REBS Review of Economic & Business Studies
Volume 8, Issue 1, pp.169-181, 2015
ISSN-1843-763X

UNIVERSITY RESEARCH ECOSYSTEM: A CONCEPTUAL UNDERSTANDING

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Abstract: *The aim of this paper is to propose a new theoretical perspective and a conceptual model to build a sustainable research ecosystem in universities. The paper is conceptual in nature and draws upon existing literature to propose a unique framework on sustainable research ecosystem. This paper borrows the theoretical foundations from natural ecosystem to propose a process and stakeholder view of a research ecosystem in universities and suggests means to achieve sustainability in the long run. A thriving university research ecosystem leads to consistency, efficiency and sufficiency in research output. The ideas proposed in this paper are in the nascent stage and in the emerging market context. Future research is suggested to operationalize and validate the proposed framework in both developing and developed nation context. The insights generated here would therefore contribute to the existing models and frameworks that few universities subscribe to. From an originality point of view present work has conceived and conceptualized a new direction of thinking, i.e. creation of a sustainable research ecosystem.*

Keywords*: research, research ecosystem, sustainability, sustainable research ecosystem, emerging markets, process view, stakeholder view, higher education.*
JEL Classification*: I10*

1 INTRODUCTION

Across various disciplines there has been an increased call to focus on the relationship between university research, its productivity and stakeholder's involvement. The importance of research lies in the fact that research is the

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foundation for knowledge that has made innovation and application possibly resulting in benefits for the society at large (Marginson, 2009). It is also true that all research does not lead to immediate gains and in reality some of it does not lead to any measurable outcome but it is the inquisitive spirit of mankind that expresses itself through research. This gives rise to some interesting questions such as what it takes to produce high quality research, how various stakeholders interact with each other and what could be the possible measures to increase research productivity. In this paper we aim to answer these questions by bringing in a new perspective of University Research Ecosystem (URE) which is analogous to natural ecosystem involving all the potential stakeholders. Paper also advances the body of literature by proposing means to build a sustainable research ecosystem.

This paper is divided into five sections. Section 2 briefly discusses the origin of universities, section 3 discusses the advent of research universities and the university research system, developing on the understanding developed in the previous sections, section 4 presents the definition of University Research Ecosystem (URE). To further substantiate the meaning of University Research Ecosystem subsections also describe the stakeholder and process view of URE. Section 5 discusses the sustainable research ecosystem, and further describes the basis of sustainable research ecosystem; this includes Research Culture (National/ Regional/ Institutional), Disturbance Regime, Research resource management/ Knowledge management and research stakeholders. Section 6 describes the contextualization of proposed model. Discussions, conclusions and future directions for research are presented in the section 7.

2 THE ORIGIN OF UNIVERSITIES

Universities are one of the major contributors of scientific research leading to invention and innovation in the world. Universities not only prepare the labor force, they create the much needed skilled human resource. University is derived from the word "*universitas*" in Latin which means the "whole".[1] The Oxford Dictionary defines university as "a high level educational institution in which students study for degrees and academic research is carried out".[2] In the words of JawaharLal Nehru, the first Prime Minister of India, the central objective of the university is as under (Das, 2007, pp.47):

[1] Latin Dictionary, revised, enlarged and rewritten by Charlton T. Lewis, Oxford, Charendon Press, 1937, pg. 1933

[2] Oxford Dictionary and Thesaurus, edited by Maurice Waite, Oxford University Press, 2007, pg. 1131

"A university stands for humanism, for tolerance, for reason, for the adventure of ideas and for the search of truth. It stands for the onward march of human race towards even higher objectives."

Structured learning at a single place existed in the 7th century BC in the form of the Buddhist monasteries and in the 3rd century AD at Nalanda. Few of these centers were quite large and had several faculties'. Records suggest that there might have been approximately 10000 students and 3000 teachers participating in the process of learning at Nalanda. With students and scholars from Korea, Japan, China, Tibet, Indonesia, Persia and Turkey, the major areas of learning at Nalanda were Buddhist studies, fine arts, medicine, mathematics, astronomy, politics and the art of war (Cochrane, 2009). In the European context, the first so called university originated in the form of a medical school at Salerno, Italy in the 9th century. In the true sense though, the first university originated at Bologna. The first university to be established in northern Europe was the University of Paris, established sometime between 1150–1170 A.D. The University of Oxford, founded in the 12th Century was the most reputed in England. Major part of the curriculum consisted of the seven liberal arts namely: grammar, logic, rhetoric, geometry, arithmetic, astronomy and music. Although the universities in the 12th till 14th Century were controlled by the state, they drew there powers from the church (Ross, 1991). Their autonomy from local government control, in other words, depended upon their subordination to the community of God. In keeping with the Christian order of truth, knowledge was constructed as eternal and scholarship as a matter of interpretation, imitation, and cultivation. During the Reformation, in the 16th century, many universities were freed from the direct control of the Church and came under secular state supervision. In the process, they lost their monopoly over knowledge and science (de Ridder-Symoens, 2003).

Immanuel Kant in his works positioned the university as the embodiment of "thought as action toward an ideal"—the ideal being the production of a national culture and a reasoning subject to serve as its vehicle. He also argued that universities should examine and guide the "inmost thoughts," the "secret intentions," the conduct, and the health of the citizenry through pure disinterested reason (Readings, 1996).

3 ADVENT OF RESEARCH UNIVERSITIES

Today research has become an important function of the university system although its roots can be traced back to the beginning of the 19th century in Germany where the University of Berlin came into existence with scientific research at its core (Ben-David &Zloczower, 1962). In the following centuries till

date, research is of ultimate importance for all universities as the status of universities is based on the research quality and productivity. Many authors have defined research in many ways as regards to the discipline and form in question. Research is primarily defined in different ways by various disciplines and can take many forms. A broad definition of research by Shuttleworth (2008) suggests that research includes any gathering of data, information and facts for the advancement of knowledge.Another definition by Creswell (2002) states that "research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue". It consists of three steps: pose a question, collect data to answer the question, and present an answer to the question.

Research universities are at the zenith of the university system. They serve only the crème of the students and are very few in number (Clark, 1995). However number of such universities has been increasing in the past decade (Altbach & Salmi, 2011). The aim of these universities is to bring research to the core of the university system and apply that research to national economic development. It all started in the later part of the 19th century with the onset of the American Land Grant universities which included direct service to society mainly in agriculture and industry to the objectives of research universities. This brought universities to the limelight and since then universities have been contributing to the society more directly through research and development in almost all countries worldwide (Altbach, 2008).

3.1 The University Research System

Over a period of time, universities world over have developed indigenous science and technology system. The science and technology system comprises of resources available to the university like finance, governance or administrative, human, intellectual, and physical capital that acts as inputs to the productivity through research, education, training, and socialization generating intellectual and human outputs. According to Frischmann (2008), the system comprises of:

I. ***Human Capital*:** Faculty, Researchers, Students, Administrators, Technicians etc;

II. ***Governance Capital:*** Rules, Norms, Policies;

III. ***Physical Capital:*** Land, Facilities and Equipment;

IV. ***Intellectual Capital*:** Knowledge, Information, Ideas; and

V. ***Financial Capital:*** Research Grant, Funding etc.

Each of these resources is integral to the system. It is interesting to note that the combination in which these resources are put together and the derived behavior

of that combination differs from university to university. The elements of this system, combined within a university structure, together act as valuable inputs in reaching the desired goals of universities like facilitation of research, dissemination of knowledge through education, imparting training and acting for the betterment of the society at large.

University science and technology research systems, like any other system, are invaluable to the society because of the economic activity they generate in addition to the knowledge base that they create for the society. In fact the contributions of the research systems are in the value that is imbibed in final output (Frischmann, 2005). The research results produced by these systems mostly contribute to industrial and social needs by facilitating the production of various private or public goods. The results derived from research not only vary in specifications but also in terms of its use and application to reach desired outcomes towards the benefit of the society (Reichman and Uhlir, 2003).

Allocation of the infrastructural capital of the universities is not a conscious decision to exploit the market potential of research results (Auerswald and Branscom, 2003). Therefore, the majority of the research and development activities resulting in results have not been towards market oriented research. Of course, this is not to say that university research systems have not contributed by way of conducting commercial research or that research results have never been used commercially but rather that this area has not been an area of priority to the universities (Henderson, Jaffe and Trajtenberg, 1998). Historically speaking, as regards to the industry or its need in terms of industry orientation, universities have not allocated enough resources. But the trends are changing with changing times.

In the same way, for a good part of the last century public funding for research in universities have not been towards finding solutions for specific problems of the commercial segment of the society (Fossum et al., 2004). To solve the problems of insufficient research and underutilization of research results by the industry, a re-look at the age old concept of production and utilization of intellectual property was required (Kieff, 2001). An identification of major facilitators of research in universities thus becomes pertinent.

4 DEFINING UNIVERSITY RESEARCH ECOSYSTEM

University Research Ecosystem (URE) can be basically understood as a community of researchers which interacts with one another, their environment and other stakeholders interested in their respective areas of research in such a way that knowledge is transferred between them and system-level processes emerge. For a research ecosystem to evolve, sharing of knowledge is a must as it works like

essential abiotic components of a biological ecosystem. Research ecosystem can be better understood if we analyze it by two views: stakeholder view and process view.

4.1 Stakeholder view of research ecosystem

We conceptualize stakeholders view as collection of interaction of individuals and institutions. The key stakeholders of a research ecosystem of an institution are their faculty, doctoral students, research associates and postgraduate students. Burrows (1999) called these stakeholders, facilitators which included regulatory powers, teaching staff, administrative personnel, competitors, donors, governmental organizations, and various partners among others. Here, it should also be noted that research in isolation is not possible in new age and knowledge economy.Cut throat completion, changing technology and other resource constraints define the context which calls for collaboration with external institutions, industry, central or state government. For research ecosystem to survive, each and every stakeholder has to play a critical and responsible role. Figure 1 below presents the stakeholder view of research ecosystem.

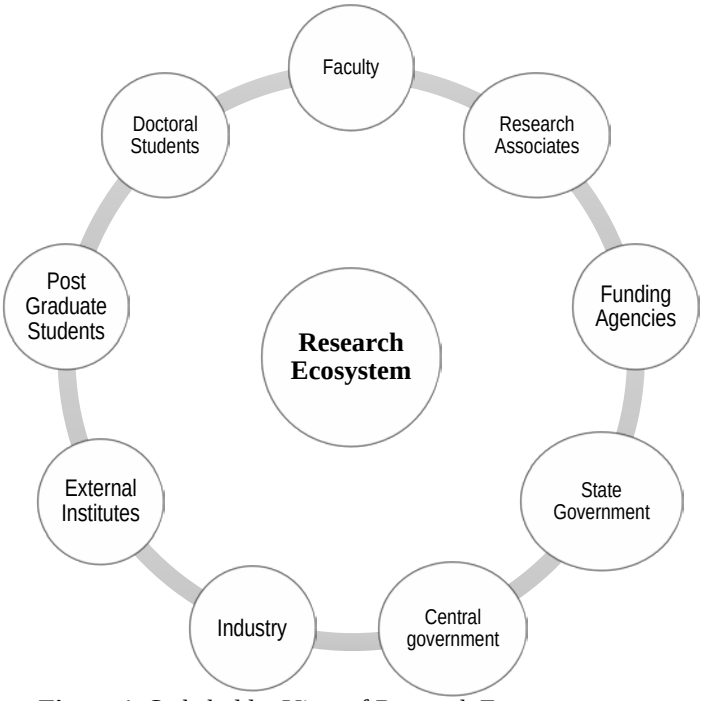


Figure 1: Stakeholder View of Research Ecosystem

4.2 Process view of research ecosystem

The different processes which help the stakeholders of the research ecosystem to share and transfer knowledge among them are shown in the figure 2. The process view is characterized by the processes that can guide a university research ecosystem if managed carefully. These include regular brainstorming in seminars, workshops, conferences and online forums and informal gatherings as well. Technology being a major factor in almost every walk of life cannot be ignored in creation of a research ecosystem. Leveraging on technology available, a library information system and an academic information system can be developed by the institutes to give access to journals, books and audio and video archives as well as making forums and notice boards, etc.

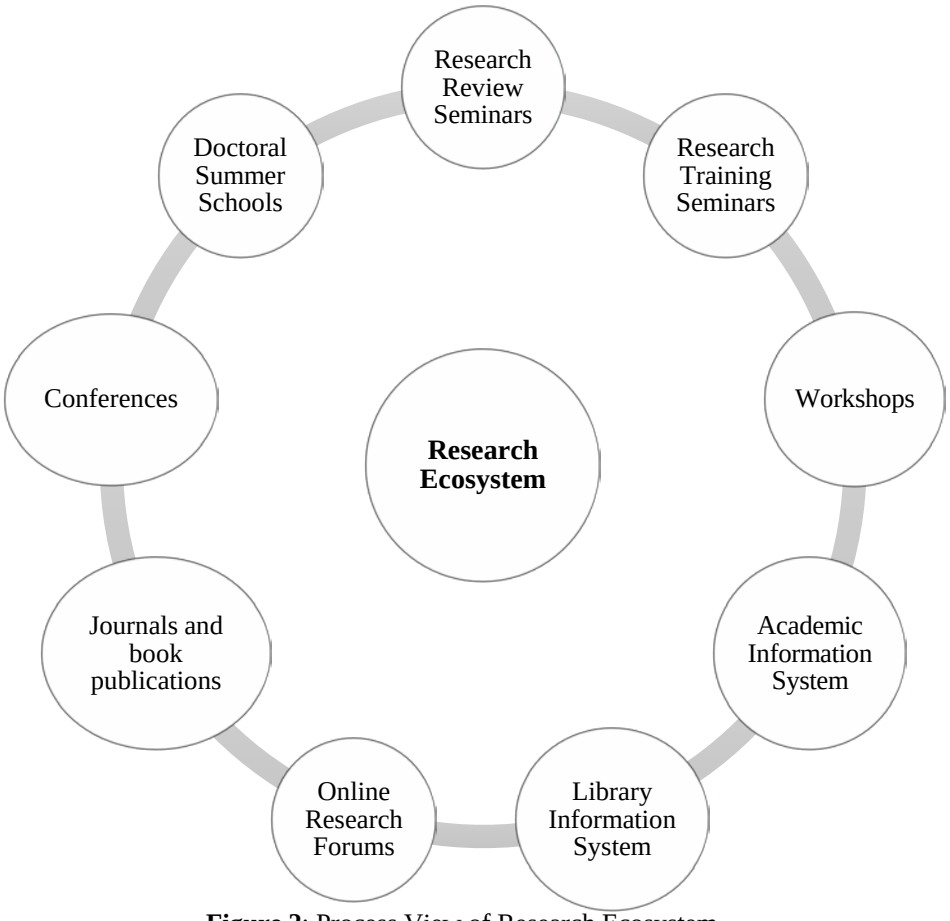


Figure 2: Process View of Research Ecosystem

5 SUSTAINABLE RESEARCH ECOSYSTEM

A sustainable research ecosystem is a system that survives, functions, and updates itself over time; a system in which research community can continue to interact, share, and transfer the knowledge; which can guide the upcoming generations of researchers on its own. If we take the analogy of sustainable natural ecosystem (Chapin III, et.al., 1996), a sustainable research ecosystem can be defined as one that, over the normal cycle of disturbance of events (e.g. economic slowdown), maintains its characteristic diversity of major stakeholder groups, research productivity and its contribution towards the society as a whole.

Few research ecosystems are sustainable and longer than two to three decades, because factors such as research culture, knowledge resources and key stakeholders which shape ecosystems change significantly over these periods of time, as each stakeholder migrates according to its unique knowledge requirement and research capabilities. Like natural ecosystem, it is hard to sustain the current level of research output, composition and structure of stakeholders of any research ecosystem indefinitely. However, sustainability is a relevant and important concept to protect the invaluable knowledge for upcoming generation of researchers.

Research ecosystems are not static. Research stakeholder composition, research productivity, and research processes all change in response to stochastic events and successive change. The specialty of a sustainable research ecosystem is that it maintains these traits within stable bounds.

5.1 The Basis of Sustainable Research Ecosystem

The properties of a research ecosystem are governed by four dynamic elements or interactive controls: regional research culture, research resource management, research stakeholders, and disturbance regime. These interactive controls are constrained by four external factors: global research culture, global research community, and time. A conceptual model of sustainable research ecosystem has been provided in figure 3. From the figure, it is clear that interactive controls must be conserved to sustain a research ecosystem. A new research ecosystem with different properties will evolve with the major changes in any interactive controls. Though each interactive control may change over the time, these controls operate within bounds represented by unique research ecosystem in a way that large changes in interactive controls are prevent

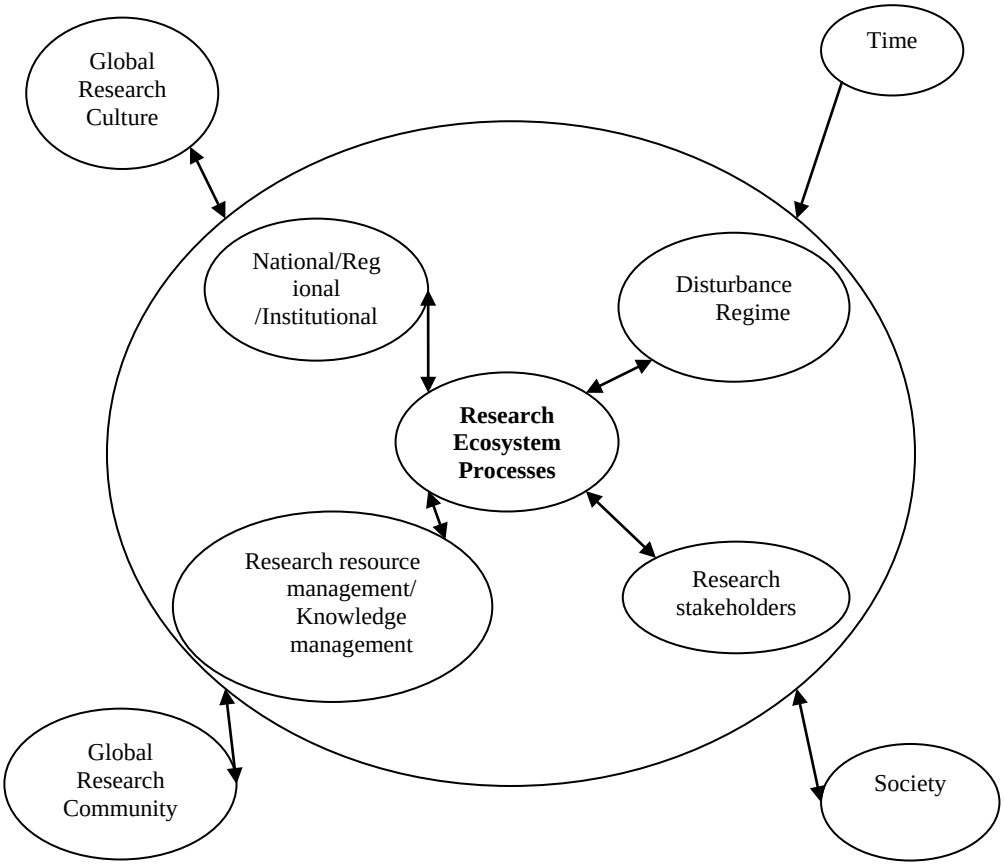


Figure 3: Conceptual Model for creation of a sustainable research ecosystem

5.1.1 Research Culture (National/ Regional/ Institutional)

Research culture is the interactive control that most strongly governs the structure and research productivity of a research ecosystem. The key ingredients of the research cultures are: trust, collaboration, cooperation, and motivation.

Trust is necessary for the stakeholders to interact and share their research ideas without fearing of theft of the same with a hope that they will get honest feedbacks from others. Trust will make the foundation for the research stakeholders to collaborate and cooperate for the greater interest of research community and society at large. Collaboration and cooperation amongst similar as well as cross disciplinary stakeholders will increase the research productivity of ecosystem and effectiveness of the research ecosystem processes. Motivation such as rewards, acknowledgements, promotions, incentives will lead to the greater interests of the

researchers and other stakeholders to concentrate towards the quality research that in turns results into the synchronization among the research stake holders and creation of sustainable research ecosystem. Sharing of knowledge plays a vital role in attaining the sustainability for a research ecosystem. However current studies show that for sharing the knowledge trust, cooperation, collaboration and motivation is required.

5.1.2 Disturbance Regime

Change in the intensity or frequency of disturbance can create long-term research ecosystem change. For example, in an economic slowdown the research grant given to the respective stakeholders may be reduced and the nature and scope of research, composition and structure of the research stakeholder may also change as a result of that. These changes may have long lasting effect on the sustainability of research ecosystem. Same may be the case with the research orientation of institute heads and government research policies.

5.1.3 Research Resource Management/ Knowledge Management

Research resource management or knowledge management should be catering to the need of fulfilling a research ecosystem in a way by creating a virtuous cycle of knowledge creation, sharing, storage, application and protection. If KM efforts are systematically and deliberately carried out with a research focus it will enable strategic planning to carry out newer projects; improve effectiveness and innovative thinking; allow better decision making; create better value for the research institution and subsequently enhance research performance. In the nutshell, knowledge management can be viewed as the systematic management of knowledge resources and processes in order to create value for the institution (Wong &Aspinwall, 2004). However, this management of knowledge is not easy. Knowledge sharing is the most important critical success factor of all knowledge management strategies. Effective knowledge sharing practices allow individuals to reuse and regenerate knowledge at the individual and organizational level (Chaudhry, 2005).However, at the heart of knowledge sharing, two types of bottlenecks exist; individual and organizational barriers. Individual barriers include internal resistance, trust (Barson, Foster, Struck, Ratchev, &Pawar, 2000), motivation (Disterer,2001) and a gap in awareness and knowledge (Bureš, 2003). Organizational barriers consist of language, conflict avoidance, bureaucracy (Disterer, 2001) and distance (Nonaka, 1991). Effective knowledge sharing occurs when appropriate solutions are built into an organization. Institutes of higher learning need to look into the systems

and processes within to clear this bottleneck to succeed in creation of sustainable research ecosystem.

5.1.4 Research Stakeholders

Research stakeholders as mentioned earlier form a critical part of research ecosystem. These stakeholders such as doctoral students, research associates and faculty members need open environment to be nurtured in a manner to achieve the desirable result. Interactions within and outside while collaborating with others in the similar and other disciplines encourage collaborative learning which can lead to innovative and distinguished work. Institutional collaboration and support from the government and other statutory body can help the building and smooth functioning of a research ecosystem. Grants from the government bodies and corporate for doing research of managerial and policy implication can take a nation to new heights.

6 CONTEXTUALIZING THE MODEL

As an initial attempt to propose a new perspective this paper made an effort to develop a model for creation of research ecosystem which can be sustainable. The model presented in this paper can be considered as a “small program” model where in an academic institute the faculty members of various academic disciplines are available for interaction and collaboration. This model has been developed in the context of developing countries where institutes of higher education face resource constraints. For example this model would be applicable in a small institution which has relatively small number of faculty who are working in areas which are somewhat overlapping (such as management education). The researchers are closely knitted, working together either physically as well as virtually through various modes of advanced communication (e.g. Skype, WebEx, blogs, online research communities, etc.). However, this model might fall short in major research institutions which have many faculties some of whom are working in areas which are significantly different from their colleagues and where the researchers are scattered across institutions and even internationally. Research community however will benefit if the departments (which can be treated as standalone ecosystem) interact and collaborate with one another to form a bigger ecosystem encompassing all these smaller ecosystems i.e. ecosystem of ecosystems.

7 DISCUSSION AND CONCLUSIONS

This paper started with an aim to develop a new understanding of producing high quality research through the development of a unique perspective of creation of sustainable research ecosystem. We expect that research based on this perspective would immensely benefit the research both as a practice and process in institutes of higher learning in emerging markets like India and other South East Asian countries. Firstly, it is expected that such research would provide valuable input towards the creation of such sustaining ecosystems of research, on the basis of features operationalized and described in this conceptual paper. The insights generated here would therefore contribute to the existing models and frameworks that very few institutes follow. New as well as existing institutes can take these inputs to co-create an ecosystem of learning.

7.1 Future Directions

This paper has conceived and conceptualized a new direction of thinking, i.e. creation of a sustainable research ecosystem. More research is clearly warranted on the subject to explain how some universities in the western world have managed to significantly improve their research performance. The future research initiatives need to carefully analyze the dual perspective of research as well as the teaching in the universities same can be studied from the knowledge sharing point of view.

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