VALIDATION OF INFORMATION CONSUMPTION PRODUCTION THEORY AND ROLE OF INFORMATION TECHNOLOGY

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CHAPTER VI

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CHAPTER VI

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Information is broadly the recorded or communicated knowledge gained by human being through experience, observation, experiments and other means. It is the mankind's most valuable resource, which has been playing a crucial role in building human civilization and society in all spheres. In the post industrial society information becomes essential resource for planning and management of all other resources. Backwardness of a society or nation in the modern sense can be attributed by its inability to generate and handle including processing, storing, retrieving and disseminating scientific information and knowledge in the proper way.

The complex processes of scientific information or knowledge consumption and production could be methodologically studied only with the help of a set of sound theories. However no major attempt has so far been made to formulate correct theories and thereby to formulate strategies and policies in the practical context, except two theories formulated by Mathew as early as in 1985 that appeared in different languages, including Russian, Spanish, French etc. thanks to the interest

of the International Federation for Information and Documentation (FID), The Netherlands. These theories are known with the names of the author.

6.1 Restatement of the theories

As the theories are presented and elaborated in the chapter III of the present work, they are given below in a brief and abstract manner with further definition to explain the basic concepts.

Mathew named the two aspects of information consumption and production, rate and level, which denote the qualitative aspect and quantitative aspect respectively. The two theories are:

1) Mathew's theory of information/knowledge consumption production correlation

2) Mathew's stage theory of information growth

6.1.1 Mathew's theory of information/knowledge consumption production correlation

"There exists a direct correlation between high level information consumption and high level information production. Such kind of correlation may or may not exist in the case of low level information consumption."

6.1.2 Mathew's stage theory of information consumption growth

The process of transformation from the low level information consumption to the high level information consumption takes place through various stages. The theory states that there are following four stages.

i) Backward or low level information stage: The user or the society as a whole consumes and produces low level information at low rate too. Information has no value or important at this stage, even if they are available. Consumption of information is quite casual and not purposive. Information literacy is the dominant feature of this stage. Use of libraries, if any is for entertainment or for elementary information and material.

ii) Pre-Condition to Take off stage: Consuming low level of information at a higher rate mainly from text books, class notes, popular materials or media; developing reading habits using libraries in a traditional sense, inculcating awareness of the value of information; feeling the need for advanced library services and simple information technology are the characteristic of pre-condition to take off stage or in brief, pre-take-off stage.

iii) Critical or take off stage: Consuming fundamental and basic information in depth, increasing specialization in selected areas (s) familiarising with the state of art, attaining full mastery

information skill, greater dependence on highly advanced library services and information technology so as to get the latest development in the area of specialisation are some of the essential features of this stage. At this stage information is considered as an input or raw material. In other words, information is for application, for which the user acquires essential skill, including techniques of presenting or writing technical notes, reports, papers in standard style and format in an effective manner. This is a critical stage in the sense that only if one enters in this stage can survive at the high level information consumption.

iv) Advanced stage or stage of affluence in information consumption: At this stage the user is noted with developing his information production capacity and to make assessment of the present trend of information growth and to visualise future trend too. The already attained high level information consumption, resulted in high level information production. The major activity of life has been reduced into high level information consumption and production, information technology has become the part and parcel of day to day life so as to minimise communication gap at international level.

6.2 Restatement of the major findings of the study

The investigator has studied the information consumption and production of various Physical Scientists, which includes Research

Scholars, Lecturers, Readers and Professors of the four Universities in Kerala. It is observed that there is increase in the productivity with increase of experience and status among the scientists who are productive in research papers (more than three papers) and doctoral theses (one or more)

The university physical scientists are classified into five categories according to their designation Research scholars initial stage, Research scholars final stage, Lecturers, Readers and Professors. The time spent for information consumption and the average productivity in terms of research papers and Ph.D. theses of each category are tabulated in Table 6.1.

Similarly, the university physical scientists classified according to their experience in seven groups and their average productivity with respect to research papers and Ph.D. theses are tabulated in Table 6.2.

Table 6.1

Information consumption and production of hysical cientists

Category	Consumption time Hours per week	Average Productivity	
		Research papers	Doctoral theses
Research Scholars Initial	109.17	0.833	
Research scholars final	43.4	9.38	
Lecture	29.67	14.81	0.188
Readers	33.78	23.62	1.517
Professors	37.3	47.038	6.308

It is observed that the research scholars-initial stage spent 109.17 hrs per week for the information use or consumption. At this stage the productivity is negligible. Research Scholars-final stage spent only 43.4 hrs per week, very less compared with the previous stage and the productivity increases to 9.38, lecturers spent only 29.67 hrs per week and their productivity in research papers 14.81. During this stage they starts guiding research scholars, some of them find successful by the end of this period. At the Reader stage the consumption time increases to 33.78 hrs per week along with the increase of productivity in research papers 23.62 and doctoral theses 1.517. At the stage of Professors, all the three quantities increase.

Table 6.2

Information consumption and

Productivity of Scientists with respect to experience

Experience years		Information consumptive time	Average productivity	
			Research papers	Doctoral theses
1	3 or less	107.14	2.8	0
2	3-5	48.15	13	0
3	6-10	24	22.81	1
4	1-5	36.31	24.28	1.67
5	16-20	35.74	24.74	2.95
6	21-25	44.34	40.1	6.2
7	26 & above	24.29	61.86	7

The scientists of experience 3 or less years spent maximum time of 107.14 hrs per week for the information consumption. But the average productivity is seen only 2.8. Scientists of experience 3-5 years the consumption time reduces to 48.15 hrs per week and the productivity in research paper increases to 13. Scientist 6-10 years experience spent minimum time for information consumption of 24 hrs per week and their productivity in research papers is 22.81 and productivity in doctoral theses is 1. Scientists of experience 21-25 years spent 44.34 hrs per week for information, consumption and their productivity in research papers is 40.1 and productivity in doctoral theses is 6.2. Scientists of experiences of 26 years and above spent only 24.29 hrs per week. Their productivity is 61.86 far greater than the previous group.

The validity of the theory of information consumption production of Mathew (1985) has been tested with the observations of the present study.

6.3 Implication of the two theories on the scientific information productivity of physical scientists

6.3.1 Information Consumption Growth in Physical Scientists

It is seen that the research scholars initial, who are the beginners in research, enroll as a research scholar and spent maximum time for information use. They spent 109.17 hrs per week (Table 6.1). In this stage low level information consumption takes place. The researcher has to

spend maximum time on the information use and consumption because of the lack of information handling skill. In order to carry on the research topic, he needs certain basic knowledge and hence more time is spent to acquire the basic knowledge. Hence as seen no new information is generated at this stage though more time is spent for the acquiring of information. The same case is with scientists of experience 3 or less years, who spent 107.14 hrs per week and nominal productivity in research papers of 2.8. The productivity observed at this stage is not of the research scholar, but it is research out put of the research supervisor, who publishes the results of his research work with research scholar as second author, to motivate and train him for publishing of research papers.

The research scholars-initial stage and 3 or less experience stage in the case of university scientists coincides with the first two stages in Mathew's theory. The research scholar acquired the general knowledge at the post graduate level require more of general information some what specific with the research topic to carryout his research. Hence the research scholar needs advanced special library services in the Universities, most of the departments are having a specialised library for this purpose Hence he spent most of the time in the reading of various literatures in his topic as well as in peripheral to subject. Hence the research scholar having no skill in generation of new information, exhibits negligible productivity.

On entering the next stage research scholar-final stage, the time spent for consumption reduces to 43.4, and scientist of experience 3-5 years, spent 48.15 hours per week, which is far less compared with the previous stage. In this stage he needs high level information and more specific information and starts analysing the consumed information. He uses the acquired information for conclusions with the help of his research guide. These conclusions or new ideas derived from the consumed information are coming out as new informations termed as information production. In this stage user acquires the techniques of presenting or writing technical notes, reports, papers in standard style and format in an effective manner. Once this skill is acquired the researcher needs high level informations. Thus at the end of his stage he completes the doctoral thesis with the publication of some research papers. Hence the productivity of research papers 9.38 for research scholars-final stage and 13 for scientists 3-5 years experience is observed. This stage is equivalent to the third stage, Critical or Take off stage in Mathew's theory. By the end of the stage he acquires skill of information handling and he can independently carry out the process of information consumption production. Thus he enters the last stage in Mathew's theory, the advanced stage.

After successful completion of doctoral research work, one enters in the profession as scientists in the University with designation as Lecturer. Hence he has acquired the necessary skill in handling of

information known as information consumption and production. He attains high-level information consumption, which result in high level information production. With the saturation of information consumption he is spending only least time for consumption on current developments in the field for more productivity in research papers (Table 6.1). He spent 29.67 hrs per week for consumption of information for the average production of 14.81 research papers. During this period some productivity in Ph.D. theses are also observed. During this period research scholars are registered under his guidance and some of them will be completed at the end of this stage. This stage can be called as the advanced stage in Mathew's theory. Hence we can observe the high level information consumption for high level information production.

After attaining saturation or near saturation point of high level information consumption, what a scientist could do is to make himself aware of the latest trends for that he could attain with limited or less information consumption time. In most cases top scientists make use of the information consumption of their junior scientists or research scholars to keep themselves abreast of the latest development, that too with a limited time. This period corresponds to 6-10 years experience stage. Here also minimum time is spent for information consumption (24 hours per week for the average production of 22.81 research papers and doctoral theses productivity 1).

In the scientists of 11-15 years and 16-20 years experience, though the consumption time increases to 36.31 and 35.74 hrs per week, no considerable increase in paper productivity is observed, instead an increase in the productivity of Ph.D. theses is observed (form 1.67 and to 2.95). This indicates that during this period University teachers concentrate on the completion of Ph.D. theses of already existing research scholars and guiding more number of research scholars. The professors show an increase in the consumption time with a steep increase in productivity of papers as well as productivity of Ph.D. theses. Here the more the number of successful Ph.D. theses, the more papers published. The productivity of experienced teachers of 26 and above years irrespective of the publication drop phenomenon a steep increase in publication of research papers observed. This is due to the completion of more number of Ph.D. theses and publication drop due to burn out phenomenon in case of the scientists are not actually observed.

Hence the first stage in the ICP starts from the post graduate level, then Research scholar-Initial stage, Research scholar final stage, lecturer stage which is the advance stage, are the equivalent stages in Mathew's stage theory. By entering the lecturer stage, normally the University scientists develop skill of information consumption production and become experts in ICP.

6.3.2 Theory of information consumption production correlation

In the Table 6.1, it is seen that the time spent for information consumption and information production are not uniform at different stages. At the beginning stage of scientists, the time spent is more for information consumption and the productivity is least. While going up on the higher stage the time spent for information consumption decreases, where as that the productivity increases. Then reaches at a stage when, time spent for the consumption becomes minimum and there is considerable productivity. From this stage onwards, the time spent for consumption of information increases with increase of productivity.

The research scholars at the initial stage consume information for 109.17 hrs per week with average productivity if 0.8333 research papers. At this stage low level information consumption takes place. The research scholars final stage spent 43.4 hrs per week and have average productivity of 9.38 research papers. The lecturers spend the least time for consumption, 29,.67 hrs per week but have average productivity of 14.81 research papers. Then readers spent 33.78 hours per week for information consumption and their productivity in papers rises to 23.62. The professors spent 37.3 hrs per week for information consumption for the productivity of 47.03 research papers. In the case of productivity of Ph.D. theses, lectures have average productivity of 0.188, readers have 1.57 professors have 6.308. (Table 6.1)

In the table 6.2 the information consumption time and productivity of the scientists are tabulated. Scientists of 6-10 years experience spent the least time of 24 hrs per week and their average productivity 22.81 in research papers and 1 in doctoral theses. The scientists of 11-15 years, and 16-20 years experience spent more time 36.31 hours per week and 35.74 hours per week for the productivity of 24.28 and 24.74 respectively in research papers and 1.67 and 2.95 respectively in Ph.D. theses. Here the proportionate increase is not seen in average productivity of research papers because of the guiding of more number of research students and not completed the theses. Scientists with 21-25 years experiences utilises 44.34 hours per week for information consumption and their average productivity is 40.1 in research papers and 6.2 in Ph.D. theses.

The time spent for information consumption by scientists in the cardre of lecturers and of experiences 6-10 years is minimum and have considerable productivity in research papers. From this stage onwards we can observe an increase in time spent for information consumption corresponds to an increase in average production in research papers and Ph.D. theses. Hence we can say that in the scientists in the cadre of lecturers and of experience 6-10 years onwards there exists a direct correlation between the information consumption time and scientific productivity.

But at the Research Scholar- initial stage and final stage low level information consumption takes place, with more consumption time, but

the information production is less. Hence there is no relation exists between the low level consumption and production.

From the findings of the present study of scientific productivity and information consumption of physical scientists of Universities in Kerala, the Mathew's theory of information consumption production correlation is found to be valid in the case of physical scientists of Universities in Kerala.

6.4 Role of Information Technology in the Information Consumption production

The norm of science dictates that science is public knowledge and therefore scientific findings must be communicated to the community of scientists. Hence scientific papers and scholarly journals have always been the prime channel of science communication.

In 1962 Fritz Machlup indicated that the United States was the major player in the production of information. Price observed modern science has been growing exponentially in size and complexity. Hence the term "big science has been coined to refer to this significant growth. Price pointed out that a research publication was a characteristic of a modern nation and proportional to the national's economic size as measured by its gross domestic product. Hence, productivity of science and technology information determines the nation's over all development. The scientific productivity of the nation's will be increased for the overall

development of the nation, hence the nations give prime importance to the conduct of research.

6.4.1 The conduct of research

The research is an information management process in which four steps are involved, data collection and analysis, communication and collaboration among researchers and or communication of research findings information storage and retrieval and dissemination. Hence in this process of research, proper application and utilization of information technologies has the following advantages.

1. Increase the use of computation in support of data collection and analysis.
2. Increase the amount of informatics that can be collected and analysed.
3. Possibilities of creation of new families of instruments in which computer control and data processing are central to data collection.
4. Automated operation of instruments and automated collection of data often at remote locations without the researcher having to be present.
5. Increased availabilities of software packages for standard operations such as engineering design, data storage and retrieval, statistical analysis and computation of mathematical function.
6. Increased and more rapid information sharing

7. Possibility of new type of collaborative arrangement among researchers, increasingly independent of geographical location and local time schedules.

8. Communication of information at remote.

The scientific productivity of scientists has been found to be dependent on various factors. Among these factors sex, age, designation, experiences, subjects are personal characteristics of a scientist and they are constants with respect to a scientist. The variable Ph.D. produced is a factor of productivity and it is the net result of the remaining variables. Hence we will discuss the remaining variables and their characteristics in the scientific productivity.

The variables and multiple correlation excluding a particular variable is given in the table 6.3. Since the multiple correlation coefficient 'R' considering all the variables is 0.7988, which indicates that the variables in the table are highly significant for the scientific productivity of scientists. These variables can be classified in to two groups. One is the time spent for information consumption and other is the use of information sources.

Table 6.3

Multiple correlation of variables

Variables	Multiple correlation without this variable
Information Consumption Time	0.5850849
Abstracting / Indexing journals	0.5665671
Review articles	0.5693451
Conference proceedings	0.571622
Consultation with others	0.5832756
Book / Monographs	0.5833241
Primary journals	0.5861187
Reprints / Preprints	0.5861899
Research reports	0.589137
Attending seminars / Conferences	0.590067
Membership in learned / Professional bodies	0.6618745

6.4.2 Use of various information sources

The task of collecting, recording and making available all informations on the intellectual activities of man have itself becomes a complex process calling for specialised skills and knowledge. The increase in the volume of printed matter and recorded information has become bewilderingly large and varied the continuous and proliferation of information at a tremendous rate is now described as a phenomenon of

information explosion. Scientific knowledge has extended to such a degree of magnitude that its size dwarfs all other areas of knowledge.

There is a vast growth of books and periodicals. This growth of books and periodicals not only made problems for stacking, cataloguing, budgeting, etc and also for locating informations. Due to rise in periodicals, as a bibliographic control, the abstracting and indexing journals emerged. It is estimated that there are about 2,000,000 journals in all fields of science and technology altogether in 1980's. Growth of scientific organisations, made scientists to attend the international conferences, which increased fo[illegible]fold from 1950 to 1970 and the number of scientists and technologists increased much. Due to increase of publications, no effective bibliographic control is possible. In order to tackle the above said problem with case of information sources, considering its significance in the scientific productivity of teachers, the application and proper utlisation of new information technologies has become a necessity now a days.

6.4.3 The information consumption time

It is observed that the information time of scientist has a high significance in the scientific productivity in the sense that optimal consumption time so as to attain optimal productivity. Hence the scientific productivity of scientists can be increased either by increasing the consumption time of scientists or increase of rate of consumption. Since most of the highly productive scientists are utlizing the maximum

available time for the information consumption and production, there is no more time to spare for the purpose. Hence only alternative is to increase the rate of consumption. This is possible only by the application of information technologies.

In the two theories formulated by Mathew (1985) he has elaborated the strategic role of information technology both in information consumption and information production processes. The study validated this basic proposition that of the theories that information technology has very important role in information consumption production processes. The study conducted in USA (Clement, 1990) also validated the basic proposition.