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**The effects of economic and time
resources: an Inter-individual analysis
of information seeking**

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The effects of economic and time resources: an Inter-individual analysis of information seeking

This study investigates the effect of economic resources, namely cost, and time resources on information seeking trends of individuals. The study considered individual level variations, as observed in the attitude to these resources of information, arguing that the responses to different resources varied across individuals. The cost and time related dimensions were derived from the data and its effect on information seeking behavior of individuals was estimated. An in-depth questionnaire was administered to 307 respondents. Factor analysis, cluster analysis, multiple regression and Bayesian regression were used in order to identify cost and time related dimensions, find segments of individual information seekers, estimate their effect on the actions of individual information seekers, and make a comparison between the individual level effect and aggregate level effect of cost and time related dimensions on individual information seekers. A significant difference of effect of these two resource related dimensions on individual's information seeking was observed when the effect was estimated at the aggregate level as opposed to the effect estimated at the individual level. This study provides insight into the decision of individuals regarding their choice of resources when seeking some particular information. The study also highlights the benefit of using inter-individual variation. The findings of this investigation are discussed to understand the implications and to provide avenues for future research.

1. Introduction

The information seeking behaviour of an individual is affected diversely by the cost of information and its benefit since information centre deals with an environment which is uncertain as well as expensive [1, 2]. Consequently, gaining an insight into the characteristics that motivate as well as inhibit individual information seekers is critical for information providers as well as organizations. While the first international publication on information seeking behaviour was carried out in the early 20th century, the first study of information seeking process was published in 1960s [3]. The study, carried out by Ellis [4] focused on detailed processes in his highly developed information behavioural model of information search strategies. In the field of consumer behaviour Stigler's [5] work established that the cost of information is not the same for all people, as the cost time is higher for higher income groups. Researchers proved that the assimilation of information was not a pleasant task for most people, but that people were willing to put in an effort for a piece of information when the task was presented in an enjoyable format. He predicted that when choice alternatives were similar, search efforts were reduced as the gains were reduced. Studies carried out more recently have been

concerned with the manner in which source characteristics and task characteristics determine information seeking behaviour [6, 7, 8]. Borgers et al. [9] discovered in their study of information seeking behaviour of out-patients suffering from cancer that the duration of consultation time and interruptions such as telephone calls were barriers to the seeking of information. Information exchange between patients and doctors was affected by the lack of time.

Several studies of factors that affect an individual's information seeking behaviour have been carried out in the last three decades [10, 11, 12]. The research, carried out in the area of communication as well as risk adversity, developed several models of information seeking processes that involve uncertainty reduction, goal orientation, source credibility, desire for control that implicitly proposed the benefit of the information and the related cost in obtaining that information [11, 13, 14, 15, 16, 17]. Perceived cost, on the other hand, deals with the anticipated effort put in by the user to seek accurate information, perceived social cost to the user, negative performance expectations, and low self-confidence [11, 18, 19].

While these studies revealed several aspects of cost and the benefit to information seekers, they also dealt with the criteria of decision taking of the information users. In other words these studies have concentrated on the outcome of the processes [20].It is important to note that all these studies considered information seekers at the aggregate level. These studies tend not to consider the users as individuals, studying them instead in the context of their cultural system. Information needs were seen as the secondary needs and as those that were derived from other, basic needs. There was no scope to consider individual variation of information searching behaviour. This study emphasizes the importance of cost and time of information seeking behaviour in the context of personal behaviour. Individual level heterogeneity among the information seekers suggests that different seekers behave differently while seeking information to satisfy their needs. Perceived cost as well as the perceived benefit from same source of information would vary across individuals depending upon their social and educational background, previous knowledge, urgency of information, risk adversity of individual etc.

A fundamental property in user behaviour is the difference among individuals. Users differ in terms of prior degree of understanding about the information they seek, the way they look for information, the sources they use, the channels they prefer and the way they communicate. Different users are differently sensitive to searching variables like time,

distance, perception about information availability, and consequently their searching process changes to a great extent. The successful implementation of the library activities requires a thorough understanding of distribution of user heterogeneity and identification of preferences at user level. The critical point emphasized here is that the preferences and sensitivities towards time, distance and other costs can not be well represented through aggregate level statistics. The determination of service requirements is unique for each individual and it requires knowledge of the model parameters at an individual level. This diversity provides information centers with the economic/social incentive to offer different services to different groups of people. These different services can be promoted, priced and presented to the users in a manner appropriate to the target groups. Previous researchers were less interested in individual differences; and heterogeneity was regarded as a statistical parametric problem. But in the context of application the differences in coefficients are critically important. The classical way of capturing heterogeneity by using factor analysis and cluster analysis cannot provide actionable information since it gives aggregate level estimates. Bayesian methodology can provide estimates of all the parameters of all the individual units. This study uses hierarchical Bayes methodology in estimating parameters considering individual level information.

The organization of the paper is as follows: the next section provides a review of the already existing literature on information seeking behavior related to economic cost and value of time to a user. It also includes a section on the salient literature on individual level heterogeneity. The next section focuses on the four research questions that are addressed in this investigation. An illustration of the methodology used in finding cost and time related dimensions follows. The information users based on cost and time related variables are segmented. After this comes a description of hierarchical Bayes methodology in estimating parameters considering individual level information, a discussion of the data and presentation of the findings. The conclusion presents a summary of the findings and discusses their implications. The paper ends with a list of future research topics possible in this area.

2. Literature review

Traditional paradigms of information retrieval tend to simplify the information seeking process. Robertson [21] presented models in which the seeker entered a query and matched results. This model described the information seeking process. Bettman [22] outlined a general framework for studying consumer information acquisition and search strategies. Belkin [23] focused on the revelation that information seekers, and even experts in a given information system, are unable to formulate proper queries to access the required information. Later, in the 1980s, a change in approach to studies carried out on information needs and uses was noticed. It is possible to identify two phases in this development. The first phase focused on surveys carried out by particular groups of users aiming to determine the patterns of information-use that could be applied to other groups. This approach was not without its critics [24, 25]. They were especially critical of its limited focus and the methodologies used for the study of interaction of individuals with the information. The results obtained were also rarely applicable to designing and improving information systems. Several empirical models were later developed to describe information behaviour [25, 4, 26]. Gertsberger and Allen [27] proposed the cost-benefit ratio, based on Zipf's 'law of least effort' [28]. According to this law an individual will select the information channel that requires the least average rate of probable work. Allen [29] determined that the accessibility of an information channel is closely related to the frequency of its use. Wilson [30] also asserted that accessibility of an information source will influence the individual when selecting that particular source from a wide variety of alternative sources. The Ashford and Cummings model [10] described information seeking as a process of uncertainty reduction. According to this model anticipated benefits of acquiring information and also the anticipated costs of obtaining that information were decided by the information seekers. A number of studies have been carried out by Ashford and other researchers [11, 17] to conceptualize costs and benefits in different ways. All these studies observed that the frequency of information seeking was positively related to perceived benefits and negatively related to perceived costs. Liu [31] noticed that graduate students preferred to use online information channels rather than printed ones due to easy accessibility of these electronic channels. Several researches [32, 33, 34] on the information seeking behaviour of different groups of users studied the user's choice of an information channel. Orr [35] asserted that the source with the lowest cost would maximize the cost-benefit ratio of the

information searching process where the information seekers faced a set of equivalent channels. Culnan [36] identified three-dimensional accessibility as understandability, ease of use and aspects of physical access to the information resource that might influence the selection process. Hardy [37] applied Zipf's principle and concluded that at the time of seeking information people used the path of least resistance rather than focusing on quality. O'Reilly [38], in his study on social welfare workers, found that the usage of a source was determined by the accessibility of it though there were many factors such as uncertainty of the task, education, time constrains etc. by which the information channel was affected. Fedor et al. [16] found partial support for their prediction that information seeking was positively related to the source credibility. Johnson and Meischke [39] noticed that interpersonal sources of information were more effective in reducing uncertainty as they provided immediate feedback. These sources were also more effective in handling special individual needs and questions. They found that individual information seeking had become a critical element in determining health behaviour and proposed a comprehensive model of information seeking synthesizing the health belief model. Many researches [40, 41, 42] support the opinion that individuals who evaluate the costs of information seeking to be high, seek less information than those who evaluate the costs to be low. Levin [43] explored the survey on information seeking behaviour of local government officials where information was gathered and analyzed in eight areas: kinds of information needed, preferred sources, barriers to accessing information, use and usefulness of professional reading materials, receptiveness of public affairs organizations, satisfaction with amount of information, time spent in information-gathering, and the role of office computers. He suggested improvements in the delivery of information focusing on the development of electronic 'expert systems' and need for information literate person. The fundamental requirement for information seeking was that the sources of information should be accessible.

The economic issues related to information seeking behaviour consider both direct economic cost and the value of time. The study on Jewish scholars investigated the cost benefit ratio that focused in the quality of the information providedand the least effort principle of the accessibility of the channel [44]. Savolainen [45] noticed that the time available for information seeking was an influential parameter in information behaviour. Green [46] observed that low cost informal contacts were preferred to the formal bibliographic sources. In the field of consumer behaviour, Stigler's model [5] showed

that the cost of search was approximately proportionate to the number of sellers approached, for the chief cost of time. He noticed that the cost of time was higher for a person with a large income and vice versa. He also came to the conclusion that the assimilation of information was not an easy task for most of the people and that they might be willing to spend more for the information when supplied in an enjoyable form. Jacoby et al. [47] found negative and zero relationship between the wages and search effort as the wage value of time is not the only deciding factor. In the field of psychology the uncertainty theory of Urbany, et al. [48] suggested that when choice alternatives were similar, the search would intensify in an effort to reduce uncertainty. Cameron et al. [49] found that the information exchange between doctor and the patients was inhibited by the lack of time available, the stress of the situation and the use of the unfamiliar terminology. Hannay et al. [50] found that in a consultation period very little time could be devoted to the doctor to act as a source of health information since all the time was spent in the examination, diagnosis and explanation of treatment.

Though some factors influencing information seeking behaviour have been explored, relatively little is known about cost and time and how and to what extent these factors affect information seeking behaviour, particularly in the case of individual users. While considering individual level heterogeneity in information science sounds elegant, the difficulty lies in estimating parameters considering individual level information. Hierarchical Bayes estimation procedure solves this problem to a great extent. Several hierarchical Bayes literature on random effect model [51, 52, 53] suggest the method that helps in estimating individual specific parameters using aggregate level information under limited data. In this model individuals were considered as independent, conditional on aggregate level parameters. This means the prior induced in individual level were not independent prior. Individual parameters were considered as drawn from the whole population through mixing distribution. Rossi et al. [51, 54] tried to incorporate demographic information in their research to study the individual specific parameter differences. This study examines the effect of cost and time on information seeking behaviour at both, the aggregate and individual level, with the variations revealing the change of these two contexts.

3. Research questions

In this study, information seeking behavioural variables capture an individual's inclination to spend time and money in order to acquire information. An individual's propensity to incur cost and spend time and their behavior under certain circumstances are considered. The following questions motivate this exploratory research:

1. Is there a relationship between the cost and time dimensions and the frequency of visits to an information centre?
2. Is there any effect of cost and time dimensions on the time spent on internet searches and browsing?
3. Is there any difference of cost and time dimensions at the time of conferring with peers and experts?
4. Is there any comparison between the individual level analysis and an aggregate level analysis?

4. Methodology

Information seeking behavior dimensions are a part of an individual. These behavioral traits are inside the users' mind and are not revealed. . This study uses first Kaiser-Meyer-Olkin (KMO) statistics and Bartlett's test of sphericity of the variables collected by the questionnaire and interviews to measure and identify any significant correlations among the variables and also to ascertain if the factor analysis is applicable. Then several information seeking behavioural variables and resource related variables that possess significant correlations are selected to carry out factor analysis to identify the underlying dimensions. SPSS software package for factor analysis has been used to extract a number of interrelated variables with Eigen value above 1.

The second step entails carrying out the multiple regression analysis. The estimated regression coefficient shows the effect of the behavioural dimensions on the dependent variables, such as the effect of cost and time dimensions on the frequency of visiting information centre etc.

After identifying the factors segmentation of the respondents is carried out using cluster analysis method. This analysis divides the respondents into a number of groups having low variability among the group members. The number of respondents in each group is high. .

Then the regression coefficients are estimated separately for each behavioural dimension, both at aggregate level and also for each segmented information user having similar behavioural characteristics. Hierarchical Bayes regression (HR Reg) module of Sawtooth

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software was used for data analysis at the individual level. The advantage of Bayesian methodology is that it produces estimates of individual units across all parameters. These estimates are of particular interest to the information service providers who are eager to pursue service differentiation strategies. These strategies include designing services which are offered to specific groups of users with specific needs. The classical way of capturing heterogeneity cannot provide information since it gives aggregate level estimates.

Natter and Feurstein [55] pointed out that only demographic variables may not be adequate to capture individual level heterogeneity. They believed that one requires additional information about the consumer and needed to take into consideration expectation values with reference to the distribution of heterogeneity. Thus, it is imperative that the methodology of estimating users' information seeking behaviour consider individual level heterogeneity through hierarchical Bayes. Bayesian methodology [56] is proposed in this research to estimate individual parameters with a particular distribution as opposed to the classical method of parameter estimation where population parameters are constant.

5. Data analysis and Findings

Peer evaluation of the instrument was carried out [57] before the pilot testing of the instrument. After incorporating the comments of the peers, the pilot test was carried out. The first pilot test was carried out with 30 respondents from the same population. For this research we conducted three focus group interviews. At the time of focus group interview samples are selected by quota sampling technique. Three in-depth interviews of the subject specialists are also conducted for this research.

The final questionnaire was sent to a total of 563 management and doctoral students in six major cities in India. MBA students were chosen as a sample. Although the sample has a more or less similar demographic profile in terms of age and education level, they behave differently and this is due to individual behavioural characteristics. At the same time it was noticed that students belonging to different age groups, different subjects of specialization, different occupations, different experiences, and with local variations were also grouped in the same segment, i.e. behave similarly. The behavioural characteristic of each segment is similar and different from the other segment. Information providers can use the previous behavioural pattern of the information seeker in order to serve the

sources of information in such a way that information seekers can be satisfied at getting the required information easily. 366 responses were received, out of which the data of 307 respondents was suitable for analysis. These respondents shared their experiences of the different behavioural characteristics at the time of seeking information for various purposes. They also agreed that information searching behaviour varies depending on individual variation. Every student has some specialty unique to him or her. Thus the information seeking behaviour also varies from one individual to another.

Identifying the information seeking behavioral dimensions from the behavioural variables:

Information seeking behaviour dimensions are behavioural traits that are inside the mind of the users. We collected the data of indicator variables on the seven point Likert scales, which is a continuous scale commonly used in behavioural research. Then we checked the correlation between each of the measured variables. Sampling adequacy was measured by the Kaiser-Meyer-Olkin (KMO) statistics. This method reveals if there is any correlation between the measured variables. According to researchers [58] when the KMO value is more than 0.5 we can proceed with factor analysis. The KMO value in this investigation is 0.688 and hence factor analysis can be executed. Bartlett's test of sphericity was also conducted, a significant value of which indicates that the variables are related. The value of the test was less than 1% (i.e. 0.01) proving that the correlation matrix was not an identity matrix and factor analysis could be executed.

The Measure of Sampling Adequacy (MSA) for the respective item was checked. MSA values that exceed 0.5 indicate a good fit. In this research, MSA value is 0.688. Communality value of each variable was checked and it was ensured that all variables had a communality value that exceeded the specified value of 0.5. Factors having Eigen values greater than 1.0 were the only ones extracted and rotated to get a final solution. Two factors are extracted from the variables. Cumulative variance of the set of variables is 68.43.

Table 1: Underlying dimension and their corresponding variables

Identification of Factors (Underlying Dimension)
Propensity to incur cost

Propensity to spend time

Table 1 reveals two underlying dimensions related to cost and time of information seekers. These dimensions reveal how the users behave in terms of economic cost as well as value of time when they decide to visit an information centre in their search for information. The variables we considered for factor analysis represent an individual's propensity to incur cost and spend time. That is, their behaviour in particular situations when acquiring information that requires incurring cost and spending time.

Cronbach alpha [59] measure is used to gauge the reliability of the factors. Cronbach's alpha generally increases as the inter-correlations among test items increase, thus earning it the reputation of providing an internal consistency estimate of reliability of the factors. Cronbach opined that an Alpha value greater than 0.6 indicates that the factors are internally consistent and that they show high reliability of the variables under consideration. The Cronbach alpha value was higher than .7 for both the factors.

Effect of cost and time dimensions on frequency of visiting information center:

To see the effect of the two cost and time related dimensions i.e. tendency to incur cost and tendency to spend time on the dependent variable 'frequency of physically visiting library or information center', multiple regressions are carried out. The dependent variable is a metric variable measuring the number of times that the information user visits the information centre in a particular month.

The model summary reveals that the adjusted R^2 is .579, i.e. 57.9% of the variation in dependent variable 'frequency of physically visiting library or information center' and can be explained by the two resource (cost and time) related dimensions. A study of the ANOVA table suggests that the regression model is significant in <1% level of significance. High significance level (<1%) suggests that there exists a linear relationship among the dependent and independent variables (two resource related dimensions) and that these two dimensions explain the change in how frequently one uses online databases. The impact of each individual resource related behaviour dimensions on the dependent variable is presented in Table 2:

Table 2: Coefficients of each individual resource related dimensions

Information seeking Behavior Dimensions	Coefficient value	Level of Significance
Propensity to incur cost	-1.064	0.000
Propensity to spend time	.051	0.999

The table of individual coefficients proves that the propensity to incur cost has a significant negative effect on frequency of visiting library and other information center. This means that those who visit libraries and information centers tend to incur higher cost to procure information. Such people have a tendency to purchase books and other material rather than visit a library to source them. The analysis also proves that a propensity to spend time does not have a significant impact on the frequency of library visits. This implies that infrequent visits by information seekers to a library and information center may not be due to time constraint but rather their reluctance to visit such centers.

Effect of cost and time dimensions on time spent on searching the internet and browsing:

In order to study the effect of the two cost and time related dimensions i.e. tendency to incur cost and tendency to spend time on the dependent variable 'length of time spent on searching information on the internet and browsing', multiple regressions are carried out of the dependent variable 'length of time spent on information gathering by searching internet and browsing' on two resource related dimensions. It is found from the model summary that adjusted R^2 is .775, i.e. 77.5% of the variation in dependent variable 'the length of time spent on information seeking on the internet and browsing' can be explained by the two individual resources (cost and time) related dimensions. The ANOVA table suggests that the regression model is significant in <1% level of significance. The impact of each individual resource related behavior dimensions on the dependent variable is given in Table 3:

Table 3: Coefficients of each individual resource related dimensions

Information seeking Behavior Dimensions	Coefficient value	Level of Significance
Propensity to incur cost	1.662	0.000

Propensity to spend time	-.077	0.126

The table of individual coefficients proves that a propensity to incur cost has a significant positive effect on the length of time spent on information seeking on the internet and browsing. This implies that information seekers, who spend more time on the web in order to gather information, are highly motivated to spend money to acquire information. Such people exhibit a tendency to buy books and other material while browsing the internet and may be constantly motivated to do so. This finding is quite intuitive considering present social habits of Indian information seekers. The young generation of India spends a considerable time on the web and they do spend sufficient money buying information and other related material. The analysis also suggests that a propensity to spend time does not have a significant impact on the length of time of information searching on the internet and browsing behavior. In other words, information seekers who do not spend much time on the internet probably behave so not due to time constraints but due to their reluctance to do so.

Effect of cost and time dimensions on conferring with peers and experts:

To see the effect of the two cost and time related dimensions i.e. tendency to incur cost and tendency to spend time on dependent variable the amount of time one spends conferring with peers and experts, multiple regressions are carried out of the dependent variable 'amount of time one spends conferring with peers and experts' on the two dimensions.

It is found from the model summary that adjusted R^2 is .602. It is found from the ANOVA table that the regression model is significant in <1% level of significance. The impact of the individual resource related behaviour dimensions on the dependent variable is presented in Table 4:

Table 4: Coefficients of each individual resource related dimensions

Information seeking Behavior Dimensions	Coefficient value	Level of Significance
Propensity to incur cost	.08	.180
Propensity to spend time	1.262	.000

A study of the table of individual coefficients reveals that a propensity to incur cost does not have a significant effect on the amount of time one spends conferring with peers and experts. This finding is quite intuitive when we consider that conferring is based on the individual user's characteristics and social habits when seeking information. This kind of behavior may not be influenced by one's propensity to spend money and hence the effect should be insignificant, as proved by the data. However, the analysis does prove that a propensity to spend time does have a significant impact on the amount of time one spends conferring with peers and experts. In other words, information seekers who like to spend time seeking information have a strong inclination to interact with the people whom they see as reliable sources of information.

Segmentation of people based on same information seeking behavior variables:

After identifying information seeking behaviour, cluster analysis is carried out to classify the users into relatively homogeneous groups called clusters. The respondents in each cluster tend to be similar to each other and differ from individuals in other groups. Concerned heterogeneity among the information seekers will be revealed in this analysis since it is based on the algebraic distances between the coordinates of the respondents.

Clustering based on cost and time related behavioral variables:

Four cost and time related clustering variables which provided characteristics of users' inclination to invest resource for acquiring information were selected. These clustering variables are:

Time taken by an information provider to provide information
Expenses incurred to acquire information
Recurring expenses incurred to acquire information
Influence of proximity to information center on information search

Cluster analysis technique is carried out in two steps using SPSS software package. In the first step hierarchical clustering procedure was used to identify the homogeneous groups present in the data.

Then Wards method was selected to generate clusters with minimum variance. K-mean clustering technique was used in the second step to identify the location of the segments on clustering variables. K-mean clustering also helped estimate the approximate size of user segments in the population. Four distinct clusters were identified through k-mean procedure and their behavioral criteria. The size and characteristics of each segment were calculated using the k-mean procedure. Following are the profiles of these clusters along with their size and characteristics.

Profile of Respondent Segments

Segment 1 (Cluster 1): This segment consists of 16.2% of the population. The respondents of segment 1 rate high in spending time and monetary resource locator information. However, this segment is low in covering distance, and showed a preference to avail the source that was close to them. They revealed a willingness to pay for having information from a source that was in close proximity to them.

Segment 2 (Cluster 2): This segment is the largest and consists of 39.4% of the population. The analysis proves that respondents of segment 2 are moderate in spending time and covering distance. However, this segment is low in both the cost dimensions. Also the respondents were unwilling to pay for having information from a source.

Segment 3 (Cluster 3): This segment consists of 15.6% of the population. It is clear from the analysis that respondents of segment 3 are high in incurring cost and traveling

distances. However, this segment does not want to wait to acquire their required information.

Segment 4 (Cluster 4): This segment consists of 28.8% of the population. It is clear from the analysis that respondents of segment 4 are high in incurring cost. However, this segment is moderate in covering distance and shows a disinclination to use a source at a great distance from them. They are however, willing to pay in order to get information from a source that is close to them. This segment is also reluctant to wait for their information; being willing to wait only for a moderate amount of time.

Individual level Bayesian analysis and comparison with aggregate analysis:

In this research, we estimated separate regression estimates for each individual respondent. In the past, researchers have tried to handle this problem with an adjustment by way of ignoring heterogeneity among individuals. They pool all the data together, and estimate a single set of regression coefficients that describes the "average" of all individuals. However, an alternative solution has recently become available with the introduction of "hierarchical Bayes" (HB) methods. In this method, the analysis is carried out by considering each individual as a sample from a population of similar individuals, and "borrowing" information from other individuals in the estimation for each one.

Individual level effects are estimated for four segments. Respondents from each segment are taken for segment level analysis. To estimate the individual level coefficients, Hierarchical Bayes regression (HB Reg) module of Sawtooth software is used for data analysis. This software estimates individual level coefficients considering individual level data. During simulation the ordinary least square (OLS) estimates are taken as the starting values of the parameters. Since the target distribution of the simulation is not dependent on the starting value of parameters, starting with OLS estimate would not affect the posterior parameter value. It will only lead to relatively quick convergence. As the extreme data points may hinder rather than help the convergence, trial runs are carried out with both OLS starting value and zero starting value. It is proved that the convergence is reached faster when simulation is started with OLS starting value.

1,40,000 iterations in the simulation process were used to reach convergence. These draws were burnt off (not saved or used for estimating parameter). A study of the visual graph reveals that the parameters have converged in their posterior distribution. After the

chain converged, 40,000 draws were picked up from subsequent iteration and every 100th draw was saved for each coefficient. These saved draws were used to estimate effects of each dimension.

The following table provides the segment-wise individual level Bayesian estimates of the effects of underlying dimensions of information seeking behavior on several dependent variables. Table 5 shows the segment-wise effects of resource related behavioural dimensions on frequency of physically visiting library or information center:

Table 5: Segment wise effects of resource related behavior dimensions on frequency of physically visiting library or information center: Individual level Bayesian estimation (IBE)

	Segment 1 (IBE)	Segment 2 (IBE)	Segment 3 (IBE)	Segment 4 (IBE)	Aggregate Level
R^2	33.5%	55.6%	74.9%	58.5%	57.9%
Std. Error of estimate	0.901	0.827	0.506	0.587	0.904
Coefficient of Propensity to incur cost	-0.881**	-1.13**	-1.49**	-1.33**	-1.064**
Coefficient of Propensity to spend time	0.004	-0.366*	0.281*	-0.160	0.051

**Denotes that the coefficient is significant at <1% level of significance
*Denotes that the coefficient is significant at <5% level of significance

Table 5 reveals that segment 3 with individual level model has better explanatory power than the aggregate level model (74.9% as opposed to 57.9%) while the explanatory power of other three segments are not significantly different from aggregate level model. The standard error of the estimates is found to be significantly lower (better) in individual level model than that of aggregate level model in two segments out of four segments. Hence the efficiency of the estimates is better in case of Bayesian analysis when compared to the individual level data. It is also evident from the finding that coefficient of propensity to incur cost has significantly high negative value in segments 3 and 4. It is also found that coefficient of propensity to spend time has significant negative effect on frequency of physically visiting library and information center for segment 2 and 3 while it does not have significant effect at aggregate level.

Table 6 shows the effects of four segments on one's inclination to use web /e-mail as source of information.

Table 6: Segment wise effects of resource related behavior dimensions on length of time spend in information gathering searching internet and browsing: Individual level Bayesian estimation (IBE)

	Segment 1 (IBE)	Segment 2 (IBE)	Segment 3 (IBE)	Segment 4 (IBE)	Aggregate Level
R^2	91.4%	45.7%	61.6%	30.5%	77.5%
Std. Error	0.403	0.621	0.852	1.068	0.875
Coefficient of Propensity to incur cost	1.974**	1.458**	1.985**	1.729**	1.662**
Coefficient of Propensity to spend time	0.179*	0.147*	-0.024	0.556*	-0.077

**Denotes that the coefficient is significant at <1% level of significance
*Denotes that the coefficient is significant at <5% level of significance

It is found from Table 6 that segment 1 with individual level model has higher and better explanatory power than the aggregate level model (91.4%% as opposed to 77.5%) while the explanatory power of other three segments are not significantly different from aggregate level model. The standard error of the estimate is found to be significantly lower (better) in individual level model than that of aggregate level model in three segments out of four segments of which in segment 1 it is less than half the aggregate level model. It is also evident from the finding that coefficient of propensity to incur cost has significantly higher value in segments 1, 3 and 4. Interestingly, it is also found that coefficient of propensity to spend time has significant positive effect on length of time spent in information gathering by searching the internet and browsing for segment 1,2 and 4 while it does not have significant effect at aggregate level and also the sign is negative.

Table 7 shows the amount of time spent conferring with peers and experts by the respondents of the four segments.

Table 7: Segment wise effects of resource related behavior dimensions on amount of time one spends conferring with peers and experts: Individual level Bayesian estimation (IBE)

	Segment 1 (IBE)	Segment 2 (IBE)	Segment 3 (IBE)	Segment 4 (IBE)	Aggregate Level
R^2	53.3%	53.8%	32.3%	31.8%	60.2%
Std. Error	1.03	1.02	0.590	0.707	1.026
Coefficient of Propensity to incur cost	0.013	-0.323	0.329*	-0.133	0.08
Coefficient of Propensity to spend time	1.471**	1.191**	0.809**	0.895**	1.262**

**Denotes that the coefficient is significant at <1% level of significance
*Denotes that the coefficient is significant at <5% level of significance

Table 7 proves that for all segments with individual level model have less explanatory power than the aggregate level model. The standard error of the estimate is found to be significantly lower (better) in individual level model than that of aggregate level model in two segments out of four segments. It is also evident from the findings that coefficient of propensity to incur cost has significantly higher value in segment 3 in individual level model while it is insignificant in aggregate level model. It is also found that coefficient of propensity to spend time has higher effect on amount of time one spends conferring with peers and experts for segment 1 while it is less than aggregate level model for segments 3 and 4.

6. Discussions and Conclusion:

This research calculated first information seeking behavior of the information seekers at an aggregate level. Hierarchical Bayesian Statistics was used to calculate the same characteristics. Different results emerged at every step. The results obtained from the study of every resource related behavioral dimension at an individual level deviate from the aggregate level study of the respective behavioral dimensions.

In previous researches on information seeking behavior the population was always grouped according to their demographic variables, i.e. age, sex, educational level, subject specialization, working place, occupation etc. These studies grouped people according to any one or two of the above characteristics and then observed the information seeking behavior. But people having the same demographic characteristics may not have the same choice or may not act similarly at the time of searching information. For example, behavioural characteristics of information seeker having same educational level or same

age might vary due to the differences in their culture, their previous knowledge, and their background.

In this study, we have estimated parameters for each individual and they are grouped into segments according to their observed behavioural characteristics. Then the regression coefficients are compared. Thus, this grouping may give more accurate results at the time of estimation of behavioral pattern. These findings are very useful for information providers in the context of designing information center. If the regular information seekers can be grouped according to their behavioural characteristics, they can be served in a better way. This will save the time of both the information user and the information provider.

From the above data analysis and findings, it can be concluded that an individual's behavior in allocation of resources for gathering the required information would show different effects on their propensity to incur expenses and spend time. In this research, when frequency of visiting information centers is estimated, it is found that among the four segments, two groups do not respond to the propensity of time spent to acquire required information. But one group has a positive effect and the other group has a negative effect. That is, one group has a positive effect on both the frequency of visiting library or information centers, and the time spent in acquiring information. Consequently the other group has a reverse or negative effect, that is, if the frequency of library visit is low then the time spent by these users in the library will be high. The behavioural characteristic of each segment is similar among them, and different from the other segments.

Two new resource related dimensions emerged in this study. No significant previous researches had been carried out on the cost and time dependences on the use of information by the information seekers. We could locate only one research (Savolainen (year), that used time as a qualifier in the information seeking process. But the time dependence on behavioural characteristics is not estimated. These two dimensions - direct expense related and indirect expense (time) related - provide very rich and exemplary finding in this research. Findings suggest that propensity to incur cost has negative effect on frequency of visiting library and other information center. It means that those who make fewer visits to the library and information center tend to incur higher cost to procure information. The pricing strategy of the information may be designed

accordingly. The public library and information centers may also generate a revenue mechanism for this segment of information seeker by launching customized services and charge a service fee for the same. Findings also suggest that propensity to spend time does not have a significant impact on frequency of visits to the library. It may imply that those information seekers who do not visit library and information center quite often may not be constrained by o time but rather their reluctance to visit such centers. In such cases, information centers may start promotional campaign and advertising for paid information. It may be one prospective avenue for information providers to explore. Such organized advertising and promotion may create awareness, interest and demand for information, and information providers may identify prospective pool of information seekers whom they can address in the long run.

Wilson (1981, 1996; 1999) and several other researchers noticed the general queries posed to information research system which were concerned with the active search of the information-seekers. Ingwersen (1996), however, found a number of implicit and explicit elements in his study. In our research, the findings reveal similar trends as far as explicit and implicit behavioural aspects are concerned. However, it reveals quite different but hidden dimensions in terms of information seekers' propensity to allocate resources (both money and time) and also reveals those aspects of information seeking behaviour, which earlier researches have not done.

Considering individual level heterogeneity this research has carried out an important and pioneering work in the area of effect of cost and time resource on individual users' information seeking behaviour. Behavioural researchers in information science have investigated in an isolated fashion the effect of cost and benefit on the information seeking activities of individuals. Most of the research projects on information seeking behaviour consist of queries by type and by age and gender of information seeker. This study emphasizes the importance of the effect of resources related to cost and time on information seeking behavior in the context of personal behavior at an individual level. The study revealed that there exists considerable differences in these two resource related dimensions when direct effects are considered specifically for individuals as opposed to for the entire population at a time. This conceptualization also deals with the interplay between several resource related characteristics of information users for their information needs and information seeking behaviour.

This research reveals several interesting and thought-provoking findings that deal with individual level model of cost and time related resources. It is found that the explanatory power of the individual level models does not differ much from the aggregate level model. It is quite natural that the model fit depends upon how the data points fit in the line, and does not have much to do with the efficiency of the estimates. However, the segment level model fit intuitively shows how actual segment level model fit is different from aggregate level model fit. The individual level heterogeneity study suggests that different seekers behave differently while investing cost and time related resources to seek information. Aggregate level study does not consider this individual variation and it may lead to wrong decision making by the information providers. Resource related behavioural assumptions underlying aggregate level information seeking process do not provide a behavioural explanation of different resources related characteristics of the information seekers at individual level. This may be captured very efficiently through such individual level heterogeneity study.

7. Future research

Although this study investigated the effect of cost and benefits related dimensions on information seeking behaviour of individuals at the unit level, it is imperative to recognize that the study does not cover the entire range of resource related dimensions that play a role in information seekers' environment. In particular, several benefit related dimensions that might have variations among individual information seekers have not been considered. We suspect that some users may draw higher benefit from some particular information than other users. In other words this study does not consider all the means by which the information seekers might be benefited. Also it does not consider all the ways which might involve resource allocation. This is one of the directions that we think may be important for future research.

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Abstract:

This study investigates the effect of economic resources, namely cost, and time resources on information seeking trends of individuals. The study considered individual level variations, as observed in the attitude to these resources of information, arguing that the responses to different resources varied across individuals. The cost and time related dimensions were derived from the data and its effect on information seeking behavior of individuals was estimated. An in-depth questionnaire was administered to 307 respondents. Factor analysis, cluster analysis, multiple regression and Bayesian regression were used in order to identify cost and time related dimensions, find segments of individual information seekers, estimate their effect on the actions of individual information seekers, and make a comparison between the individual level effect and aggregate level effect of cost and time related dimensions on individual information seekers. A significant difference of effect of these two resource related dimensions on individual's information seeking was observed when the effect was estimated at the aggregate level as opposed to the effect estimated at the individual level. This study provides insight into the decision of individuals regarding their choice of resources when seeking some particular information. The study also highlights the benefit of using inter-individual variation. The findings of this investigation are discussed to understand the implications and to provide avenues for future research.

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