Environmental Informatics: Potentialities in iSchools and Information Science & Technology Programs— An Analysis

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Area/Section: Technology Management.
Type of the Paper: Exploratory Study.
Type of Review: Peer Reviewed as per |C|O|P|E| guidance.
Indexed in: OpenAIRE.
DOI: http://doi.org/10.5281/zenodo.3841661.
Google Scholar Citation: IJMTS.

How to Cite this Paper:
Paul, P. K., Ricardo, Saavedra., Aithal, P. S., Bashiru, Aremu., & Baby, Pappachan. (2020). Environmental Informatics: Potentialities in iSchools and Information Science & Technology Programs— An Analysis. *International Journal of Management, Technology, and Social Sciences (IJMTS)*, *5*(1), 238-250. DOI: http://doi.org/10.5281/zenodo.3841661.

International Journal of Management, Technology, and Social Sciences (IJMTS)
A Refereed International Journal of Srinivas University, India.

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ABSTRACT

Environment is an alarming concern and valuable to all of us, as all of us belong to the environment and ecology in a different context. There are different studies available related to the environment and as far as Informatics is concerned, it is the field of practice and study related to the information systems and information activities using tools, techniques and technologies. The applications of Informatics in different areas and branches are important concerns viz. agriculture, healthcare, transport and tourism, education and training, government and administration, business and commerce; and in this context Environmental Informatics are important. This is the application of Informatics and Information Technologies in the environment and allied subjects. There are universities and academic bodies offering Environmental Informatics academic programs mainly from the environment and allied departments and units. Though, the field is a combination of both the areas and thus can be offered in Informatics or allied departments or bodies. As far as Informatics related branches are concerned important are IT, Information Systems, Information Management, Computer Sciences, etc. And in all these departments or units Environmental Informatics can be started as a Major or Specialization with proper educational policies. *iSchools* is an international consortium and body dedicated to combining all information related institutes, departments and programs under one roof with a focus on technologies for the societies and different sectors. Thus, the field of Environmental Informatics can be started easily in the *iSchools*. Furthermore, in recent past *iSchools* considered as the academic units offering information or IT related programs irrespective of their affiliation to the *iSchools* Organization, United States. This is maybe considered as a policy paper for the environmentalist, educationalist, IT educators to think about the potentialities of Environmental Informatics in Informatics or IT or simply *iSchools* related departments, programs, etc.

Keywords: Environmental Informatics, IT, Computing, Environment, Interdisciplinary, Academic Innovation, iSchools.

1. INTRODUCTION :

During 1998 the *iSchool* originated by the following eminent educationalist and Information Professionals initially—

- Toni Carbo, School of Information Science, University of Pittsburgh;
- Donald Marchan, School of Information Studies, Syracuse University and
- Richard Lytle, College of Information Science and Technology, Drexel University

They have joined hands for building a common platform of information related departments or Information association called *I-School* Caucus.

In 2001, 'Gang of Five' were noticeable from 'three' and later on in 2003 several Information related units joined and this way it creates a wider arena of diverse information system practice with keeping traditional information fundamentals. Some of the schools from the universities like University of North Carolina, Florida State University, Indiana University, University of Illinois, etc formed a group of ten. Later on, *I-School* teams changed the conventional name from *I-School* caucus to simply *iSchools Organizations (i.e. Information Schools* organization) with new and much more sophisticated agenda. As the organization is directly associated with the Information fields thus later on others including Computing, IT, Electronics and Telecommunication Schools joined with the *iSchool* Organization. As a result, different information related programs started in the units viz. 'Information Science and Technology, Information Management, Information Systems and Management and also existing Information Science with new flavor/ approaches and concentration [1], [13].

In these schools, different educational programs related to the information, technologies related to the information are offered. As Environmental Informatics is an interdisciplinary program, thus in such schools the programs may be offered at different levels and in different allied subfields of Environmental Informatics as well [2], [3], [14].

2. OBJECTIVE :

As this current paper is interdisciplinary and educational in nature; thus, inherit with the following aim and objectives—

- To learn about the basics of Environmental Informatics including its features, functions, and role.
- To know about the stakeholders, technologies involved, and current educational programs on Environmental Informatics.
- To get the broad picture of Informatics and allied fields and potentialities to offer Environmental Informatics in the Informatics and allied programs.
- To learn about the *iSchools* i.e. the consortium and also *iSchools* in general to oversee the potentialities of offering Environmental Informatics programs in the *iSchools*.
- To know about the current scenario of listed iSchools internationally including universities, academic bodies, and countries.
- To find out the possible specialization of Environmental Informatics in Information related units or programs i.e. *iSchools* and in *iPrograms*.

3. METHODS :

Current study entitled 'Environmental Informatics: Potentialities in *iSchools* and Information Science & Technology Programs—*An Analysis'* is an interdisciplinary works and combines with different Informatics/ Information Technology, Environmental Science, Educational Science, Policy Studies etc. Thus, to do this study and analysis different sources are used to gather knowledge. It includes the secondary sources, primary sources. Further, studies undertaken using official website of *iSchools* Organization, United States to learn about the basic, latest on information related programs and potentialities on Environmental Informatics programs in the *iSchools* or any non-affiliating similar departments or departments. Government bodies related to the education, IT also analyzed to learn their recent academic activities and potentialities.

4. ISCHOOLS, IST AND ENVIRONMENTAL INFORMATICS :

Growing technological and management components changes the entire world of exiting Information Science and also its closest field. Information technology and Computing bring this changes many new knowledge gradients now associated with Information Science [5]], [9], [15]. Hence some of the Universities and Institutes focused on Information Science even started newer interdisciplinary and multidisciplinary component enriched Information Science and Technology, Information Science and Engineering, Information Science and Computing, Information Resource Management, Informatics etc [4], [7], [16].

It is worthy to note that, apart from nomenclature of Information Science and Technology many are offering different nomenclature but these are close with IST. The nomenclature of Information Science and Technology was first changed by the

American Society of Information Science and Technology *from American Society of Information Science*. As this leading Information Science Association changed their title, so thereafter many universities, institutes, research center changed their nomenclature not only Information Science and Technology but also others, as mentioned previously. Ultimately these are all Information Science irrespective of their nomenclature [6], [8], [16].

The main features of such school are Information program concentration of interaction of 'Information-Technology-People'. All these are close to the society by the Information and Technology solution. To keep in mind interaction, need and trends this *iSchools* Organization established as international association in 1988 at United States (as name of *iSchool* caucus foundation initially) [10], [14], [17].

iSchool Organization is thus deals with the department or schools or institutions or colleges in Information Sciences ranging from simply Information Science/ Information Studies/ Communication Studies/ Information Systems/ Computing and Information Technology or any other field that is directly or indirectly related to Information and Computing for proper and scientific information solution and management [11], [16], [18].

As Information Science is also called as Informatics, so that in such schools the Environmental focused may be started. During this study it is noted that only few are offered the Geo Information Science/ Informatics specializations. Such potential schools with their current unit names (also universities) are listed in table: 1.

Table1 : List of iSchools registered under the iSchools Organization, United States

Sl.No.	University & Academic Unit (iSchools)	Country
1	University at Albany, College of Emergency Preparedness, Homeland Security and Cybersecurity	USA
2	University of Arizona School of Information	USA
3	University of California, Berkley School of Information	USA
4	University of British Colombia The School of Information	Canada
5	Carnegie Mellon University Heinz College of Information Systems and Public Policy	USA
6	University of Cincinnati School of Information Technology	USA
7	University of Colorado, Department of Information Science	USA
8	Cornell University Faculty of Computing and Information Science	USA
9	Dominican University School of Information Studies	USA
10	Drexel University College Computing and Informatics	USA
11	Florida State University College of Communication and Information	USA
12	Georgia Institute of Technology College of Computing	USA
13	University of Illinois at Urbana Champaign School of Information Sciences	USA
14	Indiana University at IUPUI School of Informatics and Computing	USA
15	Indiana University, Bloomington School of Informatics, Computing and Engineering	USA
16	University of California, Irvine Donald Bren School of	USA

	Information and Computer Science	
17	Kent State University School of Information	USA
18	University of Kentucky College of Communications and Information	USA
19	Long island University University Palmer School of Library and Information Science	USA
20	Louisiana State University School of Library & Information Science	USA
21	University of Maryland, Baltimore County Department of Information Systems	USA
22	University of Maryland College of Information Studies	USA
23	McGill University, Montreal School of Information Studies	Canada
24	Michigan State University Department of Media and Information	USA
25	University of Michigan School of Information	USA
26	University of Missouri School of Information Science and Learning Technologies	USA
27	University of Montréal School of Library and Information Science	Canada
28	University of North Carolina, Chapel Hill School of Information and Library Science	USA
29	University of North Texas College of Information	USA
30	University of Oklahoma School of Library and Information Studies	USA
31	The Pennsylvania State University College of Information Science and Technology	USA
32	University of Pittsburg School of Computing and Information	USA
33	Pontifical Xavierian University Department of Information Science	Colombia
34	Pratt Institute School of Information	USA
35	The State University of New Jersey, Rutgers, School of Communication and Information	USA
36	San Jose State University School of Information	USA
37	University of São Paulo School of Communication and Arts (ECA)	Brazil
38	Simmons University, Boston School of Library and Information Science	USA
39	University of South Carolina School of Library and Information Science	USA
40	University of South Florida School of Information	USA
41	State University of New York, Buffalo Department of Information Science	USA
42	Syracuse University School of Information Studies	USA
43	The University of Tennessee School of Information Sciences	USA
44	Texas A&M University	USA

	– Kingsville Department of Electrical Engineering & Computer Science	
45	University of Texas at Austin School of Information	USA
46	University of Toronto Faculty of Information	USA
47	University of California at Los Angles Graduate School of Education and Information Studies	USA
48	University of Washington The Information School	USA
49	Wayne State University School of Information Sciences	USA
50	University of Wisconsin, Madison The Information School	USA
51	University of Wisconsin, Milwaukee School of Information Studies	USA
European*iSchools* Directory		
52	Aalborg University Department of Communication and Psychology	Denmark
53	University of Amsterdam Graduate School of Humanities, Archives and Information Studies	Netherlands
54	Bar-Ilan University Department of Information Science	Israel
55	University of Borås The Swedish School of Library and Information Science	Sweden
56	University Carlos III of Madrid Department of Library and Documentation	Spain
57	Open University of Catalonia Faculty of Computer Science, Multimedia and Telecommunications.	Spain
58	Charles University in Prague Institute of Information Studies and Librarianship (IISL)	Czech Republic
59	University of Copenhagen Department of Information Studies	Denmark
60	University College Dublin School of Information and Communication Studies	Ireland
61	University of Glasgow Humanities Advanced Technology and Information Institute	UK
62	Hacettepe University Department of Information Management	Turkey
63	Humboldt University of Berlin Berlin School of Library and Information Science	Germany
64	IMT Atlantique (A Technological University) Department of Logic Uses, Social Sciences and Information	France
65	Linnaeus University Information Institute (iInstitute)	Sweden
66	University College London Department of Information Studies	United Kingdom
67	Makerere University The College of Computing and Information Sciences	Uganda

68	Northumbria University Department of Computing and Information Sciences	United Kingdom
69	Nova University Lisabon Information Management School	Portugal
70	Manchester Metropolitan University Information and Communications	United Kingdom
71	The University of Minho ALGORITMI Center School of Engineering	Portugal
72	Oslo Metropolitan University Department of Archivistics, Library and Information Science	Norway
73	University of Oxford The Oxford Digital Information Group	Oxford
74	Polytechnic University of Valencia School of Informatics	Spain
75	University of Porto Faculty of Engineering in cooperation with the Faculty of Arts	Portugal
76	University of Regensburg Institute for Information and Media, Language and Culture	Germany
77	Robert Gordon University Department of Information Management of Aberdeen Business School	United Kingdom
78	University of Sheffield Information School	United Kingdom
79	University of Siegen School of Media and Information (iSchool)	Germany
80	University of Strathclyde Computer and Information Sciences	United Kingdom
81	Josip Juray Strossmayer University of Osijek, Croatia Department of Information Sciences	Croatia
82	Tampere University Faculty of IT and Communication Sciences	Finland
	Asia Pacific *iSchools* Directory	
83	Central China Normal University School of Information Management	China
84	Charles Sturt University School of Information Studies	Australia
85	University of the Chinese Academy of Sciences Department of Library, Information and Archives Management	China
86	University of Hong Kong Human Communication, Development, and Information Sciences (CDIS)	China
87	Jilin University School of Management	China
88	KhonKaen University (KKU) Department of Information Science	Thailand
89	Kyungpook National University (KNU) Department of Library and Information Science	Korea
90	Kyushu University Department of Library Science, Graduate School of Integrated Frontier Sciences	Japan
91	National Chengchi	Taiwan

	University Graduate Institute of Library Information and Archival Studies	
92	Nanjing University of Science and Technology School of Economics and Management	China
93	Nanjing University School of Information Management	China
94	Monash University Faculty of Information Technology	Australia
95	University of Melbourne Department of Computing & Information Systems	Australia
96	National Taiwan University Department and Graduate Institute of Library and Information Science	Taiwan
97	National Taiwan Normal University Graduate Institute of Library and Information Studies	Taiwan
98	Renmin University of China School of Information Resource Management	China
99	Shanghai University Department of Library, Information and Archives	China
100	Soochow University Department of archives and e-government	China
101	University of South Australia School of Information Technology & Mathematical Sciences	Australia
102	National Taiwan University Department and Graduate Institute of Library and Information Science	Taiwan
103	Peking University Department of Information Management	China
104	University of the Philippines School of Library and Information Studies	Philippines
105	Sun Yat-Sen University School of Information Management	China
106	Sungkyunkwan University Library and Information Science	South Korea
107	University of Technology, Malaysia (MARA) Faculty of Information Management	Malaysia
108	University of Tsukuba Graduate School of Library, Information, and Media Studies	Japan
109	Waikato University School of Computing and Mathematical Sciences	New Zealand
110	Wuhan University School of Information Management	China
111	Yonsei University Department of Library and Information Science	South Korea

5. ENVIRONMENTAL INFORMATICS POTENTIALITIES IN ISCHOOLS OR IN IST RELATED DEPARTMENTS/ UNITS :

Environmental Informatics is interdisciplinary practicing domain and responsible for the utilization of Information Technology and Computing in Environment and related subjects dedicated to the Nature and Ecology [12], [19. Moreover, areas such as Geology, Agriculture, Forestry, Geography, Climatology, Oceanography,

etc are also important users of Environmental Informatics. It is also called as Eco Informatics and Ecology Informatics in some contexts. Environmental Informatics is also related with Environmental Information Technology. Environmental Informatics build with environmental and information sciences for problem solving to the environment, humans and computers [6], [20], [21].

The *iSchools* are focused on information sciences or technologies related to the information. Hence simply such can be depicted as Information Science and Technology programs. Environmental Informatics as an interdisciplinary [7], 22], [24] programs combine with environment and information technology. Thus, there are huge potentially to offer Environmental Informatics or related subjects in the *iSchools* listed by the *iSchools* Organization, United States if possible. However, in other schools or departments related to the information or IT Environmental Informatics programs can be started. The general degrees in iSchools are—

- BSc/MSc
- BS/MS
- MPS
- PhD, etc

In Informatics/Information Science Programs—

Informatics is synonym with the Information Science in some context. Both are information centric and application oriented [4], [23], [26]. Informatics is particularly mean as a practicing field while Information Science can be denoted as a field of study. In this field growing domain or field specific areas are include—

- Health Informatics
- Bio Informatics
- Geo Informatics
- Business Informatics, etc

Internationally most of these branches available with BSc/BS/MSc/MS Degree while in India and some other countries the branches can be offered in Engineering context as well. The table2 depicted such possible programs herewith on Environmental Informatics concentrated.

Table2: Possible programs with Environmental Informatics concentration in Informatics Programs

Science Concentration (Informatics)	Engineering Concentration (Informatics)
BS-Informatics (Environmental Informatics) BSc-Informatics (Environmental Informatics) MS-Informatics (Environmental Informatics) MSc-Informatics (Environmental Informatics) MPhil-Informatics (Environmental Informatics) PhD/DSc-Informatics (Environmental Informatics)	BTech/BE-Informatics (Environmental Informatics) MTech/ME-Informatics (Environmental Informatics) MSc (Engg.) -Informatics (Environmental Informatics) MPhil (Engg)-Informatics (Environmental Informatics) PhD/DSc (Engg.) -Informatics (Environmental Informatics)

In Information Systems Programs—

The field Information Systems is very close with Information Science or Informatics. This is the branch responsible for designing, developing and implementing IT and Systems for the organizations and institutes [16], [17]. The field is concentrated on different organizational and business-related aspects as well. The common degrees in this field are BSc/BS/MSc/MS Degree. As far as Engineering is concerned, the table 3 depicted possible specializations of Environmental Informatics.

Table 3: Possible programs with Environmental Informatics concentration in Information Systems Programs

Science Concentration (Information Systems)	Engineering Concentration (Information Systems)
BS- Information Systems (Environmental	BTech/BE-Information Systems (Environmental

Informatics) BSc- Information Systems (Environmental Informatics) MS- Information Systems (Environmental Informatics) MSc- Information Systems (Environmental Informatics) MPhil- Information Systems (Environmental Informatics) PhD/DSc-Informatics (Environmental Informatics)	Informatics) MTech/ME- Information Systems (Environmental Informatics) MSc (Engg.) - Information Systems (Environmental Informatics) MPhil (Engg)- Information Systems (Environmental Informatics) PhD/DSc (Engg.) - Information Systems (Environmental Informatics)

In Information Management Programs—
Environmental Informatics branch or specializations can be started in Information Management Degrees. Information Management is responsible for the managing information of different systems or organizations using various tools, systems. The possible programs in Information Management with Environmental Informatics concentration is depicted table 4 herewith.

Table 4: Possible programs with Environmental Informatics concentration in Information Systems Programs

Science Concentration (Information Management)	Engineering Concentration (Information Systems)
BS- Information Management (Environmental Informatics) BSc- Information Management (Environmental Informatics) MS- Information Management (Environmental Informatics) MSc- Information Management (Environmental Informatics) MPhil- Information Management (Environmental Informatics) PhD/DSc-Informatics (Environmental Informatics)	BTech/BE-Information Management (Environmental Informatics) MTech/ME-Information Management (Environmental Informatics) MSc (Engg.) -Information Management (Environmental Informatics) MPhil (Engg)-Information Management (Environmental Informatics) PhD/DSc (Engg.) -Information Management (Environmental Informatics)

In Computer Sciences—
In academics as far as, Computing field is concerned there are many subjects viz. Computer Science, Computer Engineering, Computing, Computer Applications etc. Ultimately these subjects are responsible for designing, development and applications of computer systems. These are mainly hardware centric. But still, within this category most suitable subjects in which Environmental Informatics specializations can be started are Computing, Computer Applications. Though in Computer Science, Computer Engineering, etc the specializations of Environmental Informatics can be started for providing the solutions of software development responsible for the environmental solutions. Table 5 herewith depicted in detail.

Table 5: Possible programs with Environmental Informatics concentration in Computing related Sciences Programs

Science Concentration (Computer Sciences)	Engineering Concentration (Computer Sciences)
BS- Computer Science (Environmental	BTech/BE-Computer Science (Environmental

Informatics) BSc- Computer Engineering (Environmental Informatics) BS- Computing (Environmental Informatics) BCA (Environmental Informatics) MPhil- Computer Science (Environmental Informatics) PhD/DSc-Computer Science (Environmental Informatics)	Informatics) MTech/ME-Computer Engineering (Environmental Informatics) MSc (Engg.) –Computer Science (Environmental Informatics) MCA (Environmental Informatics) MPhil (Engg)-CS/CSE (Environmental Informatics) PhD/DSc (Engg.) –CS/CSE (Environmental Informatics)

In Emerging Technologies as research focus—
Environmental Informatics as a sub field of Informatics is also depends on various emerging technologies viz. –

- Big Data Management.
- Data Analytics.
- Cloud Computing.
- Virtualization Applications.
- Internet of Things (IoT).
- Converged Network.
- User Experience Designing.
- Usability Engineering.
- Human Computer Interaction.
- 3D Graphics and Media.
- Wireless Network and Censor.
- Satellite Technology, etc.

And all these technologies can be applied in different areas of Environmental Informatics for better environmental solutions. Some of the possible programs in this regard depicted in Table 6 herewith.

Table 6: Possible emerging technologies with Environmental Informatics concentration

Science Concentration (Emerging Technologies)	Engineering Concentration (Emerging Technologies)
BSc Data Science (Environmental Informatics) MSc Data Science (Environmental Informatics) MPhil/PhD Data Science (Environmental Informatics)	BTech/ BE-Data Science (Environmental Informatics) BTech/ BE- Data Science (Environmental Informatics) BTech/ BE- Data Science (Environmental Informatics)

6. SUGGESTION :

- Environmental Informatics as inter-disciplinary thus apart from the environment related programs it can be started at informatics or information science and technology related programs as specilizations/concentration at Bachelors or Masters or Research levels by adding professors and professionals from the field/s.
- The departments or academic units which offers IT or Computing related department can start full-fledged Environmental Informatics programs as Bachelors, Masters and Doctoral Degrees.
- The schools i.e. *iSchools* Organization listed already offers wide range of IT, informatics programs on different technologies and domain centric programs and in some of these institutes the specilizations of Environmental Informatics or full-fledged Environmental Informatics could be started.
- The departments, schools or academic bodies follows the programs and academic attributes related to the *iSchools* Organization listed schools *but not* under this consortium may also start this specilization by taking measure on proper policies and arrangement. And in a country like India as well this type of procedure would be suitable.
- In case of health infrastructure of environment or allied branches Environmental Informatics allied subjects can be started viz. Forest Informatics, Irrigation Informatics, Ecology Informatics, etc based on need and potentialities.
- In case of difficulties in academic programs offering the institutes can offer Environmental Informatics as a research major and easily started.

7. CONCLUSION :

World is changing and uncountable changes in different sectors and spaces are noticeable. All we belong to the society and this is a valuable part of the environment. Practically the Societal development can lead the Environmental Development in many contexts. Different weapons, tools, techniques, etc are useful in environmental monitoring and systems. 'Environmental Informatics' is become an important name for modern environmental practice. Environmental Informatics is concerned with the utilizations of Information technologies in environment as well natural resource management in different way. The educational programs on Environmental Informatics are an important step at this moment. The iSchools both under listed of iSchools Organizations and non-listed but following such approaches can move to start educational programs, major, minors, specializations and research areas leading to research degrees on the Environmental Informatics or allied areas. Further, it is important to note that the institutes already have Geo Informatics or allied subjects can easily started educational programs on Environmental Informatics.

REFERENCES :

[1] Allen T. F. Giampietro M. & Little A. M. (2003). Distinguishing ecological engineering from environmental engineering. *Ecological Engineering, 20*(5) 389-407.

[2] Chu, H. (2012). iSchools and non-iSchools in the USA: An examination of their master's programs. *Education for information*, *29*(1), 1-17.

[3] Dayal, I. (2002). Developing management education in India. *Journal of management Research*, *2*(2), 98.

[4] Dillon, A. (2012). What it means to be an iSchool. *Journal of Education for Library and Information Science*, *53*(4), 267.

[5] Goldberg-Kahn, B., & Healy, J. C. (1997). Medical informatics training in pathology residency programs. *American journal of clinical pathology*, *107*(1), 122-127.

[6] Gupta, D., & Gupta, N. (2012). Higher education in India: structure, statistics and challenges. *Journal of education and Practice*, *3*(2). 17-24.

[7] Henricks, W. H., Boyer, P. J., Harrison, J. H., Tuthill, J. M., & Healy, J. C. (2003). Informatics training in pathology residency programs: proposed learning objectives and skill sets for the new millennium. *Archives of pathology & laboratory medicine*, *127*(8), 1009-1018.

[8] Hjorland, B., & Albrechtsen, H. (1995). Toward a new horizon in information science: domain-analysis. *Journal of the American Society for Information Science (1986-1998)*, *46*(6), 400.

[9] Kapur, D., & Mehta, P. B. (2004). Indian higher education reform: From half-baked socialism to half-baked capitalism. *Center for international development working paper*, *103*.

[10[Michael Buckland and Ziming liu (1995).History of information science. *Annual Review of Information Science and Technology, 30*(1), 385-416.

[11] Nambissan, G. B., & Rao, S. (Eds.). (2013). *Sociology of education in India: Changing contours and emerging concerns*. New Delhi: Oxford University Press.

[12] Nikolov, R. (1987). Integrating informatics into the curriculum. *Education and Computing*, *3*(3), 269-74.

[13] Pau1, Prantosh Kumar and Sridevi, K V (2012). I Schools: An overview emphasizing need of versatile I-Programme in India: A Study. *International Journal of Embedded Systems and Computer Engineering, 4*(2), 133-137.

[14] Paul, Prantosh Kumar(2013). Business Informatics: Emerging Domain of Interdisciplinary Information Science with Possibilities in I-Schools. *International Journal of Marketing Theory, 3(2),* 113-120.

[15] Paul, Prantosh Kumar, Dipak Chatterjee, Ajay Kumar (2013). Geographical Information System and its specialization requirement in I- schools [Information Schools]. *The Sci-Tech International Journal of Engineering Sciences*,*1*(1), 88-95.

[16] Paul, Prantosh Kumar (2013). Business Informatics: Emerging Domain of Interdisciplinary Information Science with Possibilities in I-

Schools. *International Journal of Marketing Theory*, *3*(2), 113-120.

[17] Paul, Prantosh Kumar (2013). MSc-Information Science [Geo Informatics]: Overview emphasizing twoproposed curriculum for sophisticated GeoSpatial development. *International Journal of Pharmaceutical and Biological Research, 4*(5), 218-227.

[18] Paul, Prantosh Kumar, Dipak Chaterjee (2013). Retail Informatics: The Wonderful Cluster of Information Science and Marketing Management. *SIT Journal of Management*, *3*(11), 89-95.

[19] Paul, Prantosh Kumar, Jhuma Ganguly, M Ghosh (2013). Chemical Information Management powered by Chemo-Informatics: Possibilities and opportunities emphasizing need and way in Academics and Universities. *Current Trends in Biotechnology and Chemical Research*, *3*(2), 137-141.

[20] Paul, P.K. Aithal, P.S. (2017) Informatics as a Branch in Indian Academics with Case of Private Universities: Emphasizing Biological Information Sciences. *Current Trends in Biotechnology and Chemical Research*, *7*(1-2), 37-42.

[21] Paul, P. K., Aithal, P. S., & Bhuimali, A (2017). Business Informatics: A possible specialization of MSc-Information Science & Technology (IST): Challenges and Opportunities in Developing Countries Context. *International Journal of Recent Researches in Science, Engineering & Technology*. *5*(10), 54-63.

[22] Paul, P. K., Aithal, P. S. & Bhuimali, A. (2018). Business Informatics: With Special Reference to Big Data as an emerging Area: A Basic Review. *International Journal of Recent Researches in Science, Engineering & Technology* 6(04), 21-27.

[23] Sood, R., & Adkoli, B. V. (2000). Medical education in India–problems and prospects. *J Indian Acad Clin Med*, *1*(3), 210-212.

[24] Sohani, N., & Sohani, N. (2012). Developing interpretive structural model for quality framework in higher education: Indian context. *Journal of Engineering, Science & Management Education*, *5*(2), 495-501.

[25] Tilak, J. B. (2008). Transition from higher education as a public good to higher education as a private good: The saga of Indian experience. *Journal of Asian Public Policy*, *1*(2), 220-234.

[26] Wiggins, A., & Sawyer, S. (2012). Intellectual diversity and the faculty composition of iSchools. *Journal of the American Society for Information Science and Technology*, *63*(1), 8-21.

[27] Wu, D., He, D., Jiang, J., Dong, W., & Vo, K. T. (2012). The state of iSchools: an analysis of academic research and graduate education. *Journal of Information Science*, *38*(1), 15-36.

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