? Research knowledge may be used in instrumental, conceptual, or symbolic ways (Lavis et al., 2010). Transfer method needs to be carefully considered in light of a number of factors, including the nature and size of the audience and available resources to devote for dissemination. Finally research is developed as a product, process, services, new technologies and policy guidelines. For utilization purpose academic research is protected in form of different intellectual property rights such as copyright, patent and industrial design.

5. What were the outcomes of utilized academic research? Outcome of research can be assessed by identifying the desired impact of utilized academic research. It includes set specific objectives for each type of end user. To evaluate the impact of knowledge transfer strategies, the academic research utilization activity should be focused on what impact the proposed activities will achieve before it is implemented (Gagnon, 2011). This article offers additional contribution in literature, providing empirical evidences to answer these questions in practice to explore the current practices of academic research utilization produced by the PhD faculty members in the universities in Sindh by the multiple national and international organizations working in the field of environment.

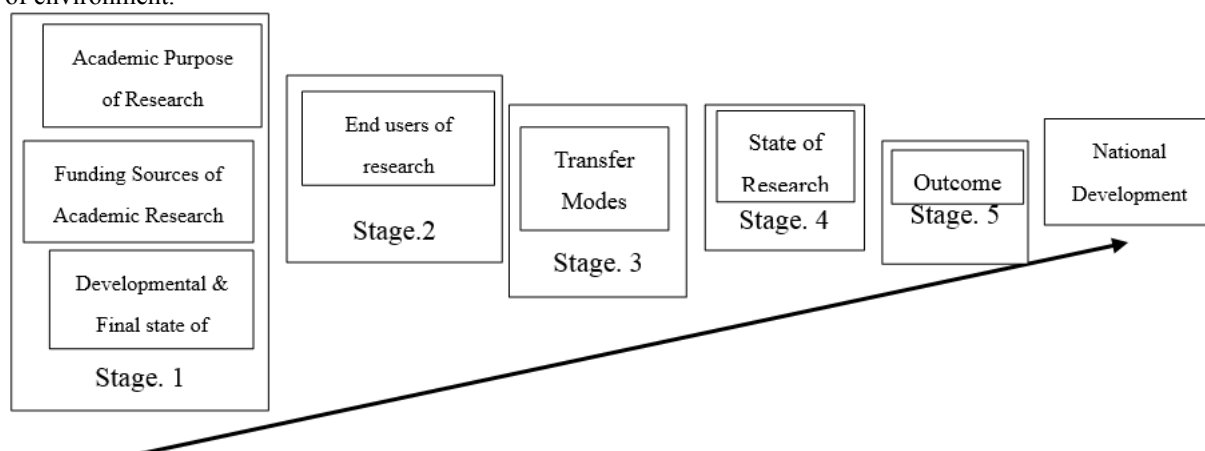


Figure1. Methodology for Assessment of Research Utilization

4. Research Methodology

Research focuses on the utilization assessment of academic research produced by PhD faculty members, in universities in Sindh offering degrees in the field of environment engineering and environmental sciences. Sample has been selected based on the offered degree program which is focused to solve the environmental issues to achieve the target of environmental sustainability in Sindh Pakistan. Academic research contributions have been assessed because, in the changing world, which is increasingly adding uncertainty, all higher education institutions should provide favorable responses to social needs and it has proven by experiences that universities can provide best performance to the community (Etzkowitz, 2000; Lashari et al., 2013). Initially information about universities and their faculty were collected from the official websites of universities. Primary data were collected from the PhD faculty members working in the universities in Sindh offering degrees in field of environmental engineering and environmental sciences. From total 8 numbers of identified universities offering degrees in field of environment, 3 universities offer degrees in environmental sciences and 5 offer degrees in environmental engineering. In terms of highly qualified faculty there are 24 PhD faculty members 12 working in the universities offering degrees in environmental engineering and 12 in environmental sciences.

Identified faculty members were contacted by telephone and emails. Semi-structured research instrument has been developed to collect the required data in this research. Research questions asked in Semi-structured interviews are often preceded by observation, informal and unstructured interviewing in order to allow the researchers to develop a keen understanding of the topic of interest necessary for developing relevant and meaningful semi-structured questions (Cohen & Crabtree, 2006). Initially research instruments were designed based on thorough review of literature and refined with comments of respondents. Research instrument used in this research were comprised of both open and closed ended questions identified from the literature and were finalized during interview session. From total 24 PhD faculty members, 22 face to face interviews about 1 hour with individual respondents on the availability of respondents. Interviews held during July 2014 to December 2014. Obtained data has been analyzed using statistical packages for social sciences SPSS Version 20. Descriptive statistics, pie and bar charts have been build to organize the obtained results to answer the research question. Following section will present the analysis of data and findings of results.

5. Data Analysis and Results

Utilization of research contributions produced by PhD faculty members has been examined on multiple stages developed in the utilization methodology shown in figure 1. At the start utility of research were explored either research done by PhD faculty members have been utilized by end users for national development or not. Academic purpose of research contributions, funding bodies of research contributions, state of research contributions, end users of research contributions, transfer modes of research contributions, final state of research contributions, intellectual property of utilized research contributions at the end problems solved with the utilized research contributions were explored. Results related to all stages included in the assessment research utilization methodology are discussed in detail in the following sections.

5.1 Utilization of Research Contributions by End Users

Findings show that research contributions of 63.6% PhD faculty members have been utilized by end users. Research contributions of 36.4% PhD faculty members have not been utilized by end users shown in table. 1.

Table 1. Research work have been Utilized by End Users

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	8	36.4	36.4	36.4
	Yes	14	63.6	63.6	100.0
	Total	22	100.0	100.0	

5.2 Stage 1. What were transferred to end users from academic research?

Research produced by the academicians is done for different academic purposes and it is finalized in the different forms with different objectives such as in form of thesis reports, project reports and research papers in journals and conference proceedings. Research done in academic institutes can be financed by different funding bodies which also makes influence on the research area and its utility. Research contributions are developed in different states such as prototype, experimenting and ideas of new knowledge which can be utilized for different sort of issues.

5.2.1 Academic Purpose of Research

Research contributions of PhD faculty members utilized by end users were produced to fulfill different academic requirements. Researches utilized by end users have been produced as a PhD thesis of self researchers and their students, Masters Thesis of self and students, and also in the form of research project reports. Results are shown in table 2. But findings have suggested less relationship between research utilization in form of academic research papers which is most common method of research dissemination in the academic community.

Table 2. Academic Purposes of Utilized Research

Self PhD Thesis, PhD Thesis of Student, Self Master's thesis, Master's Thesis of Students, Research Project Reports

5.2.2 Funding bodies of Utilized Academic Research

Research done in the academic the academic environment is financed by different national and international funding bodies which directly are indirectly make influences on the research and its utility. Finding shows multiple funding sources of academic research utilized by end users. Research has identified that, larger number of utilized academic research is financed by public organizations at national level.

Table 3. Funding body of Utilized Research

EPA Sindh, HEC, Parent University, Sanghar Sugar Mill, IUCN, Karachi Development Authority, National Institute of Oceanography Government of Pakistan, World Bank, European Union, WAPDA Karachi

5.2.3 Developmental State of Utilized Academic Research

Research finding shows that academic researches utilized by end users have been produced in the different states. Research produced as an idea and experimenting shows larger number than other with 61.54%. Result shows less academic research have been utilized in state of prototype.

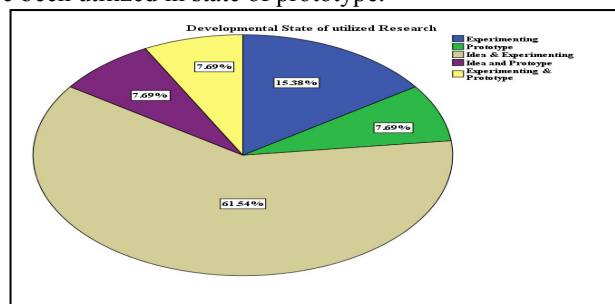


Figure 2. Developmental States of Utilized Academic Research

5.3 Stage 2. Who were the End Users of Utilized Academic Research?

Academic research utilized by different practitioners must comprise of their relevant needs which makes absorptive capacity of the research. In this section identified results relate to end users of academic research are presented.

5.3.1 End User Organizations of Utilized Academic Research

Research has found multi type of end user organizations of academic research at national at international level. At national level most of the research has been utilized by funding bodies of academic research mentioned in the table 3. Organizations include; WAPDA, Ministry of Alternative energy Government of Sindh, Sanghar Sugar Mill, EPA Sindh, Karachi Development Authority, Ministry of Environment Pakistan. Research has been utilized by non-funding bodies at international level such as; France Government, International Union for Conservation of Nature (IUCN), Malaysian Government, UK Government, Thailand Government.

Table 3. Research utilizing organizations

EPA Sindh, National Highway Authority, Motorway Police, Karachi Development Authority, Ministry of Environment Pakistan, France Government, International Union for Conservation of Nature (IUCN), Karachi Sewerage & Water Board, Malaysian Government, SDP/Climate Change Center GIS, SRDC, Thardip, HRDP, PAC, USAID, SIDA, UK Government, Thailand Government, WAPDA, WASA, RSRWR, Ministry of Alternative energy Government of Sindh, Sanghar Sugar Mill

5.4 Stage 3. How academic research was transferred to end users?

Academic research is transferred to end users through different channels of communication within the different states. This section assesses how and through which mechanism academic research produced by PhD faculty members in the field of environment have been transferred to its end users.

5.4.1 Transfer channels of utilized academic research

Research findings have identified different channels of research knowledge transfer to end users. Most of the academic research has been transferred to end users through personal links with the end user organizations of academic research shown in figure 3. After using personal linkages for academic research transfer to end users; academic research has been transferred through other channels of academic research knowledge transfer such as; workshops, seminars, conferences, trainings and through print/electronic media. Findings have explored that very less number of research have been transferred to end users through research knowledge transfer offices and through HEC and PEC program.

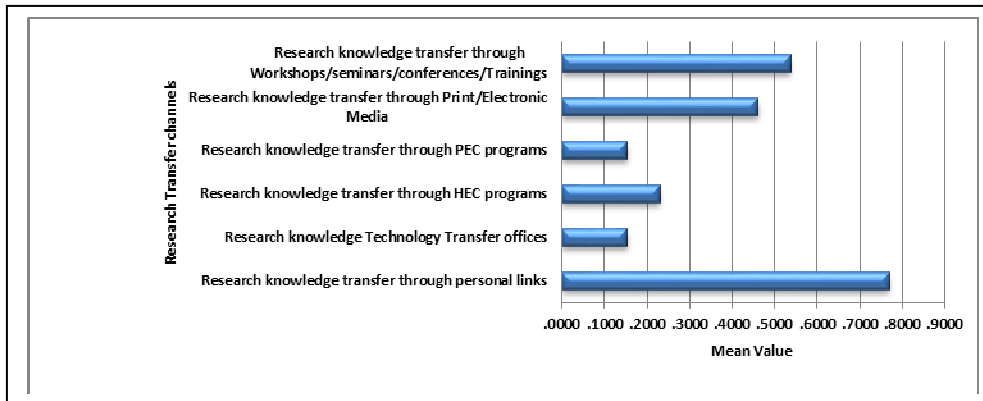


Figure 3. Channels of Research knowledge Transfer to End Users

5.5 Stage 4. How academic research knowledge were utilized by End users

Academic research done within the academic environment can be developed as a product, process, new technology and policy advice. Every state of research needs different intellectual property rights. This section assesses developed state and intellectual property rights of utilized academic research produced by PhD faculty members in the field of environment.

5.5.1. Developed state of Utilized Academic Research

Outcomes of academic research done by PhD faculty members in field of environment have been found in different states. Though, larger numbers of utilized academic research have been produced in states of Process & Policy advice with 53.85% than products and processes with 15.38%. shown in figure 4. Very few numbers of academic researches have been utilized by end users of New Technology and new products.

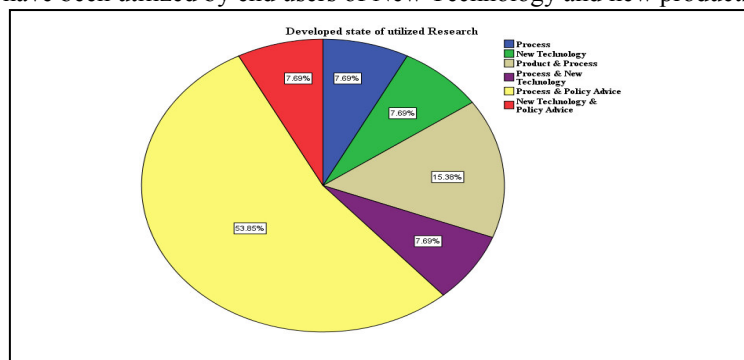


Figure 4. Developed States of Utilized Academic Research

5.5.2 Intellectual Property (IP) Rights of Utilized Academic Research

Intellectual property is the most common indicator for measurement of scientific and technological knowledge utilization for the national development. Result shows more than half of the academic research has been utilized with intellectual property of copyrights at 53.85% shown in figure 5. Very few numbers of utilized academic researches have been identified with intellectual property of Industrial designs and patents. It revealed that academic research is mostly science oriented less related to technological development of county in field of environment.

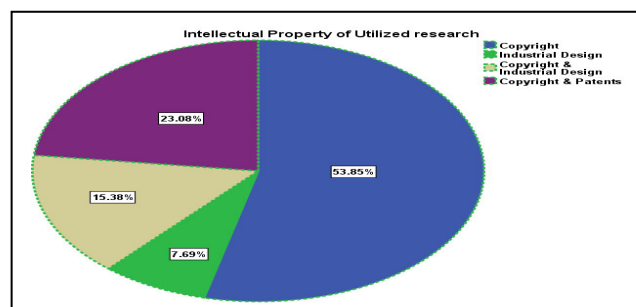


Figure 5. Intellectual Property (IP) Rights of Utilized Academic Research

5.6 Stage 5. Outcomes of Utilized Academic Research

Outcomes of utilized academic research are categorized based on different national issues which have been

solved with the utilization of academic research are assessed.

4.6.1 Areas of Utilized Academic Research Related to National Issues

Research findings have explored that, utilized academic research is most relevant to existing national issues. Research contributions were focused in areas of national issues such as energy crises, waste management, water quality, biodiversity, global warming, water, and air pollution.

Table 4. Research areas of utilized Academic Research

Alternative Energy production from municipal waste, Air Pollution, Sustainable Road Transportation, Coastal Management, Energy Crises, Global Warming, Renewable Energy Production, Evaluation of Policy Impact on Energy Consumption, Green Energy Production, Protection of Biodiversity, Waste Management, Water Purification, Water Resources Management, Solution of Air Pollution, Efficiency of Alternative energy Resources Utilization, Water Treatment, Drainage System Improvement, Biofuel Production

6. Discussion and Conclusions

The research has proposed a methodology which comprised of five stages for the assessment of academic research utilization for national development. Proposed methodology have been developed based on literature review and interviews with PhD faculty members in the universities in Sindh, Pakistan offering degrees in the fields of environmental engineering and environmental sciences. Despite the relatively small sample size using case study approach, this is one of the few exploratory studies to systematically consider assessment of academic research utilization for the national development. Recent years have seen understanding of knowledge shift from “knowledge as a thing” which can be given and received towards “knowledge as a process” which evolves over time and is context specific (Evely et al., 2011; Philipson et al., 2012; Reed et al., 2014). By using this approach the first stage of assessment methodology is developed. First stage of methodology assesses the development of academic research utilized by their end users. The research argues that academic research may be comprised of different states such as experimenting, prototype and in the form of innovative ideas (stage 1). Most of the research utilized by end user was produced as a experimenting and ideas with little in state of prototype.

Research contributions have been utilized by couple of end user organizations for national development. Larger numbers of research contributions were utilized by different organizations which were the funding bodies of such academic researches (stage 2). Most of the researches financed by the academic bodies such as Higher Education commission of Pakistan (HEC) were utilized by the non funding organizations at national and international level. These findings suggests that research contributions financed by the HEC plays effective role for academic development but less focused for the national development in terms of utility of research. Utility of academic research can be enhanced by making efforts for research targeted to national development planes.

Research has been transferred through personal linkages of researchers with the end users of academic research and the other most frequent is; through academic activities of knowledge transfer such as conferences, seminars and trainings (stage 3). Personal links are not applicable as source of research knowledge transfer to end users in the professional knowledge exchange system. Universities must focus to identify and produce mechanisms of knowledge transfer for continue and effective academic knowledge transfer.

Ensuring time is spent reflecting on how academic research knowledge is being generated and shared with end users (stage 4), in state of processes and policy advice at larger number with intellectual property of copyrights. Academic research has been utilized rare cases in state of products and new technology with intellectual property of industrial design and patents. Policy makers must focus towards the increase in the academic research utilization in state of products and new technology by promoting new startup companies and incubators for technological development in field of environment.

Importantly, while the problem for which academic research is utilized is assessed to explore the impact of research towards national development in field of environment (stage 5). Utilized academic research have provide solutions regarding to environmental issues in Sindh as a providing renewable energy resources, providing solutions related to air and water resources. Though end users have utilized the academic research but it needs to be optimized by making focus on the capabilities of research producing organizations for the utilization of academic research for national development. Following five stages of proposed assessment methodology should help researchers, research funding bodies, policy makers and practitioners in assessment of academic research utilization for national development particularly in field of environment.

This research has proposed methodology for assessment of academic research utilization for national development which was empirically applied on the research produced by the PhD faculty members working in the universities which were offering degrees in field of environment in Sindh, Pakistan. Future research can be done by using this methodology in other academic fields of study. Proposed methodology can also be used for assessment of utilization of research produced by other national and international research organizations. Individual stages of proposed research methodology can also be used for the assessment of research utilization for national development.

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