Journal of Information Science Theory and Practice

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Aims and Scope
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## Call for Paper

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A Unified Framework of Information Needs and Perceived Barriers in Interactive Video Retrieval

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ABSTRACT
Information needs of users have been examined both generally and as they pertain to particular types and formats of information. Barriers to information have also been investigated, including those which are situational and also across certain domains and socioeconomic contexts. Unified studies concerning both information needs and barriers are needed. Both are likely always present in any given interactive search situation; further, users’ attempts to satisfy their own individualized information needs will likely encounter barriers of some sort. The present study employed a survey method to collect users’ perceptions of video information needs and barriers as part of recent video search situations. Findings from this analysis establish a unified framework, based on the themes emerging directly from the responses of users, and present the suitability and benefit for informing future designs and evaluations of user-centered interactive retrieval tools.

Keywords: Interactive video retrieval, information needs, information barriers

1. INTRODUCTION
Gaps in knowledge form the basis of information needs, which then motivate and stimulate information seeking and retrieval (Belkin, Oddy, & Brooks, 1982). Research about information needs dates back, well before the digital era. Further, information needs have been thoroughly examined across many different contexts and life situations (Case, 2012). Examining these needs has provided knowledge about end-users and
uses of information, even ultimately helping conceive designs of early information storage and retrieval tools, such as the library catalog, based on how people look for information to satisfy such needs (Wilson, 1994).

In more recent times, information needs that correspond to specific types or formats of digital information have also been examined. Image research, in particular, has been quite active in studying the information needs across different visually-oriented domains, which, in turn, has provided generalizations of basic need types (Choi & Rasmussen, 2003; Hastings, 1995; Jørgensen, 1996; Fidel, 1997). Jørgensen (1996) is one example that described types or categories of image needs. The image needs emerging from Jørgensen’s study demonstrated that image criteria can be directly recognized by users, i.e. “perceptual” and/or individually deciphered, i.e. “interpretive.” Image content itself has also been generally depicted to exist along the “object pole” and/or the “data pole” based on tasks that involve the use of images (Fidel, 1997). Information needs whether as a concept or concrete sets of categories have not only been argued and defined, but also tested in terms of their influence within interactive retrieval situations (Fidel, 1997; Garber & Grunes, 1992; Jørgensen & Jørgensen, 2005).

Information barriers, on the other hand, have also been examined from different perspectives. Information access (or lack thereof) throughout various domains and contexts, including health and education, has revealed some significant existing barriers and their impact (Barta, 1995; McKenzie, 2003). Factors associated with information literacy are also seen as contributors to information barriers based on suitability of provided content for given audiences. Barriers have also been shown to derive from disparities in technological access, such as across socioeconomic and/or groups with varying levels of skills and abilities (Hilbert, 2014; Albertson & Whitaker, 2011). However, even users with both the means and abilities to access and use information effectively may still face difficulties from individualized obstacles that are present as part of their own everyday information seeking and retrieval situations (McKenzie, 2003).

Interactive video retrieval, as an area of research, examines the seeking, discovery, assessment, selection, and use of video information for satisfying information needs of users. The makeup and structures of video as a multi-channeled time-based format make it unique; such characteristics can present additional criteria and/or considerations for users with video needs (Albertson & Ju, 2015). In turn, interactive searches for video may present certain limitations related to the information needed and the retrieval system(s) used (e.g. navigating to a time-point within a particular video), prompting additional effort by the user (Albertson & Meadows III, 2011). The potentially distinct aspects among both the needs and barriers for video information within an interactive retrieval context motivate the current study. Moreover, needs and barriers have not been framed together, regardless of context, which, considering their interrelated nature, is needed. Few information needs are satisfied automatically, without complication. Therefore, if researchers strive to understand information needs, it is also important to reveal common barriers in order to provide more holistic knowledge of the interactive video retrieval experience.

2. STUDY OBJECTIVES AND RESEARCH QUESTIONS

Despite the interrelated existence and tensions between information needs and barriers, they are rarely examined in conjunction with one another. Also, generally speaking, there has yet to be a sufficient examination of either within the context of video retrieval, specifically – even separately. Findings from a unified exploration of both information needs and barriers in video search can provide positive implications for future research. The potential is demonstrated by the results of prior studies – across other contexts like image retrieval – contributing practical applications for retrieval tools like digital libraries (e.g. visual arts digital libraries).

The overarching objective of the present study is to examine information needs and perceived barriers of users (for fulfilling their needs) within a video search context. Progress of the current study will provide generalizable understanding of the characteristics of both needs and barriers in video search, and thus help develop a unified framework with the capability to represent each with unique and measurable examples from users. Further, the current study aims to further assess the significance of any emerging generalized quality or category of needs and barriers in order to also provide
a prioritization which can enable more precise or granular application for future work. Having information needs and barriers generalized and prioritized together can support future research by providing expanded yet contrasting understanding of each within a video search context. Definitions of the concepts operationalized and applied as variables for the purposes of the current study include:

Need: the video information users require in order to fill gaps in current knowledge and/or to facilitate the completion of tasks necessitating video information.

Barrier: a challenge or difficulty users experience when attempting to satisfy information needs either before, during, or after formal action in a video search process.

The need for understanding of these factors within a video search context motivates an exploration of the corresponding research questions:

- **RQ1a.** At what level do users perceive themselves as knowing or understanding the video information they need as they initiate a search for video?
- **RQ1b.** What are the primary or generalizable video information needs of users in a typical video search?
- **RQ2a.** At what level do users perceive themselves as facing or experiencing barriers in a search for video?
- **RQ2b.** What are the perceived primary or generalizable barriers of users attempting to fulfill video information needs in a typical search?
- **RQ3.** How are the generalized categories of both video information needs and barriers in a video search prioritized, based on number of occurrences?

These research questions provide the means for achieving the overarching goal of the current study. The resulting analysis will provide the impetus to conceive a framework that can generalize information needs and barriers in video search situations, together, yet also enable a comparison of the prioritization of the qualities of each from a user-centered perspective. Video, a time-based resource with a combination of structural and physical components, can present its own unique aspects about what is both needed and actually experienced in search situations.

### 3. LITERATURE REVIEW

As discussed above, different types of information needs and barriers have been examined, identified, and described over the years, including across diverse contexts. Conceptual and even theoretical research, as reviewed here, which inform and provide implications for investigations of information needs and barriers are also pertinent to the current study.

#### 3.1. Information Needs

Information needs have been deliberated from many different perspectives, even as they pertain to the psychological and physiological states of humans. Taylor (1968), in a first of its kind study, examined queries expressed by users to the reference desks of libraries in order to frame needs according to different cognitive stages. These stages were discovered to include visceral, conscious, formalized, and compromised information needs. Such research on information needs sparked new investigations into information seeking and retrieval (Belkin et al., 1982; Kauthau, 1988). Further research into information needs and behavior continued, providing significant understanding of the different types and criteria of information needs including as part of image-based tasks and visually-oriented domains.

Within information seeking, need formulation is a common (and expected) phase of the larger process. Even further, the realization of everyday goals, not limited to information seeking, has been described in behavioral models that generalize daily tasks and courses of action taken by humans (Norman, 1990). The development stages of everyday goals are many times viewed as a parallel (or corresponding) function to the formulation of information needs within an information seeking process.

Conniss, Ashford, and Graham (2000) demonstrated that need formulation is present in the starting stage of the image seeking process. Here, it was discovered that needs require individualized defining by users who set boundaries and levels of flexibility around need criteria. The formulation of visual needs by users, in particular, can be a rapid process or can take time to resolve, depending on level of complexity, importance, abstraction, and the need for feedback. Garber and Grunes (1992) qualitatively assessed visual need development
in an advertising context and found that image needs originated mostly from the development of a larger initial artistic concept. The formulation and defining of visual needs has been shown to not be isolated to the initial stages; users’ criteria have also been shown to develop as a search continues (Garber & Grunes, 1992). Furthermore, a visual need becomes further specified in the visual information seeking process and may even result in a search for a known image. This prior research is significant to the current study by establishing a process of need development and the continuous shaping of visual needs within the cognitive processes of users which has relevance to understanding a search for video information.

Further, information needs ultimately motivate and thus bridge to a course of action taken by users in an attempt to fill gaps in knowledge and/or reduce uncertainty. Users have been shown to act upon their realized needs by targeting and selecting resources that demonstrate potential to facilitate fulfillment. As part of this course of action, users must express their needs through the constraints of a system that they target for use. Feedback from this process, as depicted in information seeking models, serves as the basis for assessing need fulfillment and for potentially reformulating information needs and seeking strategies (Kulthau, 1988). Research shows that needs are influential to the progress, processes, and outcomes throughout the full information seeking process.

3.2. Barriers to Information Needs

The presence of barriers within information seeking or search can form a significant factor and set of consequences for users. Further, barriers can influence selection, use, and acceptance of technology based on users’ perceived difficulties for using technology in order to successfully facilitate the completion of tasks. Girard (2014), in a review of existing research, categorized, tallied, and tabulated the approaches and methods as previously employed for examining information barriers within an e-book use context. Notably, barrier types were generalized for the purposes of examination and discussion, and shown to include the categories of cognitive, social, and physical barriers (Girard, 2014). These categories inform the basis and structure for reviewing literature pertinent to the current study.

With regard to cognitive or psychological barriers, user confidence is one of many factors which can develop into or influence existing barriers. For example, user confidence is many times operationalized as perceived self-efficacy, based on the work of Bandura (1994), which takes into account how people (users in this case) view themselves and their chances in performing a given task at hand. Research has shown that as confidence and perceived self-efficacy decrease, so does the likelihood of selecting approaches or putting forth the needed effort in order to complete tasks (Billings & Macvarish, 2010). Of relevance to the current study is that perceived self-efficacy can be seen as a stimulus for barriers in the cognitive or psychological states of users in an information seeking or search situation.

As adopted in human computer interaction (HCI) studies, the gulf of execution and evaluation from Norman (1990) also provide a psychological perspective and explanation to certain barriers as a result of internal obstacles or challenges that can ultimately impede progress toward the successful attainment of overarching goals. The gulf of execution presents challenges, as in the example of a search task, when attempting to apply or express information needs through the constraints of the user interface of a system. Further, to bridge the gulf of execution, users must successfully translate their internal needs and cognitive manifestations of the need into concrete expressions and action. The gulf of evaluation denotes the difficulties in employing feedback for determining success or goal attainment. The challenges pertinent to the gulf of evaluation arise during the process of assessment or evaluation by users.

Social influences on barriers have also been studied and are considered relevant for the current study. For example, social and subjective norms have been examined as they relate to and influence perceptions and ultimate action, including with regards to the use of technology (Ajzen, 1991; Pynoo et al., 2011). Users’ decisions to pursue a given task at hand with a particular tool or resource can be influenced by what others think and believe, particularly those who the users see as important to them (Lee & Kim, 2009; Pynoo et al., 2011). As a result, low regards from social groups or inner circles can construct the basis for inaction and thus barriers based on the social influences surrounding the user.

Physical barriers, in a technology use context, have
been described to pertain to computing hardware that does not successfully accommodate expectations, use, and ultimate fulfillment of information needs of users. Examples of physical barriers can also include limitations for actually possessing the technology as needed in a physical setting and other capabilities as expected by users for enhancing the process to acquire information (Girard, 2014).

As evident, there are many extensions of research that have examined barriers of some sort, spanning studies that are more conceptual up through direct issues related to information access. Further, barriers arising from the internal or cognitive processes of users along with social influences are significant to consider for the research of the current study.

4. METHODOLOGY

A survey method was employed to explore the research questions of the current study; an online survey was designed, distributed, and collected. Data collection was open for approximately two months. At the end of the data collection period, a total of 215 participants contributed full valid surveys. Participants were recruited through a subject pool as coordinated by a research institute at a large university. As a result, undergraduate students comprised the overwhelming majority of the sample, which is considered an acceptable limitation of available sampling in social science research. Further, considering the current study is the first of such to examine users’ perceived needs and barriers in a video search context, data collection and analysis were not confined to a particular domain; with a more general scope to the current study, recruitment of participants was open to available sampling.

4.1. Demographics of Participants

The use of a subject pool at a university as the primary recruitment approach meant that a vast majority of participants fell between the ages of 18-20 (92%), with lower rates observed for the 21-22 (7%) and 23-29 (1%) age groups. Participants were also asked to self-identify their level of experience with video searching, i.e. how often or how regularly they search for video online. Participants rated their level of video search experience on a scale of 1-5, with 5 representing “all the time” and 1 “never.” Video search experience among the sample was, on average, high, with a mean of 4.08, a SD of 0.82, and a range of 3; no respondents identified as a 1 (“never search for video”). Demographic data were used to ensure that participants and the overall sample possessed a suitable level of video search experience for participation in the study.

4.2. Data Collection

The survey was broken up, logically, into two parts. One part presented questions pertinent to information needs, and the other collected data about perceived barriers of users, both framed from the perspective of video searching. Both parts on the survey included one closed, i.e. scaled, and one open-ended question. The basic approach to the survey, overall, particularly the open-ended questions, was to collect data from participants by having them reflect on recent experiences with searching video, not before or after any formal action or part of any interactive experimentation.

First, for one of the scaled questions on the survey, participants were asked to rate the extent that they believe they know or understand the video information needed when initiating a search. This question was followed up with an open-ended question asking participants to provide up to five examples of video information needs they could recall from recent searches. This same question sequence was then used for collecting data about perceived barriers; further, participants first rated their level of agreement with a statement that they (as users) feel they encounter barriers when searching for video, followed by a request for up to five open-ended examples of barriers when searching for video.

4.3. Data Analysis

Responses on the closed-ended questions were analyzed quantitatively. Descriptive statistics were computed for both scaled questions, and a correlation test measured the level of association between the two variables – i.e. participants’ rated levels of 1) knowing their video needs and 2) feeling of encountering barriers in a video search.

Responses to the open-ended questions were first examined independently by the primary researcher of the study in order to begin defining a preliminary set of themes or categories of both video information needs and barriers. Content analysis was then conducted on
all individual responses using this set of categories. The content analysis process involved two separate researchers (i.e. coders), with no further involvement on the study, who worked independently through the sets of participants’ responses. Both coders coded every response provided for both open-ended questions; therefore, every video need and perceived barrier statement freely provided by participants on the survey was ultimately coded twice (once by each coder). In sum, a total of 775 open-ended video need statements and 638 perceived barriers were coded with what the coders saw as the most appropriate of the three categories or “not applicable.” This analysis would be used to assess the suitability of the proposed categories for framing users’ needs and barriers.

In the end, a total number of 23 openly expressed video needs from participants had to be removed from the response set, as they were not relevant to the study, resulting in a total number of 752 ultimately coded needs. Forty-one non-applicable barrier statements also had to be excluded, bringing the number of categorized barriers to 597.

Following, the codes from each coder were compared. Consistency among all assigned codes was quantified using inter-rater agreement rate and Cohen’s Kappa. This analysis enabled formal assessment of the emerging categories in terms of their potential for framing needs and barriers in video search. Results here were used to support (i.e. validate) the categories and their respective boundaries according to the direct responses from participants.

After the levels of similarity and agreement-rates were calculated, all individual disagreements were resolved by the primary researcher of the study, who ultimately served as a third (and “tie breaking”) vote, only when needed, to decide the final code. Thus, a final category code was assigned to all applicable open-ended responses from the participants for both need and barrier statements.

The final assigned code to each response was then used to tabulate frequencies or number of occurrences for each of the primary categories. The frequency level for each category was based on the number of times each was provided by participants in their responses (and coded as such). This analysis enabled both simple and weighted frequencies and the ranking or prioritization of the individual categories in terms of their significance for video information needs and barriers. Simple frequency provides the number of times for each categorical occurrence (i.e. concept) across the overall set of responses; weighted frequency is calculated using the occurrence of each concept in relation to the total number of an individual participant’s responses (up to five) on the survey. Further, simple frequencies provide the overall tally, while weighted frequency enables a more precise measurement of frequencies based on equality. Findings using these methods aim to provide a richer understanding of the application of the emerging framework in terms of not only generalizing video needs and perceived barriers together, but also depicting the significance of the different categories, separately. Finally, a percentage of occurrence for each category was computed, presenting an overall rate according to the full response set of both needs and barriers.

5. RESULTS

Data analysis of the current study provided a variety of insightful and important findings. Results from both the scaled survey questions and the quantification of the open-ended data, using content analysis, are presented here. Results address the research questions of the present study.

5.1. Perceived Levels of Knowing Video Needs and Experiencing Barriers

As described above, participants rated their level of agreement (“5” representing strong agreement, and “1” strong disagreement) with the two separate statements on the survey that captured the essence that when searching for video they (as users): 1) know or understand the video they need when initiating a search, and 2) feel that they encounter barriers when searching for the digital video they need. A mean score of 4.12 out of 5.0, with a SD of 0.55 and a range of 3, was produced with regards to participants believing they know their video needs as they begin a search. On the other hand, participants perceived themselves as encountering barriers during a search for video at a mean of 3.08, with a SD of 0.89 and a range of 4. A correlation test between participants knowing their needs and perceiving they encounter barriers produced a coefficient of $r(212)=0.324 \ p=.068$, statistically insignificant.
5.2. An Emerging Framework

Three categories were formulated based on themes emerging from the open-ended responses of participants. These categories were used to construct and test a framework capable of generalizing both video needs and perceived barriers of users together. The framework comprised the categories of distinctive, evaluative, and associative in order to apply for both needs and barriers in a video search context. The definition for each includes:

- **Distinctive**: Qualities of video derived directly from content by users
- **Evaluative**: Qualities of video requiring individualized assessment by users
- **Associative**: Situational or contextual factors corresponding to access and use

Specific examples of both needs and barriers for each of these categories, as taken directly from the responses of participants, are presented in Table 1. Table 1 provides examples in order to further define each category and depict their respective boundaries.

These three categories (Table 1) were employed as the coding scheme for the content analysis component of the current study. The inter-rater agreement rate across the 752 applicable coded open-ended video needs from participants was .798, with Cohen’s Kappa = .652 (p<0.001). The 597 barrier responses from participants were categorized at a rate of agreement of .861 and a Kappa = .746 (p<0.001). These results provide a moderate to high level of significant agreement, providing confidence in the categories of the framework.

Table 1. Video Needs and Barriers of Participants

<table>
<thead>
<tr>
<th>Need</th>
<th>Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distinctive</td>
<td>Advertisements</td>
</tr>
<tr>
<td>- Specific series or program</td>
<td>Accessibility (e.g. &quot;login,&quot; &quot;not available in area or country,&quot; age)</td>
</tr>
<tr>
<td>- Known or existing things (&quot;puppies,&quot; &quot;kittens,&quot; &quot;Taylor Swift&quot;)</td>
<td>Obvious unsupportive duration</td>
</tr>
<tr>
<td>- Genre or video type (e.g. &quot;dance videos,&quot; &quot;music videos,&quot; &quot;how-to videos,&quot; &quot;sports clips,&quot; &quot;speeches&quot;)</td>
<td>Date (e.g. &quot;old&quot; information)</td>
</tr>
<tr>
<td>- Date (e.g. &quot;new videos&quot;)</td>
<td>Language</td>
</tr>
<tr>
<td>- Advertisements</td>
<td>Video access (i.e. &quot;removed&quot;)</td>
</tr>
<tr>
<td>Evaluative</td>
<td>Bias content (e.g. &quot;produced by a proprietary company&quot;)</td>
</tr>
<tr>
<td>- Exploratory topics</td>
<td>Irrelevant videos after assessment</td>
</tr>
<tr>
<td>- Application suitability (e.g. &quot;educational,&quot; &quot;helpful,&quot; show to demonstrate &quot;media bias&quot;)</td>
<td>Inaccurate video representation (e.g. &quot;visual does not match content&quot;)</td>
</tr>
<tr>
<td>- Personal value (e.g. &quot;funny,&quot; &quot;entertaining,&quot; &quot;interesting&quot;)</td>
<td>Technological (e.g. &quot;internet connection,&quot; &quot;hardware,&quot; &quot;video plugin&quot;)</td>
</tr>
<tr>
<td>- Abstract (&quot;conspiracy&quot;)</td>
<td>Search difficulties (e.g. ineffective retrieval, interface)</td>
</tr>
<tr>
<td>Associative</td>
<td>Not recalling known item</td>
</tr>
<tr>
<td>- Desired quality for device or situational use (e.g. &quot;high,&quot; &quot;mobile&quot;)</td>
<td>Not currently popular</td>
</tr>
<tr>
<td>- Current &quot;hype&quot; or social interest (e.g. &quot;trending&quot; or &quot;viral video&quot;)</td>
<td>Lack of help for using video</td>
</tr>
</tbody>
</table>
5.3. Prioritization of Video Information Needs and Barrier Categories

Once the open-ended responses from participants were coded, regular and weighted frequencies of the different categories were calculated. A percentage level for each category, i.e. its rate of occurrence among the overall response set, was also calculated. Results from these analyses provide a priority level for each category of the framework, including for both video needs and perceived barriers.

Table 2 and Table 3 present the categories of the framework along with these different measures for ranking their levels of occurrence, thus enabling a prioritization of the categories of information needs and barriers existing in a video search. These results provide a number of observations, including demonstrated variations between the information needs of users in relation to their perceived barriers in video search; implications of these findings for future work and research will be further described below.

6. DISCUSSION AND IMPLICATIONS

6.1. Discussion of the Results

Results, as presented, demonstrate a number of positive implications for video retrieval research with several immediate insights for user studies of information needs and perceived barriers. A major contribution of the current study is the user-centered categorical framework of generalized video information needs and perceived barriers, together, accompanied with applicable examples of each (Table 1). The framework included distinct, evaluative, and associative categories of video needs and barriers, which emerged from the responses of study participants.

Evaluation of the video information need statements, as they correspond to the framework, demonstrated significant levels of agreement and coding consistency from the independent coders. Further, participants of the study provided a total of 752 valid video need statements and, in turn, rated their perceived level of knowing or understanding their video needs (when a search is initiated) at a mean of 4.12 out of 5.0. The most common types of video needs were distinctive in nature, i.e. information that users needed or sought to attain directly from the video content itself. These needs were followed by evaluative and associative needs, respectively, according to frequency among responses.

In regard to the perceived barriers in video search, the

### Table 2. Frequencies, Percentages of Occurrence, and Weighted Frequencies of Need Categories

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage of Responses</th>
<th>Weighted Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distinctive</td>
<td>534</td>
<td>71</td>
<td>144.7</td>
</tr>
<tr>
<td>Evaluative</td>
<td>179</td>
<td>23.8</td>
<td>50.2</td>
</tr>
<tr>
<td>Associative</td>
<td>39</td>
<td>5.2</td>
<td>11.2</td>
</tr>
</tbody>
</table>

### Table 3. Frequencies, Percentages of Occurrence, and Weighted Frequencies of Barrier Categories

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage of Responses</th>
<th>Weighted Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distinctive</td>
<td>176</td>
<td>29.5</td>
<td>56.6</td>
</tr>
<tr>
<td>Evaluative</td>
<td>96</td>
<td>16.1</td>
<td>31.8</td>
</tr>
<tr>
<td>Associative</td>
<td>325</td>
<td>54.4</td>
<td>109.2</td>
</tr>
</tbody>
</table>
6.2. Implications of Video Information Needs

The framework emerging from the set of current findings provides positive implications to support further development in this area. Further, findings can provide insights for designing video search tools centered on the needs of users. Understanding video information needs may also help counterbalance against the barriers as perceived by users, as reflected in the unified framework, when designing video search tools.

Future potential of having a framework of video needs can be highlighted by the applied findings from similar studies in other contexts. Prior studies have contributed understanding of information needs and, in turn, informed recommendations or implications for enhancing retrieval. Image research, in particular, has framed user-centered designs of information storage and retrieval components around the needs of users, such as specialized record structures or bibliographic access points, retrieval functions, and interface features (Hastings, 1995; Choi & Rasmussen, 2003; McDonald & Tait, 2003). Results of the current study can serve as a basis for similarly supporting video search through new understandings of users and their needs, perceptions, and experiences.

A framework of video information needs can also benefit information retrieval experimentation by supporting the creation of realistic (i.e. valid) sets of information need statements, such as sample video search topics. Realistic information need statements are necessary for targeted and ecologically-valid retrieval systems evaluation (Christel, 2007). Sets of information need statements, i.e. test search topics, have also been carefully designed and assembled for the purposes of standardized video retrieval evaluations, including search task experiments of the Text REtrieval Conference’s Video Retrieval Evaluation (Search: TRECVID 2009 Guidelines, 2009) and other venues. Video search topics can comprise attributes uniquely applicable to video separately, as an information resource, such as needs that require aspects of motion. Previous studies conducted subsequently to formal participation in standardized evaluations – like TRECVID – have extended the use of the common test dataset(s) and video search topics for examining interactivity (of system and users), search tactics, and user behavior (Wilkins et al., 2009; Yang, Wildemuth, & Marchionini, 2004). These considerations demonstrate the significance for studies on video needs separately, or in addition to image and textual research. Yet, despite the fact that standardized video retrieval evaluations are routinely conducted,
video needs themselves have not been systematically tested, described, and/or categorized. Having such a framework can serve as a basis for supporting future video retrieval evaluations, demonstrating another positive implication for having a framework.

6.3. Implications of Perceived Barriers

Understanding the perceived barriers of users with video information needs can also provide immediate insights for continued research and development in this area. First, more generally, the current study provides a unified categorization of general needs and barriers together in one emerging framework, which is significant as interactive search processes will inevitably comprise both (needs and barriers). Further, as part of the design process, after identifying the target audience, designers and researchers can consider the envisioned needs and tasks along with potential barriers of users; needs should not be considered necessarily without also taking into account other factors potentially influential to the successful fulfillment of those needs. Therefore, it is significant in its own right to frame needs and barriers for categorizing the "do's" and "do not's" as part of one supporting framework. Application of these findings can be similar to that of applying an understanding of needs for designing retrieval tools. Findings here provide an overall framework to consider throughout design, along with concrete examples which can be used to counterbalance or avoid hindrances in users’ experiences. Overall, the current study provides a fuller picture than preceding studies of needs and barriers in video search and thus enhances its potential to support the development of interactive tools like digital libraries.

Implications for having a better understanding of barriers in video search can also be informative for future studies that aim to investigate effects of difficulty and/or complexity in interactive retrieval. Studies of complexity and difficulty particularly as part of search tasks and topics have been quite active over time (Kelly et al., 2015; Wildemuth, Freund, & Toms, 2014; Byström & Jarvelin, 1995). Findings here provide further evidence of the barriers as perceived by actual users in video search situations, which can be indicative or associated with factors related to difficulty. For example, situations that involve perceived barriers can be considered in subsequent studies and serve as a basis for examining user response in the face of common difficulties. Future research can also expand understanding about users’ intentions to adopt and sustain use of video retrieval tools in relation to different types of barriers including as they correspond to video information needs and overarching tasks.

6.4. Implications of Prioritizing Video Information Needs and Barriers

The prioritization of needs and barriers, based on frequency, weighted frequency, and percentages, among the responses of participants, contributes additional specificity in the findings in the current study. Priorities of needs and barriers are viewed as added value to the emerging framework, enabling more informed and precise application of the findings. Drawing upon this prioritization from users, video retrieval tools, again, can ensure availability and heightened emphasis of those prioritized features that support access and enhance usability. Results of the current study provide the basis for both having a categorical framework to define such conscious video needs and barriers of users and the ability to confidently and accurately apply such findings in future research.

7. CONCLUSIONS

The level of analysis provided at this stage of research is informative; for example, information needs specific to video search and retrieval have yet to be analyzed and formally described. In addition, barriers and information needs are many times described separately across separate distinct studies, with no explicit connection made between the two, which is significant as they will both be undoubtedly present in an interactive search situation. The findings provided here address the research questions of the current study and, in turn, provide descriptions and prioritizations of the needs and barriers within a video search context. Findings, even at this stage, can improve designs of user-centered retrieval features and indexing approaches, and also support evaluations, such as interactive experiments, which involve users and sample search topics in retrieval situations to help conform to “ecological validity” (Christel, 2007).

There is opportunity for future analyses to expand upon these findings and further advance understand-
ing of users, information needs, and barriers in the interactive video retrieval experience. Information needs, as they are depicted in prior research, and barriers are complex and dynamic; they can evolve throughout an information seeking process and comprise multifaceted structures and characteristics. Yet, the current study was not longitudinal in nature; therefore, the needs and perceived barriers of participants were specific to a particular point in time and thus expressed prior to any formal search for video and/or subsequent learning. The potential to depict needs and barriers as they occur over the course of a full interactive situation remains.

Also, one key finding of the current study was the high frequency level for “how-to” video needs. Users’ criteria for these needs (and corresponding useful videos) may overlap with different categories or need types as provided in the included framework. Such a finding about video needs complements prior research in image retrieval tasks, which were discovered to comprise needs for visual and data objects, known as the data pole and object pole, as part of still images (Fidel, 1997). Considering this finding, it may be warranted to further flesh out further influences with regard to these particular types of video (i.e. “how to’s”) in distinct studies of users, needs, and barriers as part of expanded interactivity and feedback to users beyond initial query statements (Albertson, 2012).

Further, it will be important to continue to readdress the criteria, needs, and barriers in a video context as technology use and development changes. As one example, social media video has demonstrated the reemergence of the importance of the shot (e.g. up to 7 seconds) for use from much larger video sets. This type of situation can contain inherently different characteristics and influences of both information needs and barriers than more traditional contexts of video search, e.g. from a digital library and/or education purpose. A re-framing and contemplation of user factors involving needs and barriers as technology evolves will be significant.

REFERENCES


Christel, M. G. (2007). Examining user interactions with video retrieval systems. In A. Hanjalic, R. Schettini, & N. Sebe (Eds.), Proceedings of Interna-
A Unified Framework


The Role of People, Information, and Technology in LIS Education: Driving a Call for Action Towards the UN 2030 Agenda

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ABSTRACT
Around the world, public access to information plays a crucial role in improving lives and facilitating development. People, technology, and information, which also represent common themes of i-Schools, are deemed relevant in adapting to these global challenges. The main purpose of this research is to identify the orientation of curriculums in LIS Schools in South Korea toward technology, information, and people for graduate schools of library and information science. This research also correlates the directions of the schools with the UN 2030 Agenda. Using the Wilson model, this study examines the orientation of courses offered. The result of classification and content analysis revealed that courses offered are leaning towards technology and information content. Courses reviewed in the light of developing knowledge and skills of information professionals to facilitate the fulfillment of global goals can make libraries more responsive to the changing times.

Keywords: UN 2030 Agenda, LIS Education, iSchool, South Korea
1. INTRODUCTION

Librarians are movers and shakers that catapult information and communication technology (ICT) infrastructure, help people develop the capacity to effectively use information, and preserve local knowledge to ensure ongoing access for future generations. With these aims, libraries need to forge dynamism to keep the balance of knowledge, skills, and attitude in managing people, technology, and information. Dynamic programs and projects begin with innovative and skilled pools of library professionals. Graduate studies is one of the avenues to enhance knowledge and skills of present and prospective library professionals. People, technology, and information are deemed relevant in the changing times and in adapting to global challenges. More importantly, libraries are entrusted with a major role in driving progress across the UN 2030 Agenda.

In September 2015, the heads of state and government and high representatives decided on new global Sustainable Development Goals (SGDs)—a historic decision on a comprehensive, far-reaching, and people-centered set of universal and transformative goals and targets, for the full implementation of the agenda by 2030. This agenda is a plan of action for people, planet, and prosperity. It also seeks to strengthen universal peace in larger freedom. All countries and all stakeholders act in collaborative partnership to implement this plan. The following 17 SGDs aim to stimulate action over the next fifteen years:

1. End poverty in all its forms everywhere.
2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
3. Ensure healthy lives and promote well-being for all at all ages.
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. Achieve gender equality and empower all women and girls.
6. Ensure availability and sustainable management of water and sanitation for all.
7. Ensure access to affordable, reliable, sustainable, and modern energy for all.
8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work.
9. Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
10. Reduce inequality within and among countries.
11. Make cities and human settlements inclusive, safe, resilient, and sustainable.
12. Ensure sustainable consumption and production patterns.
13. Take urgent action to combat climate change and its impacts.
14. Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
15. Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

The inclusion of libraries and access to information as part of national and regional development plans hopes to contribute to meeting this UN 2030 Agenda, “Transforming our World: the 2030 Agenda for Sustainable Development.” Amidst the changing platform, LIS practitioners and educators incessantly advance the importance of libraries.

The 17 SDGs and 169 targets demonstrate the scale and ambition of this new universal agenda. They seek to build on the Millennium Development Goals and complete what they did not achieve. They seek to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls. They are integrated and indivisible and balance the three dimensions of sustainable development: economic, social, and environmental. The goals and targets will stimulate action over the next 15 years in areas of critical importance for humanity and the planet.

In response to this global challenge, the International Federation of Library Associations and Institutions (IFLA) developed a “Toolkit: Libraries and implementation of the UN 2030 Agenda.” This toolkit provides...
guidelines and information on how libraries meet the 17 SDGs; however, nothing mentions about how the curriculum will develop skills of information professionals to be able to manage information and foster libraries that will meet the agenda.

Post-graduate programs are the key to developing skills for increased advocacy and visibility in the local community. This will enable libraries to succeed in implementing the need of access of information. Advocacy is essential to secure recognition for the role of libraries as engines of local development. Thus, the researchers ventured to look into the post-graduate LIS programs in South Korea as it brings in the above advocacy into skillsets to be honed in the fulfillment of the UN 2030 Agenda.

2. OBJECTIVES

The main purpose of this study is to identify the orientation of curriculums in South Korea toward technology, information, and people for graduate schools of library and information science as it correlates the directions of the schools with the UN 2030 Agenda. Specifically, this study aims to:

1. examine the orientation of post-graduate courses offered in LIS schools in South Korea using the Wilson model;
2. analyze the interaction of three important components advanced in the information studies field along with other disciplines; and
3. correlate the course offerings to their significance in fulfilling the 2030 Agenda for Sustainable Development.

3. METHODOLOGY

3.1. Grounded Theory and the Typology for Information Studies

As a general method for comparative analysis, the researchers anchored on grounded theory (Pickard, 2013). This study used the mixed method of research approaching an inquiry or investigation that combines or associates both qualitative and quantitative forms. This methodology is deemed appropriate as combining different data collection strategies and analyses can provide a more meaningful result. Furthermore, data from the qualitative and quantitative strands can be collected sequentially or concurrently (Creswell, 2009).

Glasser and Strauss (1967) advanced that theories should be “grounded” in the data collected in the field and not imposed by a set of predispositions brought about by the researcher. Using Wilson’s typology as a general theoretical framework, courses were categorized. From this categorization a conceptualization was derived. In order to avoid the pitfall of fitting data into existing categories on the assumption that categories may have emerged from the data, the researcher analyzed the data along with documents such as course objectives, programs, institutional and departmental goals, and policies from institutions where the course came from. Concepts from related studies were also consulted vis-à-vis data analysis. Documentary analysis has become an essential part as the researcher performed data collection simultaneously with analysis in order to develop the theory or concept during each step.

The classification developed is not limited to the typology used in the Wilson model. The analysis ventured to open data for further classification based on some relevant and related theories. The steps in data collection involved two phases. The first is gathering of raw data conducted through desk research. Literature was gathered from online databases to be used in the classification and websites were gathered to have a complete list of subjects. At this initial stage of data collection, web analysis started to reveal the relevant documents and information for the study, particularly the courses offered and the course description of each course. An email was sent to institutions requesting. It was followed up by telephone to confirm that the communication was received. Verification of facts and subjects also utilized email and phone calls as a means to gather information needed. When the data set was completed, the researcher proceeded with the data analysis. Courses were compiled and translated into English. This part of analysis successively gathered insights relevant for the study. In cases where information was inadequate, verification was conducted all over again. Then the researcher proceeded to the second step which is classification. A pivotal step between data collection and writing is memoing or memo writing. Memoing as a process of constant interaction with
The evidence and emerging categories is a continuous commentary of the researcher on the data in the form of memos (Glaser, 1998). It helped gather insights and allowed refinement of classification.

3.2. Demographic Profile

Table 1 shows the total number of schools offering post-graduate courses in South Korea. Out of the 42 LIS schools, 30 offer Master degree programs in Library and Information Science (archives excluded) and 22 have Ph.D. courses. Among the institutions, 27 that offer master’s degrees responded and 20 offering Ph.D. programs sent the list of courses offered in their LIS programs (Table 2).

4. REVIEW OF RELATED LITERATURE

People in schools of library and information science differ very much in their theoretical orientation and on what problems they focus (Ollson, 1995). Those focused on the use of IT have a tendency to prefer the term “information science” while people engaged in library history often prefer “library studies” (Hjorland, 2001). The field can be approached from different angles, using different disciplinary perspectives. As Ribeiro (2007) describes, “a new perspective of convergence has as its object of study on information and is seen as a unified and interdisciplinary field that convokes other disciplines in an obvious and profitable interdisciplinarity.”

Numerous studies have sought to define the field and to examine links, relations, and overlap between information science and other fields. Jaeger, Golbeck, Druin, and Fleischmann (2010) noted that, “as the research and education in the field become more interdisciplinary, previous approaches to curriculum will likely be insufficient to serve the goals of doctoral education, and a comprehensive and ongoing discussion will be necessary to support the development of new programs across the field.” Golde and Dore (2004) noted that it is important to think in “discipline-specific ways in all matters related to doctoral education—in this case, the preparation of new faculty, the nature of doctoral education differs among disciplines, and not surprisingly, the preparation of new faculty also differs among disciplines.” Barry et al. (2008) point out that interdisciplinarity is not historically novel, but has been central to the evolution of disciplines.

In Korea, the LIS curriculum development has been the emphasis of various research efforts. Analysis of LIS curriculum development from many different perspectives was the center of studies of Park (2000), Noh (2005), and Oh and Chang (2006). Kim (1998), Hahn (1998), and Um (2003) looked into the LIS development under the academic department system in Korea.

Central to this study is the Wilson model. Wilson (2001) posits that information studies may be seen as

<table>
<thead>
<tr>
<th>Institutions Offering Post Graduate Programs</th>
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<tbody>
<tr>
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</tr>
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resulting from the interaction among four fields, which are information content, information systems, people, and organization. The map is useful to show the possible relationships among subjects and the intersections of the fields.

4.1. Mapping the Curriculum Towards UN 2030 Goals

LIS is deemed most functional and useful in current society if it leads to creation of a theoretical, conceptual, and methodological identity, so that more coherent and integrated results are obtained. That convergence among disciplines is accompanied by a mutual integration of disciplinary epistemologies (Van den Besselaar & Heimeriks, 2001).

Beyond knowledge of information resources, access, technology, and management, the ability to use this knowledge in providing the highest quality information services, should match a set of attitudes, skills, and values. This will enable practitioners to work effectively and contribute positively to their organizations, clients, and profession.

Information studies may be seen as resulting from the interaction among these four fields, which are information content, information systems, people, and organization (Wilson, 2001). The Wilson model used in the analysis shows the possible relationships among subjects and the intersections of the fields. This typology of the areas related to information studies logically derived can be used in different ways: 1) to identify the curriculum areas that may be of importance in the construction of a degree program, 2) to identify all of the sub-fields as areas of interest and construct a broad curriculum, and 3) to focus on one particular main field, such as information systems, and select from its intersections with other fields those that would make up a useful and interesting special program or area of concentration.

In this macro analysis of more than 1,000 courses, Wilson's typology served as main reference to classify the course offerings that connect to the UN 2030 Agenda. Based on the abovementioned model, the following categories are explained below:

A – Information content. This category deals with the management of information content as the traditional function of libraries and information services more often referred to as “information sources.”

B – Information systems. Information Systems exists as a separate field of study, sometimes independently but more often as a part of computer science departments or business schools. This category includes courses wherein the orientation as a discipline is towards information in organizational settings, and in this context the term is used to identify not only the technology but also the human systems through which information sources and resources may be organized and managed.

C – People. This category covers studies both on information users and information providers in the sense of those who manage information providing organizations that have information systems and services, and it also covers those who manage the information providing organizations and organizations that have information systems and services within them.

D – Organization. This category focuses on organizations such as publishers that produce information content and that constitute an important part of the information chain; libraries and other information agencies that have traditionally managed information content and organizations in which information is managed and within which people use information.

E – Policy, planning, and strategy. It can be observed that there are subfields which may appear repetitive or duplicating, such as AB and BA, AC and CA, or BC and CB. The interactions among these subfields are treated differently as to orientation. For example, in the case of AB (information and technology) and BA (systems acting on content), the peculiarity lies in the fact that the former emphasizes information as the main focus while the latter underscores systems or technology in its essential function with content or information.

Assignments of fields and how they are perceived in a particular country may vary. For this study, the following subfields have evolved:

AB - Information and technology. This category deals with courses on production of information with the use of technology.

ABC - Information seeking and searching. This category is focused on information content in systems as used by people.

ABCD - Information content, systems, people, and organization. This is an intersection between four fundamental fields that focus on information content.
AC - Information content organized to fulfill the information needs of a specific group of users (Bronstein, 2007). This category includes courses that emphasize the organization of information, organization that is planned around a specific group of users.

ACD - Information content, people, and organizations; courses that deal with the role of information content in the information society/organization and information content interacting with people.

AD - Information content in organizations. This category includes courses that emphasize the roles that information content organizations play and that constitute an important part of the information chain in society at large. This study also deals with issues on information in general.

BA - Systems acting on content; information retrieval systems. This category includes courses that emphasize technology and its relation to the development and delivery of information.

BC - Principles of information systems design based on human/system interaction. This category includes courses that emphasize the design of information systems, taking into account elements of human interaction with the system.

BCD - Information systems, people, and organization. This category includes courses that emphasize the design of information systems, taking into account elements of human interaction with the system as it affects a bigger organization or institution.

BD - Systems and organizations. This category includes courses emphasizing systems role in information producing organizations or in the society at large.

CA - People interacting with information content (Bronstein, 2007). This category includes courses that emphasize user interaction with organized information content; it covers topics such as information use, information literacy, and reading.

CAB - People interacting with information content and information systems, and their role in the information society (Bronstein, 2007). This category includes courses that deal with issues involving the organization of information in information systems, and user interaction with information content through information systems. In other words, this category includes courses dealing with information behavior in general, information seeking and searching, user studies, and the use of formal and informal information channels.

CAD - People interacting with information content in specific organizations. This category includes courses that emphasize the user's interaction with organized information content in a specific organization (i.e. type of library) as well as the roles and functions of information professional in a particular organization. It also covers user issues in a specific library (Bronstein, 2007).

CB - People interacting with information systems (Wilson, 2001). This category includes courses emphasizing different elements of the human side in computer/human interaction. It deals with people interacting with systems, information seeking, and searching.

CBD - Systems managers in organizations. This category includes courses that focus on the role of systems managers or people working within the system and its relation to the bigger organization or institution.

DA - Content producing organizations; human resource management. This category includes courses that deal with the study of human behaviour as it affects the content producing organization.

DB - Organizational information systems. This category includes courses emphasizing the functions of information systems in content producing organizations.

DC - Management. This category includes courses dealing with basic strategy and planning other management functions in the context of content producing organizations.

Although this study used a single paradigm, the interactions between the fields were unique and specific to this study. Various theories served as bases along with previous studies in library and information science. The information collected was analyzed using the content-analysis method and then grouped under categories extracted from the data.

The typology shows the overarching relationship of information, people, and technology. Courses are treated as what Ribeiro (2007) described as a unified and interdisciplinary field that convokes other disciplines in an obvious and profitable interdisciplinarity. Cognition of the nature of courses facilitates the fulfillment of learning outcomes. Development of a Knowledge-Skills-Attitude (KSA) that enables librarians to work effectively can contribute to the organization, profession, local community, and global society.

5. FINDINGS
5.1. Information, Technology, and People and the Overarching Relationships

Tables 3 and 4 provide the result of the classification and content analysis that revealed the orientation of courses offered towards B (information systems) and A (information content). Emphasis on technology has become an important core component of courses in LIS. Analyzing the content of this category, the key concepts apply scientific methods to problem solving using technology. Information systems exists as a separate field of study, sometimes independently but more often as a part of computer science (Wilson, 2001). Moreover, emphasis on the management of information content as the traditional function of libraries and information services often referred to as “information sources” is the focus of master’s degree programs in LIS schools.

Table 3 shows that 27 respondent-schools have orientations to integrate people (C) as a component. The

Table 3. Master’s Degree Courses in South Korea

<table>
<thead>
<tr>
<th>Classification</th>
<th>No. of Course Titles</th>
<th>Rank</th>
<th>% (n=732)</th>
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</thead>
<tbody>
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<td>1</td>
<td>28</td>
</tr>
<tr>
<td>B</td>
<td>117</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>_</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>35</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>AB</td>
<td>30</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>ABC</td>
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<td>11</td>
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</tr>
<tr>
<td>ABCD</td>
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<td>9</td>
<td>2</td>
</tr>
<tr>
<td>ABD</td>
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</tr>
<tr>
<td>AC</td>
<td>8</td>
<td>10</td>
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</tr>
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<td>ACD</td>
<td>53</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>AD</td>
<td>18</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>BA</td>
<td>23</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>BC</td>
<td>86</td>
<td>3</td>
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The Role of People, Information, and Technology in LIS Education

classes in top rank are: 1) BC, which focuses on disciplines that deal with information designs based on human-computer interaction; 2) DC, which is on management principles, as management of people is an indispensable component. At some point, master's courses in SK are more focused towards traditional library management; and 3) ACD, which emphasizes services to users and interactions between library, users, and services. A need to integrate fundamental management principles is due to the fact that a variety of managerial roles in an academic library are found necessary both in traditional and modern libraries.

For Ph.D. courses, the interdisciplinary characteristic of LIS is primarily driven by emerging technology and the changing context of the work; that, on the doctoral level, communicates across disciplinary boundaries. Like any other fields, the main component of LIS doctoral programs is research. Results in Table 4 show that both A (information content) and B (information systems) have the highest number of course offerings. The result of classification further revealed the dispersion into other fields and subfields. Ph.D. courses in South Korea have similar programs offered in master's degree courses.

5.2. Courses and Direction Towards the Fulfillment of UN 2030 Agenda

The skills for these three major emphases of LIS studies along with D (organization) is essential in the UN 2030 advocacy, driving progress and response for sustainable development, particularly access to information. Scanning through the best practices done since 2012

Table 4. Doctoral Degree Courses in South Korea

<table>
<thead>
<tr>
<th>Classification</th>
<th>No. of Course Titles</th>
<th>Rank</th>
<th>% (n=616)</th>
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<tr>
<td>B</td>
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<td>13</td>
<td>0.2</td>
</tr>
<tr>
<td>ACD</td>
<td>47</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>AD</td>
<td>11</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>BA</td>
<td>3</td>
<td>11</td>
<td>0.5</td>
</tr>
<tr>
<td>BC</td>
<td>69</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>CA</td>
<td>16</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>CAB</td>
<td>8</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>DC</td>
<td>54</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>E</td>
<td>24</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>
that address the 17 goals, the following dynamic programs and functions have been performed by librarians:
1. Provide platforms to ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services through computer literacy and guided access to the Internet and locally relevant knowledge.
2. Publish the outcomes of crop trials, agriculture policy analysis, and information on the growing farm finance movement through libraries.
3. Facilitate universal access to sexual and reproductive health-care services, particularly through health care information sources.
4. Facilitate in achieving literacy and numeracy.
5. Use information as a vital social and political equalizer.
6. Create strategies to support and strengthen the participation of local communities in improving water and sanitation management.
7. Retrieve and present complex data to non-expert users with specific needs.
8. Provide programs for people to find jobs through their public library.
9. Increase access to information and communications technology, working with schools and local communities.
10. Provide inclusive services to diverse and underrepresented populations to ensure equality of access to information in a range of institutional settings.
11. Strengthen efforts to protect and safeguard the world’s cultural and natural heritage.
12. Provide a forum to build credible voices to adopt sustainable practices and to integrate sustainability information.
13. Build decision-support tools for policymaking, climate data, natural resource management, and so on.
14. Provide access to data, research, and knowledge that supports informed research and public access to information about coastal conservation.
15. Communicate information on preservation of indigenous knowledge, influencing local decision-making about fundamental aspects of life such as hunting, fishing, land use, and water management.
16. Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements.
17. Use libraries spaces to fully operationalize science, technology, and innovation capacity-building mechanisms.

5.3. Courses, Typology, and UN 2030 Agenda on Sustainable Development Goals

Information

Acquisition of knowledge and skills related to information sources and services remain to be the focus of post-graduate programs in LIS schools in South Korea. Sample subject titles have been extracted and analyzed in the succeeding discussions. Table 5 provides a matrix of sample courses offered in LIS post-graduate programs that are classified under A and related subfields along with the SGDs fulfilled by the learning outcomes of the courses.

As to the area on “Information” the researchers deem that it has addressed SGD 4 (quality education). The knowledge and skills of librarians about diverse information sources and their ability to retrieve, provide, and preserve local knowledge and information sources in various formats is essential in promoting quality education, whether it is in a formal setting for academic and research libraries or informal and life-long learning as provided by public libraries.

Moreover, skill sets found in courses classified under A (information content) also fulfill SGD 16 (peace and justice), specifically Target 16.10 (ensuring public access to information and protecting fundamental freedoms, in accordance with national legislation and international agreements). Librarians’ understanding of information provision in a variety of domains, including academic subjects and professional disciplines, gives an insight into subject-specific information work. Practitioners’ knowledge of information resources, access, technology, and management, and the ability to use this knowledge as a basis for providing the highest quality information services is essential in fulfilling the 16th goal (Special Libraries Association, 2015). Courses that were classified under AB (information & technology) such as Digital Libraries, study of Internet sources, and Internet and local information which deals with production of information with the use of technology, are deemed responsive to SGD 8 (good jobs and economic growth), 9 (in-
novation and infrastructure), 10 (reduced inequality), 11 (cities and communities), and 16 (peace and justice). Sustained, inclusive economic growth; full and productive employment; industrialization and innovation; reduced inequality; sustainable cities and communities, and global partnership towards peace and justice can be facilitated with working knowledge of information and technology as well as by knowledge of how information interacts with systems, people, and organizations (society) through availability of information sources, technology, and collaboration in learning spaces. Skills in networking and resource sharing are also essential in the fulfillment of the abovementioned goals.

Information content organized to fulfill the information needs of a specific group of users (AC) (Bronstein, 2007) is another essential category that includes courses

Table 5. Sample LIS Courses with Emphasis on Information and the SDGs addressed

<table>
<thead>
<tr>
<th>COURSES</th>
<th>TYPOLOGY</th>
<th>SDG THAT CAN BE ADDRESSED FROM KSA ACQUIRED IN COURSES OFFERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Advanced Government Publications • Advanced Information Media • Advanced Studies in Information Flow • Knowledge Communication • Primary Sources of Korean History • Methodology in Preservation of Library Materials • Advanced Digital Libraries • Digital Preservation and Access • Internet and Local Information • Internet Sources</td>
<td>A Information Content</td>
<td>4 - Quality Education 16 - Peace, Justice, and Strong Institutions</td>
</tr>
<tr>
<td>• Advanced Digital Libraries • Digital Preservation and Access • Internet and Local Information • Internet Sources</td>
<td>AB Information &amp; Technology</td>
<td>8 - Economic Growth 9 - Innovation and Infrastructure 10 - Reduced Inequalities 11 - Sustainable Cities and Communities 16 - Peace, Justice, and Strong Institutions</td>
</tr>
<tr>
<td>• Library Cooperation • Library Cooperation Networks • Resource Sharing • Seminar on Resource Sharing and Information Network</td>
<td>ABCD Information content, systems, people, and organization</td>
<td>8 - Economic Growth 9 - Innovation and Infrastructure 10 - Reduced Inequalities 11 - Sustainable Cities and Communities 16 - Peace, Justice, and Strong Institutions 17 - Partnership and Collaboration</td>
</tr>
<tr>
<td>• Studies in Children and Youth Materials</td>
<td>AC Information content organized to fulfill the information needs of a specific group of users</td>
<td>4 - Quality Education 16 - Peace, Justice, and Strong Institutions</td>
</tr>
<tr>
<td>• Adult Reader’s Advisory Services in the Public Library • Studies in Children and Youth Materials • Reference and Information Services • Resources and Services for Adults • Seminar in Information Services in the Humanities • Seminar in Local Communities • Seminar in Public Library Service • User Service for Specialized Information Resource</td>
<td>ACD (Information People and Organization)</td>
<td>1 - End Poverty 2 - End Hunger 5 - Gender Equality 10 - Reduced Inequalities 11 - Sustainable Cities and Communities 13 - Climate Action 14 - Life Below Water 15 - Life on Land 16 - Peace, Justice, and Strong Institutions</td>
</tr>
<tr>
<td>• Information Economics • Information Transfer and Information Society</td>
<td>AD Information content in organizations</td>
<td>10 - Reduced Inequalities 12 - Responsible Consumption and Production 16 - Peace, Justice, and Strong Institutions</td>
</tr>
</tbody>
</table>
emphasizing the organization of information planned around a specific group of users. Similarly, it can support sustainable economic growth and industrialization, and foster innovation, sustainable cities and communities, and strengthen the means of implementation and revitalize the global partnership for sustainable development. Likewise, ability to provide services and creativity in programming through courses that deal with the role of information content in the information society/organization and information content interacting with people (ACD) facilitates advancement of quality education and free access to information. Courses that emphasize the roles that information content organizations constitute as an important part of the society at large can help address SGD 1 (no poverty), 10 (reduced inequalities), 12 (responsible consumption), and 16 (peace and justice). Learning spaces are not isolated from socio-economic issues as information is a driving force for development.

5.4. Technology

The analysis of courses revealed that technology as an essential component is given emphasis in LIS studies. Information content has become interdependent with the systems. With the growing web and online resources, knowledge on information facilitated using technology can facilitate services that transcend the limitation of time and space. Leveraging technology and understanding human-computer interaction can address all areas of the agenda. Ending poverty can be facilitated with online financial literacy programs. Skills in providing resources or directing resources and access to basic services such as computer literacy, retrieving and presenting complex data to non-expert users with specific needs, and understanding the dynamics of information that can be utilized by experts and common users, are the essential preparations needed by students. Table 6 provides sample courses classified under B (information systems) and other subfields which have an orientation towards technology.

Subjects such as Informatics, Information Analytics, and Big Data can equip learners with skills to provide platforms in using information as a vital social and political equalizer, building decision-support tools for policymaking, climate data, natural resource management, and so on. Technical knowledge built upon courses on information retrieval, digital contents, and human/computer interaction can help transform complex data to non-expert users and increase access to information and communications technology, working with the communities ensuring public access to information.

5.5. People

A shift to user-centered approaches prompts information professionals to extend into functions that educate users facilitating independent research and self-initiative to learn new skills. Courses that hone the skills of librarians to promote empowerment, sustainability, and awareness of international issues are most relevant in this age. Knowledge of technology and information should be coupled with skills to transmit these two important tools to people or users with different needs. Table 7 provides a matrix of sample courses and the SGD addressed. Courses that deal with information literacy or cater to users with specific needs can promote lifelong learning opportunities, and develop programs that increase awareness on gender equality, minority empowerment, and sustainable development.

6. CONCLUSION

Libraries are not just spaces; they are places for advocacy—the stirrers of intellectual conversations and thoughtful engagement. Educating information professionals along with digital or IR skills creates influencers that can drive progress beyond boundaries. Our study does not necessarily advance an overhauling of the curriculum but rather suggests two ideas: 1) a model to measure the relevance of contents and 2) honing skills sets with inclusion of social, political, legal, environmental, economic, and cultural aspects of LIS thereby amplifying participation in local, regional, national, and international endeavors. We need key players, front liners, advocates, researchers, and educators working in concerted effort towards a better future. More than ever this age calls for sustainability and the need to re-engage. IFLA begins toward the implementation of sustainable development goals, and will continue to engage and build the capacity of members. Nonetheless, the work continues. It will take the present leaders as well as a new breed of information professionals to fulfill the 2030 Agenda, which implies that there is a need to prepare prospective leaders as well as propel the
present leaders to monitor and implement the vision, stimulating action over the next fifteen years.

7. RECOMMENDATIONS

Overall, the researchers strongly recommend that for the fulfillment of these goals and making libraries more responsive to needs in these changing times, courses should be reviewed in the light of developing leaderships and communication skills as well as deeper cognizance of the policies, advocacies, and lobbying (E-Policy, planning, and strategies). Learning focuses may not necessarily shift but some broad topics can be modified to address specific issues; for example, courses in Climate Change Informatics can be developed beyond the broad subject of Informatics. It can be gleaned that the interdisciplinary of the field becomes more promi-

Table 6a. Sample LIS Courses with Emphasis on Technology and the SDGs addressed

<table>
<thead>
<tr>
<th>COURSES</th>
<th>TYPOLOGY</th>
<th>SDG THAT CAN BE ADDRESSED FROM KSA ACQUIRED IN COURSES OFFERED</th>
</tr>
</thead>
</table>
| • Informatics  
• Analysis of Web Information Resources  
• Big Data in Digital Age  
• Building Research of Digital Content  
• Information Analytics on the Humanities  
• Information Analytics on Science and Technology | B  Information Technology | ALL |
| • Advanced Web-based Information Processing  
• Information Retrieval  
• Cognitive Information Retrieval | BA  Systems acting on content or retrieval system | |
| • Advanced Metadata  
• Human/Computer Interaction  
• Information Access Systems: Indexing, Abstracting, and Other Access Systems | BC  Principles of information systems design based on human/ system interaction | |

Table 6b. Sample LIS Courses with Emphasis on People and the SDGs addressed

<table>
<thead>
<tr>
<th>COURSES</th>
<th>TYPOLOGY</th>
<th>SDG THAT CAN BE ADDRESSED FROM KSA ACQUIRED IN COURSES OFFERED</th>
</tr>
</thead>
</table>
| • Children and Youth Research  
• Legal Issues in Information Work  
• Seminar in Information Professionals and Its Role  
• Seminar in Subject Specialist and Its Role | C  People | 4 - Quality Education |
| • Advanced Information Literacy  
• Bibliotherapy  
• Information Literacy for the Aged  
• Reading Enhancement Education | CA  People Acting on Information Content | 5 - Gender Equality  
9 – Innovation and Infrastructure  
10 – Reduced Inequalities  
16- Peace, Justice, and Strong Institutions |
| • Advanced Studies in Information User Behaviour  
• User-Generated Content | CAB  People interacting with information contentand information systems and their role in the information society | *advocacy of information professionals |
| • Studies on Library Leadership | DC  Management (Managing People) | |
ent. Local context approaches to implementing SDGs are expected. The national government can emphasize or de-emphasize various goals depending on the local situation, but it is our role to ensure that libraries and access to information are not left behind. Institutionalization of advocacies, that is, creating laws and implementing guidelines that are binding to strengthen the support for SDGs and other library advocacies, begins with learning how to do it. Strategies and the key message that access to information is an essential tool in national development and global concerns must start in the classrooms. Sharing of knowledge through various forms of cooperation and networking is our bastion to address the challenges.

ACKNOWLEDGEMENTS

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The researchers are greatly indebted to the following institutions and LIS Departments who cooperated in the survey conducted.

REFERENCES


al-library-information-educational-programs.pdf.


<table>
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<tr>
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<th>Ph.D.</th>
</tr>
</thead>
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<td>✔</td>
</tr>
<tr>
<td>Chungnam National University</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Chonbuk National University</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Chung Ang University</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Chonnam National University</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>DaeguCatholic University</td>
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<td></td>
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<tr>
<td>Daejin University</td>
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<td></td>
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<tr>
<td>Eui University University</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Dongduk Women's University</td>
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<td></td>
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<tr>
<td>Ewha Women's University</td>
<td>✔</td>
<td>✔</td>
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<td>Gwangju University</td>
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<tr>
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<td>✔</td>
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<tr>
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<td>✔</td>
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<tr>
<td>Yonsei University</td>
<td>✔</td>
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</tbody>
</table>
ABSTRACT

Information seeking behaviour is an activity of an individual in the process of identifying information that suits his/her knowledge pursuit. It is observed from the review of literature that there is no single study on the information seeking behaviour of faculties of pharmacy either at state level or national levels in India. Therefore this research has been conducted to bridge the gap on information seeking behaviour of pharmacy faculty in Tamil Nadu in view of the recent developments in information seeking behaviour, with objectives such as: to identify the information needs and seeking behaviour of faculty of the pharmacy educational institutions in Tamil Nadu (India); to examine the motivating factors for information seeking behaviour of the pharmacy faculty; to examine faculty opinions about the comprehensiveness or otherwise of respective institutions’ library collections; and to analyse the extent of use and dependence on various sources of information for teaching and research. A total of 729 questionnaires have been distributed among 41 pharmacy educational institutions in Tamil Nadu, out of which 601 have responded, and the response rate is 82.44%. Based on the findings of the study certain implications have been derived as measures to enhance the quality of the pharmacy libraries in Tamil Nadu.

Keywords: Information Seeking Behaviour, Pharmacy Libraries, Pharmacy Faculty, Tamil Nadu (India), Survey
1. INTRODUCTION

Information need is one of the cognitive needs of humankind. Information need causes information seeking behaviours and these concepts complement one another. The information need and information seeking behaviours are affected by many factors. The concept of information need has proved to be an elusive one and difficult to define. What initiates seeking need has received more attention from researchers than the definition of information itself. The topic, unfortunately, is also approached from such a variety of perspectives that no single definition for the conceptual construct exists. In general, the literature falls into two broad categories: Some studies attempt to determine the nature of the need, while others attempt to distinguish between levels of perception. Information need is often a vague concept. It is a more a question asked of an information provider. It is a subjective, a relative concept, existing in the minds of experienced individuals. It changes over a period of time and varies from person to person, profession to profession, and from institution to institution and so on.

2. INFORMATION SEEKING BEHAVIOR

Information seeking behaviour is an activity of an individual in the process of identifying information that suits his/her knowledge pursuit. Information seeking behaviour is used synonymously with information gathering habits or information seeking patterns. It is an act of searching, finding, or locating information required by different people such as an individual, a professional, an academician, a researcher, a consultant, and so on. The process of searching information through various channels of communication is termed as information seeking behaviour. Information seeking behavior may be defined as those activities a person may engage in when identifying his/her own needs for information, searching for such information in any way, and using or transferring that information (Wilson, 2000).

The concept of “information behavior” was coined in the late 1990s, but it traces its roots to the concept of “information needs and uses” that arose in the 1960s. There has been a gradual shift in the focus of information behavior research from a system orientation to a user orientation. At the end of the 1970’s and in the beginning of the 1980’s researchers began to realize that questions in information needs, seeking, and use could not be seen only from the system point of view. The user of the information and his/her needs came into focus and research in cognitive science was applied in the studies. Kumar (1990) has emphasized that information seeking behavior is mainly concerned with who needs what kind of information and for what reasons; how information is found, evaluated and used, and how needs can be identified and satisfied.

3. PHARMACY EDUCATION INSTITUTIONS IN TAMIL NADU

Pharmacy education in India traditionally has been industry and product oriented. In contrast to the situation in developed nations, graduate pharmacists prefer placements in the pharmaceutical industry. In India, formal pharmacy education leading to a degree began with the introduction of a three-year bachelor of pharmacy (B. Pharm.) at Banaras Hindu University in 1937. At that time, the curriculum was presented as a combination of pharmaceutical chemistry, analytical chemistry, and pharmacy, which prepared graduates to work as specialists in quality control and standardization of drugs for pharmaceutical companies, but not for pharmacy practice. After independence in 1947, India inherited a system for the pharmacy profession from the British rulers that was unorganized, and there was no legal restriction on the practice of pharmacy. The concept of pharmacy practice was not realized until after independence. In 1948, the Pharmacy Act was enacted as the nation’s first minimum standard of educational qualification for pharmacy practice in order to regulate the practice, education, and profession of pharmacy. Currently, one needs at least a diploma in pharmacy to practice as a pharmacist. Provisions of the Act are implemented through the Pharmacy Council of India (PCI).

The establishment of Madras Medical College in Tamil Nadu, which is the second medical college in India, was a turning point in the growth of medical education in the state of Tamil Nadu. At present there are 41 pharmacy educational institutions in Tamil
Nadu affiliated to the Tamil Nadu Dr. M.G.R. Medical University (see Appendix). The first medical university for medicine was started in Andhra Pradesh and the second one in Tamil Nadu is named as The Tamil Nadu Dr. M.G.R. Medical University. An overview of pharmacy educational institutions and their libraries in Tamil Nadu has been discussed in a separate paper by the authors (Selvamani & Babu, 2014).

4. LITERATURE REVIEW

Due to the vast amounts of literature available on the subject of information seeking behavior, only recent and significant studies have been reviewed in this section.

Tahamtan et al. (2015) investigated drug information-seeking behaviour of health care professionals and the way they manage this information in a developing country that lacks necessary information technology infrastructures. The purpose of their paper is to list the resources that Iranian health care professionals used to access drug-related information, to know the features and types of drug information resources which were much more important for health care professionals, the problems they encountered in seeking drug information, and the way they organized and re-found the information that they had retrieved. Lack of access to drug information and lack of enough time were the main obstacles in seeking drug information. On the other hand, Andualem, Kebede, and Kumie (2013) assessed information needs among Ethiopian health professionals. The majority of the respondents acknowledged the need for health information in their routine activities. Important barriers to access information were geographical, organizational, personal, economic, educational status, and time. Age, sex, income, computer literacy and access, patient size, work experience, and working site were significantly associated with information needs and seeking behaviour.

In another study, DeRosa (2013) surveyed 49 physicians, 43 nursing staff members, 25 administrative staff members, 23 paramedical staff members, and 5 technical staff members, totaling 145 health professionals in Greece. The study revealed that funding for hospital libraries in Greece is an issue preventing many new initiatives, that there is no association to represent hospital libraries in Greece, that the few libraries operating in hospitals in Greece are understaffed with no administrative control, and that the majority of Greek hospitals do not have adequate library facilities. These drawbacks contribute to the information-seeking challenges experienced by Greek health care professionals.

Maharana, Dhal, and Pati (2013) investigate information seeking behavior and satisfaction level of the faculty members and students at the VSS Medical College, Burala, Odisha. The study examines frequency of library visit, purpose of information seeking, preferred resources, most preferred search engine, satisfaction level among the respondents, and so on.

Sedghi, Sanderson, and Clough (2012) reported the results of a study investigating the relevance criteria used by health care professionals when seeking medical images. The results show that participants made use of 15 relevance criteria, although they agreed on topicality being the most important. The findings suggest that users apply different criteria in different situations when evaluating the relevancy of medical images. Thus their study helps to contribute to the understanding of medical image resources and the information needs of health care professionals. A clear understanding of the medical image information needs of health care professionals is also vital to the design process and development of medical image retrieval systems.

Soundararajan and Babu (2011) analysed the information use patterns of health professionals in Christian medical colleges and hospitals in Tamil Nadu. Their study covers user information needs, search, access patterns, use of e-resources in the field of medicine and allied health fields, barriers while accessing, and e-resources.

Tenopir et al. (2009) studied the reading patterns of science, social science, technology, and medical university faculty members. Their study showed that the information seeking and reading patterns of science faculty members changed with the growth of electronic journals.

Hider (2009) analysed the information seeking behaviour of clinical staff with a random sample of 850 hospital clinical staff belonging to 3 professional groupings: medical and dental, nursing, and allied health professionals. The results from this survey indicate that hospital clinical staff in a large health care organization have clear preferences for particular resources,
searching methods, and continuing education formats. All three groups of hospital clinical staff show a clear preference for Google among electronic resources. This survey provides a unique snapshot of the skills, attitudes, and behavior of hospital clinical staff, including allied health professionals, in a large regional health organization. Potential limitations include the relatively few medical staff responders and the proportionately lower response from nursing staff. The findings suggest that a large number of staff use and highly value Internet-based resources for clinical information seeking. Jeyshankar, Rao, and Babu (2009) examined the information needs and information seeking behaviour of dentists in Chennai. They emphasized that the existing infrastructure in terms of collection, services, and other facilities in the libraries of dental educational institutions are to be strengthened. As evident in this study, the libraries are yet to emerge as an effective information handling institution in the light of changes in the IT environment.

It is observed from the review of literature that there is no single study on the information seeking behaviour of faculties of pharmacy either at state level or national levels in India. Therefore this research has been conducted to bridge the gap on information seeking behaviour of pharmacy faculty in Tamil Nadu in view of the recent developments in information seeking behaviour.

5. OBJECTIVES OF THE STUDY

• To identify the information needs and seeking behaviour of faculty of the pharmacy educational institutions in Tamil Nadu (India).
• To examine the motivating factors for information seeking behaviour of the pharmacy faculty.
• To examine the faculty opinions about the comprehensiveness or otherwise of respective institutions’ library collections.
• To analyse the extent of use and dependence on various sources of information for teaching and research.

6. METHODOLOGY

This study is based on the survey method. The data set has been collected through a questionnaire method. For this study the faculty in 41 pharmacy colleges in Tamil Nadu have been considered. A total of 729 questionnaires have been distributed among 41 pharmacy educational institutions as shown in the Appendix, out of which 601 have responded, and the response rate is 82.44%.

7. DATA ANALYSIS AND DISCUSSION

The data collected from the questionnaire have been analyzed and interpreted to test the hypotheses framed and to fulfill the stated objectives. For this purpose Statistical Package for the Social Sciences (SPSS) software has been used. The statistical analysis techniques such as frequency distribution, percentage analysis, ANOVA, Cluster Analysis, Wilcoxon Signed – Rank test, and Chi-square test, have been employed depending on the nature of the data collected from the respondents.

7.1. Background Information of the Respondents

The data in Table 1 present the classification of respondents by designation and gender. Out of 448 respondents of Assistant Professor rank, nearly half of the respondents are Male 228, and Females are 220 in number. This is followed by 48 Associate Professors of which 33 are Male and Females number 15. Out of 105 respondents of Professor ranks, 70 are Male and Females are 35 in number.

7.2. Nature and Types of Information Required: Cluster Analysis

A total of 13 types of information sources were identified as the nature and types of information required by the respondents, and the responses were analysed using cluster analysis. In the dendrogram Figure 1, at 60% distance level four interpretable clusters have been formed.

The first cluster consists of eight variables as shown in Table 2.

In Cluster 1 the agree and disagree ratio for these variables is 60.54:1, which means these sources are strongly required by the respondents. Hence this cluster has been named “Strongly Required Information Sources.”
The second cluster has been formed with two variables as shown in Table 3. In Cluster 2 the agree and disagree ratio is 40:1, which reveals that these variables are highly required by the pharmacy faculty. Therefore this cluster has been named “Highly Required Information Sources.”

The third cluster has been formed with two variables as shown in Table 4. In Cluster 3 the agree and disagree ratio is 27:1, which reveals that these variables are moderately required by the pharmacy faculty. Therefore this cluster has been named “Rarely required Information Sources.”

The fourth cluster has been formed with only one variable as shown in Table 5. In this cluster the agree and disagree ratio is 32:1, which means these sources are moderately required by the respondents. Therefore this cluster has been named “Moderately required Information sources.”

### Table 1. Designation vs. Gender of the Pharmacy Faculty

<table>
<thead>
<tr>
<th>S.No</th>
<th>Gender</th>
<th>Assistant Professors n = 448</th>
<th>Associate Professors n = 48</th>
<th>Professors n = 105</th>
<th>Total n = 601</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>228 (37.94)</td>
<td>33 (5.49)</td>
<td>70 (11.65)</td>
<td>331 (55.08)</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>220 (36.60)</td>
<td>15 (2.50)</td>
<td>35 (5.82)</td>
<td>270 (44.92)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>448 (74.54)</td>
<td>48 (7.99)</td>
<td>105 (17.47)</td>
<td>601 (100.0)</td>
</tr>
</tbody>
</table>

![Hierarchical Cluster Analysis: Dendrogram Using Average Linkage (Between Groups) Rescaled Distance Cluster Combined](image)

**Fig. 1** Mobile device ownership over time
### Table 2. Cluster 1: Strongly Required Information Sources

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variable Code</th>
<th>Description</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NTI3</td>
<td>Methods, process and procedures</td>
<td>593</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>NTI4</td>
<td>Experimental designs, results, and information application</td>
<td>592</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>NTI2</td>
<td>Background theory</td>
<td>588</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>NTI5</td>
<td>Product, material</td>
<td>588</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>NTI11</td>
<td>Information about lab procedures</td>
<td>585</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>NTI6</td>
<td>Information about previous work done in your field</td>
<td>595</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>NTI7</td>
<td>Information about current developments in your field</td>
<td>595</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>NTI11</td>
<td>Review of literature</td>
<td>593</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>4729</td>
<td>79</td>
</tr>
</tbody>
</table>

### Table 3. Cluster 2: Highly Required Information Sources

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variable Code</th>
<th>Description</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NTI12</td>
<td>Scientific and technical news</td>
<td>586</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>NTI13</td>
<td>Information about government decisions on medical field</td>
<td>587</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>1173</td>
<td>29</td>
</tr>
</tbody>
</table>

### Table 4. Cluster 3: Rarely Required Information Sources

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variable Code</th>
<th>Description</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NTI8</td>
<td>Computer programs and model building information</td>
<td>582</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>NTI9</td>
<td>Standards and patent specifications and codes of practice</td>
<td>576</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>1158</td>
<td>44</td>
</tr>
</tbody>
</table>

### Table 5. Cluster 4: Moderately Required Information Sources

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variable Code</th>
<th>Description</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NTI10</td>
<td>Statistical data</td>
<td>580</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>580</td>
<td>21</td>
</tr>
</tbody>
</table>
7.3. Purpose of Information Seeking
Behaviour ANOVA Test for Purposes of Information Seeking vs. Designation

ANOVA test has been conducted for the purposes of information seeking with the designation of the sample and the data set is presented in Table 6.

The Calculated F value is higher than the table value, for the following two variables:

1. To increase promotional opportunities (3.987)
2. To prepare notes for special lectures / public speeches, etc. (3.931)

Hence, it is inferred that there is no significant difference between the variables in the ANOVA test for the rest of the variables, since the F value is lower than the table value.

Table 6. Purposes of Information Seeking vs. Designation

<table>
<thead>
<tr>
<th>S.No</th>
<th>Purposes of Information Seeking</th>
<th>Calculated F Value</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To prepare for class teaching</td>
<td>1.458</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>To guide my students project/research scholars</td>
<td>1.234</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>General awareness for new knowledge</td>
<td>.221</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>For participation in seminars/conferences, etc.</td>
<td>1.172</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>To increase promotional opportunities</td>
<td>3.987</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>To conduct seminars/summer/winter school programmes, etc.</td>
<td>.082</td>
<td>19</td>
</tr>
<tr>
<td>7</td>
<td>To write and publish papers</td>
<td>1.058</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>To prepare notes for special lectures/public speeches, etc.</td>
<td>3.931</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>To set question papers, etc.</td>
<td>1.112</td>
<td>11</td>
</tr>
<tr>
<td>10</td>
<td>For set up and use of equipment</td>
<td>.364</td>
<td>16</td>
</tr>
<tr>
<td>11</td>
<td>To check authenticity of available results/ information</td>
<td>1.113</td>
<td>10</td>
</tr>
<tr>
<td>12</td>
<td>To check and evaluate one’s own results</td>
<td>.891</td>
<td>14</td>
</tr>
<tr>
<td>13</td>
<td>To broaden the area of attention and work done in related areas</td>
<td>.369</td>
<td>15</td>
</tr>
<tr>
<td>14</td>
<td>To crystallize broad and vague assertions</td>
<td>1.932</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>To evolve innovative ideas</td>
<td>1.171</td>
<td>8</td>
</tr>
<tr>
<td>16</td>
<td>To know about gov’t decisions on medical field</td>
<td>.246</td>
<td>17</td>
</tr>
<tr>
<td>17</td>
<td>To have visibility among peers and colleagues</td>
<td>.930</td>
<td>13</td>
</tr>
<tr>
<td>18</td>
<td>Sharing with the members of the team</td>
<td>.075</td>
<td>21</td>
</tr>
<tr>
<td>19</td>
<td>Broad ending area of attention and reviewing work done in the related areas</td>
<td>.080</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>Keeping abreast of latest development in the field</td>
<td>1.170</td>
<td>9</td>
</tr>
<tr>
<td>21</td>
<td>Orienting your work with the existing body of knowledge</td>
<td>2.288</td>
<td>3</td>
</tr>
</tbody>
</table>

Degrees of freedom 2; table value at 0.05 level of significance 2.9957
7.4. Dependence on Formal and Documentary Sources Chi Square Test on the Dependence on Formal and Documentary Sources

The data in Table 7 reveal that for three variables Chi-square value is greater than the table value, which are as follows:
1. Official documents in medical departments (31.2)
2. Trade catalogues (24.8)
3. Reference books (24.4)

It is inferred that there is a significant relationship between the dependence on the above formal and documentary sources, and the designation of the sample. Out of thirteen types of formal and documentary sources, three variables have higher Chi-Square value when analysed in relation to the designation of the respondents.

7.5. Dependence on Informal and Interpersonal Sources ANOVA Test for Dependence on Informal and Interpersonal Sources vs. Designation

The respondent’s dependence on informal and interpersonal sources has also been analysed by ANOVA Test and the results are presented in Table 8.

It is observed from Table 8 that the F value is higher than the table value for only two variables, namely “Result of own experience” and “Consulting expert in the field,” which infers that the difference in sample mean is significant.

7.6. Use of Library Special Services

Opinions on eleven different of special services were obtained and the same is shown in Table 9.

Among the services provided in the library, “Journal Circulation” is showing a positive opinion (322) 53.58%, followed by “Literature Searching” with (307) 51.08% respondents, and third rank goes to “e-Resources” with (279) 46.42% of respondents (Table 9).

The first three ranks are as follows.
Rank 1. The accuracy of information, 347 (57.74%)
Rank 2. The understandability of information, 251 (41.76%)
Rank 3. Its up-to-date-ness of information, 229 (38.10%)

Table 7. Dependence on Formal and Documentary Sources vs. Designation

<table>
<thead>
<tr>
<th>S.No</th>
<th>Formal and Documentary Sources</th>
<th>Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Books</td>
<td>4.7</td>
</tr>
<tr>
<td>2</td>
<td>Reference books</td>
<td>24.4</td>
</tr>
<tr>
<td>3</td>
<td>Conference proceedings</td>
<td>6.9</td>
</tr>
<tr>
<td>4</td>
<td>Thesis and dissertations</td>
<td>4.3</td>
</tr>
<tr>
<td>5</td>
<td>Current reading materials</td>
<td>11.4</td>
</tr>
<tr>
<td>6</td>
<td>Technical/ R&amp;D reports</td>
<td>7.6</td>
</tr>
<tr>
<td>7</td>
<td>Standards and patent specifications</td>
<td>22.6</td>
</tr>
<tr>
<td>8</td>
<td>Official documents in medical departments</td>
<td>31.2</td>
</tr>
<tr>
<td>9</td>
<td>Reprints and preprints from fellow professionals</td>
<td>12.5</td>
</tr>
<tr>
<td>10</td>
<td>Abstracting the indexing sources</td>
<td>7.1</td>
</tr>
<tr>
<td>11</td>
<td>Trade catalogues</td>
<td>24.8</td>
</tr>
<tr>
<td>12</td>
<td>Personal collections</td>
<td>14.4</td>
</tr>
<tr>
<td>13</td>
<td>Audio/video recordings</td>
<td>8.2</td>
</tr>
</tbody>
</table>

Degrees of freedom 2; table value at 0.05 level of significance 2.9957
Table 8. ANOVA Test for Dependence on Informal and Interpersonal Sources vs. Institution

<table>
<thead>
<tr>
<th>S.No</th>
<th>Informal and Interpersonal sources</th>
<th>F Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Personal experiences</td>
<td>2.579</td>
</tr>
<tr>
<td>2</td>
<td>Consulting experts in the field</td>
<td>4.030</td>
</tr>
<tr>
<td>3</td>
<td>Consulting colleagues and fellow professionals</td>
<td>1.187</td>
</tr>
<tr>
<td>4</td>
<td>Results of one’s own experience</td>
<td>5.308</td>
</tr>
<tr>
<td>5</td>
<td>Consulting library staff/catalogues/OPACs</td>
<td>2.945</td>
</tr>
<tr>
<td>6</td>
<td>Professional meetings, seminars, symposia, and lectures</td>
<td>.784</td>
</tr>
<tr>
<td>7</td>
<td>Educational and training courses</td>
<td>1.264</td>
</tr>
<tr>
<td>8</td>
<td>Fellow professionals outside</td>
<td>1.070</td>
</tr>
<tr>
<td>9</td>
<td>Visit to pharmacy industries</td>
<td>.871</td>
</tr>
</tbody>
</table>

Degrees of freedom 2; table value at 0.05 level of significance 2.9957

Table 9. Special Services Provided in the Library vs. Designation

<table>
<thead>
<tr>
<th>S.No</th>
<th>Services</th>
<th>Designation Asst Professor n=448</th>
<th>Designation Associate Professor n=48</th>
<th>Designation Professor n=105</th>
<th>Total n = 601</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Translation</td>
<td>36 (5.99)</td>
<td>2 (0.33)</td>
<td>8 (1.33)</td>
<td>46 (7.65)</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>Journal circulation</td>
<td>235 (39.10)</td>
<td>28 (4.66)</td>
<td>59 (9.82)</td>
<td>322 (53.58)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Literature searching</td>
<td>223 (37.11)</td>
<td>27 (4.49)</td>
<td>57 (9.48)</td>
<td>307 (51.08)</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Compilation of bibliographies</td>
<td>73 (12.15)</td>
<td>6 (1)</td>
<td>22 (3.66)</td>
<td>101 (16.81)</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>Indexing and abstracting services</td>
<td>127 (21.13)</td>
<td>10 (1.66)</td>
<td>41 (6.82)</td>
<td>178 (29.61)</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Library bulletin</td>
<td>94 (15.64)</td>
<td>19 (3.16)</td>
<td>25 (4.16)</td>
<td>138 (22.96)</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>Photocopying</td>
<td>165 (27.45)</td>
<td>18 (3)</td>
<td>46 (7.65)</td>
<td>229 (38.10)</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Selective dissemination of information</td>
<td>45 (7.49)</td>
<td>1 (0.16)</td>
<td>9 (1.5)</td>
<td>55 (9.15)</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>NIC-NET services</td>
<td>91 (15.14)</td>
<td>6 (1)</td>
<td>22 (3.66)</td>
<td>119 (19.80)</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>CD-ROM services</td>
<td>131 (21.79)</td>
<td>14 (2.33)</td>
<td>48 (7.99)</td>
<td>193 (32.11)</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>e-Resources</td>
<td>203 (33.77)</td>
<td>20 (3.33)</td>
<td>56 (9.32)</td>
<td>279 (46.42)</td>
<td>3</td>
</tr>
</tbody>
</table>
7.7. Time Spent in the Institution's Library

In this study the respondents were asked to furnish the time spent in their respective institution's library, and the data are presented in Table 11.

It is observed from Table 11 that 27.62% of the sample spent between 16 and 20 hours in a week in the library, followed by 21.95% with between 11 and 15 hours. A meager percentage (6.16%) spent less than 4 hours per week. Therefore it is inferred that the larger the number of respondents, the greater the number of hours spent in the library.

7.8. Delegation of Work for Information Seeking

Nearly 1/3 of respondents are in the habit of collecting information by searching individually and 41.60% delegate occasionally. It is interesting to note that the highest number of respondents delegate occasionally (41.60%) and a meager percentage (12.81%) delegate frequently. The reason may be attributed to the phenomena that the institution's environment and professors are busy with teaching and research (Table 12).

### Table 10. Factors in the Context of Information Services vs. Designation

<table>
<thead>
<tr>
<th>S.No</th>
<th>Information services</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The cost in money</td>
<td>101 (16.81)</td>
<td>93 (15.47)</td>
<td>244 (40.60)</td>
<td>62 (10.32)</td>
<td>101 (16.80)</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>The time it took</td>
<td>37 (6.16)</td>
<td>84 (13.98)</td>
<td>152 (25.29)</td>
<td>195 (32.45)</td>
<td>133 (22.12)</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Its up to-date-ness</td>
<td>26 (4.33)</td>
<td>53 (8.82)</td>
<td>146 (24.29)</td>
<td>147 (24.46)</td>
<td>229 (38.10)</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>The accuracy of information</td>
<td>1 (0.16)</td>
<td>42 (6.99)</td>
<td>85 (14.14)</td>
<td>126 (20.97)</td>
<td>347 (57.74)</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>The understandability of</td>
<td>7 (1.16)</td>
<td>31 (5.16)</td>
<td>153 (25.46)</td>
<td>159 (26.46)</td>
<td>251 (41.76)</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>The accessibility of the</td>
<td>97 (16.14)</td>
<td>44 (7.32)</td>
<td>115 (19.14)</td>
<td>163 (27.12)</td>
<td>182 (30.28)</td>
<td>5</td>
</tr>
</tbody>
</table>

1 – Not important  2 – Least important  3 – Important  4 – Very Important  5 – Most Important

### Table 11. Classification of Faculty by Time Spent in the Institution's Library per Week

<table>
<thead>
<tr>
<th>S.No</th>
<th>Time spent in the library Per week</th>
<th>Asst. Professor n=448</th>
<th>Associate Professor n=48</th>
<th>Professor n=105</th>
<th>Total n = 601</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>More than 20 hrs</td>
<td>65 (10.81)</td>
<td>6 (1)</td>
<td>8 (1.33)</td>
<td>79 (13.14)</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Between 16 and 20 hrs</td>
<td>117 (19.47)</td>
<td>17 (2.83)</td>
<td>32 (5.32)</td>
<td>166 (27.62)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Between 11 and 15 hrs</td>
<td>87 (14.47)</td>
<td>16 (2.66)</td>
<td>29 (4.82)</td>
<td>132 (21.95)</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Between 7 and 10 hrs</td>
<td>84 (13.97)</td>
<td>4 (0.66)</td>
<td>15 (2.49)</td>
<td>103 (17.12)</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Between 4 and 6 hrs</td>
<td>66 (10.98)</td>
<td>4 (0.66)</td>
<td>14 (2.33)</td>
<td>84 (13.97)</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Less than 4 hrs per week</td>
<td>29 (4.83)</td>
<td>1 (0.17)</td>
<td>7 (1.16)</td>
<td>37 (6.16)</td>
<td>6</td>
</tr>
</tbody>
</table>
7.9. Motivational Factors for Information Seeking Behaviour
The first 5 ranks are as follows:
1. To pursue research related to work in the field, 51.75%
2. For self-improvement, 46.92%
3. To achieve desired result in work, 45.59%
4. To acquire and update knowledge in the field, 41.76%
5. For pleasure of doing work, self-fulfillment, and self-satisfaction, 41.26%
It is observed from Table 14 that 1/3 of respondents

<table>
<thead>
<tr>
<th>S.No</th>
<th>Delegation of work</th>
<th>Asst. Professor n=448</th>
<th>Associate Professor n=448</th>
<th>Professor n=448</th>
<th>Total n = 601</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Delegation</td>
<td>94 (15.64)</td>
<td>14 (2.33)</td>
<td>24 (3.99)</td>
<td>132 (21.96)</td>
</tr>
<tr>
<td>2</td>
<td>Delegate Occasionally</td>
<td>186 (30.95)</td>
<td>21 (3.49)</td>
<td>43 (7.15)</td>
<td>250 (41.60)</td>
</tr>
<tr>
<td>3</td>
<td>Delegate Moderately</td>
<td>109 (18.14)</td>
<td>9 (1.5)</td>
<td>24 (3.99)</td>
<td>142 (23.63)</td>
</tr>
<tr>
<td>4</td>
<td>Delegate Frequently</td>
<td>59 (9.82)</td>
<td>4 (0.66)</td>
<td>14 (2.33)</td>
<td>77 (12.81)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S.No</th>
<th>Motivational factors</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To pursue research related to work in the field</td>
<td>24</td>
<td>37</td>
<td>127</td>
<td>311</td>
<td>102</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>To have visibility among peers and colleagues</td>
<td>30</td>
<td>84</td>
<td>180</td>
<td>92</td>
<td>215</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>To have an edge over other competitors</td>
<td>50</td>
<td>81</td>
<td>198</td>
<td>110</td>
<td>162</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>For recognition</td>
<td>34</td>
<td>69</td>
<td>179</td>
<td>158</td>
<td>161</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>To prepare for project review</td>
<td>19</td>
<td>41</td>
<td>144</td>
<td>208</td>
<td>189</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>For self-improvement</td>
<td>13</td>
<td>46</td>
<td>125</td>
<td>282</td>
<td>135</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>To acquire and update knowledge in the field</td>
<td>9</td>
<td>41</td>
<td>164</td>
<td>251</td>
<td>136</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>To maintain professional competence</td>
<td>13</td>
<td>29</td>
<td>141</td>
<td>239</td>
<td>179</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>To achieve desired result in work</td>
<td>22</td>
<td>24</td>
<td>133</td>
<td>274</td>
<td>148</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>To write and publish</td>
<td>10</td>
<td>49</td>
<td>167</td>
<td>209</td>
<td>166</td>
<td>9</td>
</tr>
<tr>
<td>11</td>
<td>To pursue continuing education</td>
<td>20</td>
<td>45</td>
<td>168</td>
<td>216</td>
<td>152</td>
<td>7</td>
</tr>
<tr>
<td>12</td>
<td>For pleasure of doing work, self-fulfillment, and self-satisfaction</td>
<td>36</td>
<td>41</td>
<td>165</td>
<td>248</td>
<td>111</td>
<td>5</td>
</tr>
</tbody>
</table>

n = 601
1 - Non motivator        2 - Weakest motivator        3 - Average motivator        4 - Fairly motivator        5 - Strongest motivator
Table 14. Environment that Affects Information Seeking Behaviour vs. Designation

<table>
<thead>
<tr>
<th>S.No</th>
<th>Environment affects of information needs</th>
<th>Designation</th>
<th>Total n = 601</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Asst. Professor n=448</td>
<td>Associate Professor n=48</td>
<td>Professor n=105</td>
</tr>
<tr>
<td>1</td>
<td>Information overload</td>
<td>64 (10.64)</td>
<td>5 (0.83)</td>
<td>27 (4.5)</td>
</tr>
<tr>
<td>2</td>
<td>Medical council of India norms on medical education</td>
<td>30 (4.99)</td>
<td>4 (0.67)</td>
<td>10 (1.66)</td>
</tr>
<tr>
<td>3</td>
<td>Challenging diseases and new drugs</td>
<td>153 (25.46)</td>
<td>15 (2.49)</td>
<td>36 (5.99)</td>
</tr>
<tr>
<td>4</td>
<td>Changing pattern of education</td>
<td>125 (27.9)</td>
<td>9 (1.5)</td>
<td>29 (4.83)</td>
</tr>
<tr>
<td>5</td>
<td>New syllabus pattern of university</td>
<td>111 (18.46)</td>
<td>9 (1.5)</td>
<td>21 (3.49)</td>
</tr>
</tbody>
</table>

(33.94%) are of the opinion that challenging diseases and new drugs, followed by “Changing pattern of education” (27.12%), and “New syllabus pattern of university” (23.46%) and “Information overload” (15.97%), and a meager percentage of opinions having “Medical council of India norms on medical education” (7.32%), are the factors that affect information seeking behaviour.

7.10. Dependence on Institution’s Library Sources for Research Wilcoxon Signed – Rank Test for the Dependence on Institution’s Library Sources for Teaching and Research

The dependence on information sources available in the institution’s library for teaching and research has been analysed through Wilcoxon Rank Test for each variable, and the results are shown in Table 15.

The frequency distribution, mean rank, and the two-tailed probability values of the respondent’s dependence on the institution’s library for teaching and research are presented in Table 15. The following inferences could be drawn:

i. The respondents differ on their dependence on the institution’s library sources for teaching and research.

ii. The two-tailed values for the all variables indicates that the dependence by the respondents on these variables for teaching do differ from research, since their values are lesser than the table value of 0.05.

iii. This may be due to the fact that these sources are not much sought for in the pharmacy subjects.

8. IMPLICATIONS FOR ENHANCING THE QUALITY OF PHARMACY LIBRARIES IN TAMIL NADU (INDIA)

According to the overall findings of the study, it was obvious that there is a need for a big shift in building and improving the system for providing pharmacy information in pharmacy colleges in Tamil Nadu. Although change is likely to take time, it is clearly vital that a much-needed pharmacy information management service is supported by high-quality resources and advanced technologies. To ensure this, some recommended strategies and practical solutions are proposed for improving the quality in pharmacy libraries in Tamil Nadu.


The majority of respondents prefer the Internet as their first source to look for needed information as they feel that it has a significant impact on their study / research / teaching. The majority of faculty members prefer pharmacy educational institutions’ libraries as the most convenient place for accessing the Internet. Networking the pharmacy college libraries would positively help users in satisfying their information needs.
### Table 15. Dependence on the Institution’s Library Sources for Teaching and Research

<table>
<thead>
<tr>
<th>S.No</th>
<th>Sources</th>
<th>Role</th>
<th>No Dependence</th>
<th>Rare Dependence</th>
<th>Occasional Dependence</th>
<th>Frequent Dependence</th>
<th>High Dependence</th>
<th>Mean Rank</th>
<th>Tow-tailed Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Books</td>
<td>Teaching</td>
<td>2.3</td>
<td>1.66</td>
<td>7.15</td>
<td>30.2</td>
<td>58.56</td>
<td>123.56</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research</td>
<td>3.16</td>
<td>3.32</td>
<td>15.80</td>
<td>29.11</td>
<td>48.58</td>
<td>113.49</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td>2</td>
<td>Article in Journal</td>
<td>Teaching</td>
<td>3.16</td>
<td>7.82</td>
<td>23.62</td>
<td>33.61</td>
<td>31.78</td>
<td>157.83</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research</td>
<td>0.83</td>
<td>2.83</td>
<td>5.32</td>
<td>18.64</td>
<td>72.38</td>
<td>148.77</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td>3</td>
<td>Newspapers</td>
<td>Teaching</td>
<td>5.99</td>
<td>24.29</td>
<td>29.95</td>
<td>21.13</td>
<td>18.64</td>
<td>125.86</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research</td>
<td>7.99</td>
<td>15.97</td>
<td>27.12</td>
<td>26.46</td>
<td>22.46</td>
<td>112.03</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td>4</td>
<td>Govt. Documents</td>
<td>Teaching</td>
<td>16.97</td>
<td>20.30</td>
<td>27.79</td>
<td>19.63</td>
<td>15.31</td>
<td>85.70</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research</td>
<td>14.64</td>
<td>19.30</td>
<td>21.46</td>
<td>24.63</td>
<td>19.97</td>
<td>87.48</td>
<td>0.000&lt;0.05</td>
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<tr>
<td>5</td>
<td>Dissertations</td>
<td>Teaching</td>
<td>10.15</td>
<td>17.14</td>
<td>27.62</td>
<td>24.79</td>
<td>20.30</td>
<td>105.61</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research</td>
<td>15.82</td>
<td>10.82</td>
<td>23.96</td>
<td>29.78</td>
<td>29.61</td>
<td>106.68</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td>6</td>
<td>Field/Survey Reports</td>
<td>Teaching</td>
<td>13.81</td>
<td>19.80</td>
<td>29.62</td>
<td>19.47</td>
<td>17.30</td>
<td>99.85</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research</td>
<td>7.15</td>
<td>15.81</td>
<td>26.62</td>
<td>22.13</td>
<td>28.29</td>
<td>107.77</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td>7</td>
<td>Indexing &amp; Abstracting Services</td>
<td>Teaching</td>
<td>10.48</td>
<td>13.48</td>
<td>26.12</td>
<td>22.63</td>
<td>27.29</td>
<td>90.94</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research</td>
<td>3.83</td>
<td>8.49</td>
<td>22.13</td>
<td>26.12</td>
<td>39.43</td>
<td>127.28</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td>8</td>
<td>Audio/Visual</td>
<td>Teaching</td>
<td>15.99</td>
<td>17.14</td>
<td>26.29</td>
<td>25.46</td>
<td>25.12</td>
<td>120.44</td>
<td>0.000&lt;0.05</td>
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<tr>
<td></td>
<td></td>
<td>Research</td>
<td>5.16</td>
<td>14.64</td>
<td>26.46</td>
<td>24.46</td>
<td>29.28</td>
<td>99.99</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td>9</td>
<td>Book Reviews</td>
<td>Teaching</td>
<td>7.15</td>
<td>11.81</td>
<td>21.13</td>
<td>32.12</td>
<td>27.79</td>
<td>77.86</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research</td>
<td>2.83</td>
<td>6.99</td>
<td>17.47</td>
<td>31.28</td>
<td>41.43</td>
<td>108.54</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td>10</td>
<td>Patents and Standards</td>
<td>Teaching</td>
<td>11.48</td>
<td>19.97</td>
<td>26.79</td>
<td>20.80</td>
<td>20.96</td>
<td>97.79</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research</td>
<td>6.49</td>
<td>12.81</td>
<td>20.30</td>
<td>26.96</td>
<td>33.44</td>
<td>123.11</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td>11</td>
<td>Internet Services</td>
<td>Teaching</td>
<td>4.16</td>
<td>6.16</td>
<td>14.81</td>
<td>29.45</td>
<td>45.42</td>
<td>88.28</td>
<td>0.000&lt;0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research</td>
<td>3</td>
<td>4.49</td>
<td>9.98</td>
<td>18.80</td>
<td>63.73</td>
<td>94.58</td>
<td>0.000&lt;0.05</td>
</tr>
</tbody>
</table>

Through other libraries. Providing Internet facilities in the library by charging nominal fees would help in generating revenue for the library.

This is a challenge as well as an opportunity to serve library users effectively. Hence it is suggested that the libraries must make all efforts to upgrade the Information Communication and Technology (ICT) infrastructure for providing seamless broadband/leased line Internet access to users. By establishing cyber libraries or computer centres within the library, the libraries can attract user communities.

### 8.2. Information Literacy Program

The respondents often face difficulties such as too much information in too many different formats scattered on the Internet. They often resolve these...
information access problems by preferring an individual, independent work, or consulting peers. Users have also indicated that they learn about information skills for information seeking in this changing ICT environment by trial and error and through colleagues and friends. In view of this prevailing situation, it is suggested that the libraries must plan and implement new information literacy programmes which impart required skills/techniques to the users in accessing electronic information resources more effectively.

8.3. Library Staff Assistance

It is recommended that the library staff or the librarians could use their time in a better way by focusing on assisting the users. The librarians should help the users to improve their skills in information seeking activities and to find the different types of information they need. The librarians should also assist the users in learning the use of OPAC, search engine, and CD-ROM products, and web sources available through the various networks.

It is suggested that advanced training for users at different levels should be planned and implemented on a priority basis. The content of training programs should be (a) Basic introduction to library resources, services and facilities; (b) Using OPAC; (c) Methods and tools for searching information resources, (d) Using the Internet; Using online and CD-ROM databases; (f) Using electronic journals; (g) Increasing the use of reference books; and (h) Introducing audio-video materials.

8.4. In-Service Training Program for Librarians

Information technology is changing rapidly. New innovations are taking place regularly. Therefore, it is suggested that librarians should continue to monitor the latest developments in technology and the adoption of technology should be based on evidence that supports the information seeker’s perspective.

It is strongly recommended that the pharmacy educational institutions in Tamil Nadu should encourage the librarians to attend regularly the training programmes organized by INFLIBNET/DELENET and other refresher courses/orientation courses, workshops, conferences, and seminars at the local and national level. There is a need to motivate medical librarians to play an important role in assessing doctors’ information needs and to help them in seeking out the required information. They should be trained to participate in journal clubs and other meetings to help doctors in assessing their information needs. This can be achieved through training and assigning qualified staff in the hospital libraries and other medical libraries.

8.5. Use of Library Services

The information needs of pharmacy faculties are varied and manifold. In the light of the distinct characteristics of pharmacy faculties, the information system and services should be tailored to correlate with the characteristics of users. The study noticed that only a few services such as lending of books and periodicals and reference services are highly ranked services used and other types of services are given lower ranking. Realizing the significance of a variety of documentation services and ICT based services that influence information seeking behaviour, it is recommended that the libraries of pharmacy educational institutions should take necessary efforts to provide those services. Hence, in order to enhance awareness of the provision of such services, it is recommended that the librarians shall conduct user education programmes to propagate the availability of library services and facilities. Further, it is also feasible to periodically conduct user studies to identify the extent of non-utilization of these services. Availability, affordability, accessibility, acceptability, and sustainability of the services shall be considered while introducing ICT based services in the libraries of pharmacy educational institutions.

8.6. Faculty Motivation to Seek Information

Since it is found that the institutional affiliation and designation of the respondents have direct influence on the motivating factors for information seeking behaviour, it is urged that the managements of the pharmacy educational institutions shall create conducive environments that promote a more refined information search process. Managements should provide necessary incentives for the research output produced by the Faculty of Pharmacy.

8.7. Collection Building

In view of the requirements expressed by faculty
on various sources of information for teaching and research, it is suggested that the libraries shall acquire a variety of sources in pharmacy and allied disciplines. In case of difficulty in procuring the necessary resources due to financial constraints, it is suggested that they can enter into resource sharing arrangements with other libraries either at a local, regional, or national level. Further, in view of the changing scenario in information and communication technologies, it is suggested that the libraries attached to pharmacy institutions shall strive toward a right choice between printed and electronic media resources. There must be a good acquisition policy for libraries formulated by librarians and managements of pharmacy educational institutions. For effective utilization of information sources, the acquisition policy should be objective and need-based.

8.8. Resource Sharing and Networking

It is a mandatory on the part of pharmacy colleges in Tamil Nadu in particular, and India in general, to participate in the ERMED (Electronic Resource in Medicine) programmes as suggested by the Medical Council of India norms. In view of the increased pressure on pharmacy institutions to share resources by becoming members of the Consortium, it is suggested that all the pharmacy institutions shall become members of the Consortium, and shall also form a Consortium of Pharmacy Libraries, to harvest the progressive benefits of resource sharing and networks. It is also suggested that the following types of co-operative programmes among the pharmacy educational institutions may be initiated:

i. To promote exchange of persons with different specializations in pharmacy subjects;
ii. To identify national and international transfer centres for the exchange of information in the field of pharmacy; and
iii. To promote exchange of publications such as technical reports, field survey reports, and other research output.

8.9. Towards the Planning and Implementation of ISO 9000 Standards

Realizing the possible benefits that accrue through standardization of services and the growing tendency of the various pharmacy educational institutions opting for ISO 9000 standards, it is suggested that the pharmacy institutions, including libraries, need:

- To facilitate the development of the standardization and Total Quality Management (TQM) of Library services;
- To facilitate the international exchange of products and services and develop intellectual, scientific, technological, and economic co-operations; and
- To join the stream of ISO 9000 standards series accredited institutions.

8.10. Designing a Methodology for the Identification of Information Needs of Pharmacy Faculty

The library and information centres of the respective pharmacy educational institutions shall formulate and implement methodology for such identification of information needs as:

- Continuous refinement and updating of their information needs;
- Study of faculty and their specific environment;
- Study of the academic/research activities in the institution; and
- Conducting of formal/informal interviews with the faculty

9. CONCLUDING REMARKS

When compared to findings of earlier studies to that of the present study, it is evident that there is a clear change in the present scenario of information-seeking behaviours of academics/scientists in the field of medicine and health sciences. A shift from library oriented information searching to Internet-based information searching is obvious. Information communication technology (ICT) has a positive impact on all the library and information services such as Reference Services, Current Awareness Services, Online Public Access Catalogues, and so on. Library users engage in a range of complementary modes of information seeking and use the electronic resources and web as an information resource to support their daily academic activities. The
information seeking behavior of users is another aspect which is influenced by developments in ICT and its application in the libraries.

The information needs of pharmacy faculty are varied and manifold. In the light of the distinct characteristics of pharmacy faculties, the information system and services should be tailored to correlate with the characteristics of users. The study noticed that only a few services such as lending of books and periodicals and reference services are highly ranked services used, and other types of services are given lower ranking. It is recommended that the libraries of pharmacy educational institutions should take necessary efforts to provide those services. It is strongly recommended that the pharmacy educational institutions in Tamil Nadu should encourage librarians to regularly attend the training programmes organized by INFLIBNET/DELENET and other refresher courses/orientation courses, workshops, conferences, and seminars at the local and national level. Pharmacy educational institutions shall create conducive environments that promote more refined information search processes. Managements should provide necessary incentives for the research output produced by the Faculty of Pharmacy. A continuous assessment of information needs and seeking behaviour of faculties and students is an essential thing to be carried out by these libraries on a regular basis. It can be expected that considering the dynamic nature of ICT and the changes in seeking behaviour, such studies would definitely bring out new findings on information needs and seeking, and will also certainly help librarians working in the pharmacy educational institutions to bring about necessary changes on a priority basis.

Introducing measures to increase the awareness of Open-Source information resources among academics is highly recommended. It is important that library professionals / information managers especially in health / medical libraries should embark on re-designing their services with innovative approaches to match with the needs of health professionals of the time. The information seeking behaviour of pharmacy faculty is significant. The pharmacy faculty had neither effective and well developed information centers such as libraries, nor Internet facilities. Conducting training on managing health information and accessing computer and improving infrastructures are important interventions to facilitate effective information seeking. Universal access to information for health professionals is needed to achieve a “health for all strategy.” Hence the pharmacy educational institutions on one hand, and the librarians on the other hand, shall strive together more professionally with a blend of service-mindedness to the community, by effectively utilizing Information Technology.

REFERENCES


## Appendix

List of Pharmacy Educational Institutions in Tamil Nadu vs. Sample Size

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the College/University</th>
<th>Year of Estd.</th>
<th>No. of Q Distributed</th>
<th>No. of Q Responded</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>College of Pharmacy, Madras Medical College, Chennai</td>
<td>1988</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
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<td>College of Pharmacy, Madurai Medical College, Madurai</td>
<td>1988</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>C.L. Baid Metha College of Pharmacy, Chennai</td>
<td>1984</td>
<td>22</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>J.K.K Natarajah College of Pharmacy, Namakkal</td>
<td>1985</td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>5</td>
<td>K.M. College of Pharmacy, Madurai</td>
<td>1985</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
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<td>1986</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>J.K.K. Natarajah College of Pharmacy, Namakkal</td>
<td>1987</td>
<td>21</td>
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</tr>
<tr>
<td>8</td>
<td>K.K. College of Pharmacy, Chennai</td>
<td>1992</td>
<td>16</td>
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</tr>
<tr>
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<td>Vels College of Pharmacy, Chennai</td>
<td>1992</td>
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<td>Swamy Vivekanandha College of Pharmacy, Namakkal</td>
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<tr>
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<td>J.K.K. Munirajah College of Pharmacy, Namakkal</td>
<td>1992</td>
<td>18</td>
<td>14</td>
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<tr>
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<td>15</td>
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</tr>
<tr>
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<td>Nandha College of Pharmacy, Erode</td>
<td>1992</td>
<td>28</td>
<td>24</td>
</tr>
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<td>14</td>
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<td>1992</td>
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<td>Year of Estd.</td>
<td>No. of Q Distributed</td>
<td>No. of Q Responded</td>
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Determinants of Adoption and Use of Open Access Publishing by Academic Staff in Nigeria Universities

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ABSTRACT
The emergence of the World Wide Web (WWW) has changed the scholarly publishing system. Today, Open Access (OA) scholarly publishing offers free access and wide dissemination for research findings anytime and anywhere as an additional value for scholarly content. Despite the potentials of OA publishing, its adoption and use is still low. This paper determines factors influencing the adoption and use of OA publishing by academic staff in universities in Nigeria using an adapted Unified Theory of Acceptance and Use Technology (UTAUT). The study applies methodological triangulation by combining quantitative and qualitative approaches. The empirical data were collected from 317 academic staff in universities in southwest Nigeria. The questionnaire forms were analyzed using the Statistical Package for Social Sciences (IBM-SPSS) 19.0 version to generate descriptive statistics, Analysis of Variance, and Hierarchical Multiple Regression. Thematic analysis also applies to the interviews. The results show that awareness, attitude, performance expectancy, Internet self-efficacy, and facilitating conditions significantly influenced the adoption and use of OA publishing. The study also reveals that due to lack of OA policy, most of the respondents did not know about OA. The findings further establish that all predictors and moderating variables jointly contributed 64.4% total variance towards the adoption and use of OA publishing. One of the implications of this study is that there is a need for adequate facilities to support adoption and use of OA publishing. The findings inform the proposed framework for improving and evaluating the adoption and use of OA publishing. The findings also have theoretical, societal, and methodological significance to all stakeholders.

Keywords: Adoption and Use, Open Access Publishing, World Wide Web, University, UTAUT, Nigeria
1. INTRODUCTION

The world has become a global village as a result of Internet development. This has caused transformation in many phases especially in scientific journal publishing. For instance, the first stage experienced the rapid shift from print-only journals to parallel print and electronic publishing (Tenopir & King, 2000). The next stage of transformation is the granting of access to publications without any barriers imposed by toll access (subscriptions). This is referred to as open access (OA) (Willinsky, 2005). Scholarly communication benefits massively in making scholarly content freely accessible and equally has enjoyed wide dissemination of research findings without any restriction via the Internet. According to Budapest Open Access Initiatives (BOAI), ‘Open Access’ means free availability on public Internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself. (BOAI, 2002, p. 1)

Hence, open access publishing can be defined as a publication that is digital, online, and free of charge, free of copyright and without any barrier at the point of consumption by the user. There are enormous benefits of OA publishing to academics and other stakeholders. For example, it promotes collaborative work among scholars; bridges the digital gap between developed and developing countries; promotes accessibility and visibility of research findings; improves the economy by making research outputs available to users; and enriches both academics’ and universities’ profiles through provision of access without any barriers (Jain, 2012; Bashorun et al., 2013).

Despite these huge benefits, the adoption and use of OA publishing by academic staff in Nigeria still remains low (Gbaje, 2010; Oluwasemilore, 2013). Most scholarly findings are published in local journals that remain less accessible and are poorly visible to users. This has implications on the research findings emanating from researchers and scholars in Africa and Nigeria in particular. Many academics are indisposed to embrace OA publishing because of insufficient aware-
Determinants of Adoption and Use

2. Determine the level of university management support towards the adoption and use of OA publishing by academic staff
3. Establish relationships among factors that influence the adoption and use of OA publishing
4. Determine the joint contribution of factors influencing the adoption and use of OA publishing
5. Suggest a suitable framework that can facilitate the adoption and use of OA publishing by academic staff in universities in Nigeria.

3. HYPOTHESIS OF THE STUDY

The following null hypothesis was tested in the study at a 0.05 level of significance.

\( H_0 \): There is no significant relationship between independent variables (awareness, attitude, performance expectancy, effort expectancy, Internet self-efficacy, and facilitating conditions) and adoption and use of OA publishing.

4. LITERATURE REVIEW

Over the past years, adoption and use of open access (OA) publishing has been a central concern in developed countries with few studies focusing on developing countries. Most studies have been designed at studying the number of factors related to adoption and use of OA publishing and their vital role to scholarly publishing. Therefore, the need to review literature in order to identify the gap and guard against duplication of effort in research is essential. This review also gives the researcher an opportunity to relate the current findings to previous studies.

The OA concept is gaining ground but is yet to be widely known among academics and researchers from various scholarly communities and research disciplines. The adoption and use of OA publishing relies on the researcher being well informed of this mode of scholarly publishing. However, users of information gain from OA initiatives without prior knowledge of this mode of scholarly publishing (Fullard, 2007). This is possible when users by accident gain access to both free and subscribed content while searching for information on the Internet (Dulle, 2010). It is essential that prior knowledge of this mode of scholarly publishing is known to users. This situation propels the need by many researchers to address the issue of awareness before determining the adoption and use of OA publishing. Awareness plays a vital role and is one of the pre-requisite conditions for successive adoption and use of OA publishing unless an individual uses it unknowingly. According to Dinev et al. (2005, p. 41), “awareness raises consciousness and knowledge about a certain technology and its personal and social benefits.” This suggests that awareness is a key determinant of user attitude and behaviour towards technology. Similarly, for successful adoption and use of OA publishing in scholarly community, awareness has also been recognized as one of the crucial factors that determine the adoption and use of this mode of scholarly communication (Warlick et al., 2006). Several approaches have been used in analyzing academics’ adoption and use of OA publishing. In this section some of the earlier and relevant studies in OA publishing are briefly discussed.

Utulu and Bolarinwa (2009) investigated the adoption of OA initiatives by academics from Universities of Ibadan and Lagos. It was reported that lack of understanding of the OA concept and the inability to identify appropriate OA journals were observed as part of the contributory factors for its low adoption and use. Emojorho et al. (2012) examined the level of awareness of OA scholarly publication among lecturers at the University of Benin in Nigeria. The findings showed that only 86% of the respondents were aware of OA while only 58% of the respondents were familiar with OA institutional repositories, while 73% lack knowledge of OA journals. Similarly, Obuh and Bozimo (2012) examined awareness and use of OA scholarly publications by 141 lecturers in fourteen universities in southern Nigeria. The researchers reported that there were indications of a fairly high degree of awareness of OA publication among lecturers in universities in the southern part of Nigeria, yet the level of adoption and use of OA publishing is low. The main principle of OA is to maximise access to information in order to promote wide dissemination of knowledge to users. A study carried out by Alemu (2009) examined the role of OA in fostering knowledge sharing and collaboration in Ethiopia. The findings revealed
that respondents in the study had very low awareness of the OA concept and this mode of scholarly publishing was yet to be practiced in the institutions under study. In addition, Dulle (2010) focused on assessment of the adoption of OA in terms of access and dissemination of scholarly information in research activities. The findings showed that 72.1% of researchers compared to 90.5% of policy makers in Tanzania’s public universities were aware of OA.

Attitude is an individual’s overall affective reaction to using a system (Venkatesh et al., 2003). Several studies (Chau & Hu, 2002; Louho et al., 2006) have established that individuals’ attitude towards technology had a strong effect on adoption and use intention. Chau and Hu (2002) in a study of physicians’ behavioural intent in using computers pointed out that the attitudes towards computers are important for technology acceptance decisions. In the same vein, Obuh (2013) examined researchers’ attitudes towards use of OA publications in order to determine the position of Library and Information Science (LIS) lecturers in southern Nigeria. It was acknowledged that both junior and senior lecturers exhibited high positive attitude towards adoption and usage of OA publications. However, this has not translated into actual use of OA publishing. For the successful adoption and acceptance of OA publishing the Internet is required, which serves as a platform for OA publishing. The Internet is an instrument used for searching, retrieving, and disseminating information across the globe (Adeogun, 2003). Internet self-efficacy is essential for adoption and use of OA publishing. According to Bandura (1986) the concept of self-efficacy involves peoples’ judgment of their capabilities to organise and execute courses of action required to attain designated types of performances. Internet self-efficacy refers to “what individuals believe they can do with the Internet skills they possess” (Hsu et al., 2004, p. 768). In support of this claim, Gbaje (2010) stated that unless researchers demonstrate specific skills for using the Internet in accessing and disseminating research findings, they may not benefit from OA publishing. Dulle and Minishi-Majanja (2011) stressed that Internet self-efficacy influences individual decisions towards OA adoption and usage behaviours. It can be apparently concluded that academic staff in universities need to develop Internet skills for them to embrace and use OA publishing. Members of university management are expected to give adequate support to academics by providing facilitating conditions that will motivate them to adoption and use of OA publishing in their scholarly works.

There are different models that have been proposed to address the issue of adoption and use of technology or technologically based systems like OA publishing. The technology acceptance models include: Theory of Reasoned Action (TRA); Theory of Planned Behaviour (TPB); Decomposed Theory of Planned Behaviour (DTPB); Motivational Model (MM); Technology Acceptance Model (TAM); Technology Acceptance Model (TAM2); Combined TAM and TPB (C-TAM-TPB); Social Cognitive Theory (SCT); Model of PC Utilization (MPCU); Innovation Diffusion Theory (IDT); and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al, 2003; Wu et al., 2007; Jayasingh & Eze, 2010). These models appear to be widely embraced among information system researchers. OA publishing is a technology driven system and the UTAUT model is the most suitable for analysis of the present study because it has the highest predictive power (69%). The UTAUT model posits that a user's adoption of a new system is determined by that user's behavioural intention to use the system, which in turn determines the actual behavioural use of the system. The model is one of the more recent theories established by Venkatesh et al. (2003). It has four core determinants of intention and actual usage behaviour. The four core determinants are: performance expectancy, effort expectancy, social influence, and facilitating conditions. In this study, social influence was not considered important at this developmental stage because the OA initiative has not been adequately embraced. Despite various approaches used in analyzing academics’ adoption and use of OA publishing, none of the studies uses the UTAUT model in the context of OA publishing.

5. METHODOLOGY

This study used the quantitative method of a survey approach for data collection. The semi-structured questionnaire was used as data collection instrument. Three universities of various ownership levels in Nigeria were purposively selected. Federal universities were represented by University of Ibadan, state universities
Determinants of Adoption and Use

represented by Adekunle Ajasein University, and private universities represented by Babcock University. The availability of functional Internet facilities was used as a criterion for the selected universities. This is necessary because Gbaje (2010) established that the Internet is the platform for OA publishing.

Participants were randomly selected from the three universities by using the lottery method. This was to avail equal opportunities to all potential participants in the study. A self-administered questionnaire was distributed to 337 participants selected from a population of 2,362 academic staff from the selected universities. Interviews were conducted with four universities’ management staff members that understand and implement university policies on scholarly communication.

6. DATA COLLECTION INSTRUMENT

A questionnaire and interview format were used to gather data from the respondents. The choice of a questionnaire was informed by its prevalent use in most studies on scholarly communication. The items from the questionnaire were adapted from various related studies (Venkatesh et al., 2003; Dulle, 2010; Mammo & Ngulube, 2013; Obuh, 2013).

The survey questionnaire consisted of four pages containing 61 items. The questionnaire was designed under nine different headings and harmonized in one single questionnaire that contained ten sections (A to J). Section A required demographic information of the participants: age, gender, work experience, educational qualification, position, and discipline, and covered items 1-7. Section B contained items on level of adoption and use of OA publishing, covering items 8 17. Section C contained awareness of OA and had items 18 25. Section D contained attitude towards OA (ATOA) and covered items 26 31.

Section E elicited information on Internet self efficacy (ISE) beliefs using the generalized self efficacy scale (GSS) developed by Stanley et al. (2002) and covered items 32 36. Section F contained effort expectancy (EE) with items 37 42; Section G contained performance expectancy (PE) and covered items 43-48. Lastly, Section H contained facilitating conditions (FCs) and covered items 49–54. Section I contained behavioural intention to use (BIU) with items 55-57, and Section J contained an open questions on important factors of adoption and use with items 58-61. De Vaus (1991) states that closed questions are easier to code and recommended exhaustive alternative responses. Items in the questionnaire were rated on a 4-point Likert scale with end points of 4 “Strongly agree” and 1 “Strongly disagree”; the two mid-points were 3 “Agree” and 2 “Disagree.” The questionnaire was validated and pre-tested on part of the population which was exempted from participation in the study. The researcher assumed that most questions were based on previous empirical studies and that they had been validated. Quantitative data (questionnaire) collected were coded and analyzed using Statistical Package for Social Sciences (IBM-SPSS) version 19.0 while qualitative data (interviews) were thematically analysed.

7. RESULTS

Demography of the Participants

The demographic information of the academic staff that participated in the survey is shown in Table 1.

As shown in Table 1, the majority of participants (206) were from the University of Ibadan and 57 were from Babcock University, while 54 were from Adekunle Ajasein University. Of 317, 212 of the participants were male while 105 were female.

Objective 1: The objective sought to identify factors that influence the adoption and use of OA publishing by academic staff in selected universities.

Table 2 shows that each of the independent variables (factors) made a significant contribution to the prediction of adoption and use of OA publishing. Effort expectancy made an insignificant contribution but has a positive relationship with adoption and use of OA publishing. As regards the magnitude of contribution, attitude towards OA publishing made the most significant contribution (Beta = .407, t = 8.774, p < 0.05) to the prediction of adoption and use of OA publishing. This is followed by awareness, with value Beta = .367, t = 8.361, p < 0.05. Next is the performance expectancy that made significant contribution (Beta = .149, t = 2.878, p < 0.05). Also, facilitating conditions (Beta = .127, t = 2.505, p < 0.05) made significant contribution to the prediction. Moreover, other factors made significant contribution in the following order: Inter-
net self-efficacy (Beta=-.114, t= -2.564, p<0.05), and
behavioural intention (Beta = -.070, t = -2.001, p <
0.05) with negative relationship. This implies that the
lower the relationship of both Internet self-efficacy
and behavioural intention, the better the adoption and
use of OA publishing. Effort expectancy (Beta = .005, t
= .082, p > 0.05) made an insignificant contribution to
the prediction of adoption and use of OA publishing.
Thus, the higher the beta value the greater the influ-
ence of the predictor variable on the criterion (adoption
and use of OA publishing). Also, all predictors are a good measure for the adoption and use of OA
publishing. Hence, it was identified that awareness,
attitude, performance expectancy, effort expectancy,
Internet self-efficacy, and facilitating conditions influ-
enced the adoption and use of OA publishing.

Objective 2: The second objective sought to estab-
lish relationships among factors that influence the
adoption and use of OA publishing.

Multiple Regression (MR) analysis was used to
address the hypotheses and relationships among the
influencing factors that contribute to the adoption
and use of OA publishing. According to Swanson and
Holton (2005, p. 118), MR has been used widely in

<table>
<thead>
<tr>
<th>Table 1. Background of the Participants</th>
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</thead>
<tbody>
<tr>
<td>University</td>
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<tr>
<td>University of Ibadan</td>
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<td>Adekunle Ajasin University</td>
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<td>Babcock University</td>
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Source: Field Data, 2015

<table>
<thead>
<tr>
<th>Table 2. Determinants of the Adoption and Use of OA Publishing (N=317)</th>
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<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>Awareness of OA Publishing</td>
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<tr>
<td>Attitude towards OA Publishing</td>
</tr>
<tr>
<td>Performance Expectancy</td>
</tr>
<tr>
<td>Effort Expectancy</td>
</tr>
<tr>
<td>Internet self-efficacy</td>
</tr>
<tr>
<td>Facilitating conditions</td>
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<td>Behavioural intention</td>
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Significant level at p<0.05
organisational research to “predict and explain” the concerns of research questions in a survey instrument. Although simultaneous, step-wise, and hierarchical tests are available methods of multiple regression for analysis of data, this study used the hierarchical method because it is a theory-driven research.

Table 3 shows that there are relationships among variables and adoption and use of OA publishing. This suggests that independent variables of the study have strong relationships with dependent variables which are significant and strongly influence the adoption and use of OA publishing. Hence, it can be deduced from the findings that awareness, attitude, performance expectancy, effort expectancy, Internet self-efficacy, and facilitating conditions are determinants of the adoption and use of OA publishing. Also, behavioural intention to use has a significant relationship with the adoption and use of OA publishing.

Objective 3: The third objective sought to determine the joint contributions of the factors influencing the adoption and use of OA publishing.

Table 4. Hierarchical Regression Showing Joint Contributions of Independent Variables to Adoption and Use of OA Publishing

Table 4 shows that awareness, attitude, performance expectancy, effort expectancy, Internet self-efficacy, facilitating conditions, and behavioural intention jointly accounted for 62% ($R^2 = .620$) of the total variance in OA publishing adoption and use by academic staff and it was significant ($p < .05$). The moderating variables accounted for an additional 2.3% ($R^2 = .023$) and is also significant at ($p < .05$). Hence, it can be concluded that

Table 3. Summary of Hypotheses (Hierarchical Multiple Regression Analysis) (N=317)

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Variable(Independent)</th>
<th>Statistical Results</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_0_1$</td>
<td>Awareness of OA</td>
<td>$B=.37$, $t=8.36$, $p&lt;.05$</td>
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<tr>
<td>$H_0_2$</td>
<td>Attitude towards OA</td>
<td>$B=.41$, $t=8.77$, $p&lt;.05$</td>
<td>Significant at $p&lt;.05$</td>
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<tr>
<td>$H_0_3$</td>
<td>Performance Expectancy</td>
<td>$B=.15$, $t=2.88$, $p&lt;.05$</td>
<td>Significant at $p&lt;.05$</td>
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<tr>
<td>$H_0_4$</td>
<td>Effort Expectancy</td>
<td>$B=.01$, $t=0.08$, $p&lt;.05$</td>
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<tr>
<td>$H_0_5$</td>
<td>Internet self-efficacy</td>
<td>$B= -.11$, $t= -.56$, $p&lt;.05$</td>
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<tr>
<td>$H_0_6$</td>
<td>Facilitating conditions</td>
<td>$B= -.07$, $t= -.20$, $p&lt;.05$</td>
<td>Significant at $p&lt;.05$</td>
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<tr>
<td>$H_0_7$</td>
<td>Behavioural intention to use</td>
<td>$B= -.07$, $t= -.20$, $p&lt;.05$</td>
<td>Significant at $p&lt;.05$</td>
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</tbody>
</table>

Dependent variable: Adoption and use of OA Publishing
Level of Sig. at $p<0.05$

Table 4. Hierarchical Multiple Regression Showing Joint between Independent Variables and Dependent Variable (Adoption and Use of OA Publishing)

<table>
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<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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<th>$R^2$</th>
<th>$R^2$Change</th>
<th>Implication</th>
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<td>560.665</td>
<td>72.130</td>
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<td>.788</td>
<td>.620</td>
<td>.620</td>
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<tr>
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<tr>
<td>2. Regression</td>
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<td>193.887</td>
<td>25.366</td>
<td>.000$^b$</td>
<td>.802</td>
<td>.644</td>
<td>.023 (.165)</td>
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<tr>
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<td>7.644</td>
<td></td>
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<td>Total</td>
<td>6326.492</td>
<td>316</td>
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Level of Sig. at $p<0.05$
influencing factors predict 62% ($R^2 = .620$) of adoption and use of OA publishing.

**Objective 4:** The fourth research objective sought to investigate the level of university management support for OA publishing. To meet this objective, interviews were conducted on university management staff of the selected universities as shown below.

The findings revealed that most respondents did not know if there is any policy that supports OA adoption and use by academics in the targeted universities. One of the respondents observed that:

Lack of OA legal framework is an issue affecting us (academic staff). If the university endeavours to formulate an OA policy, it will encourage many academics like ours (lecturers) to increase adoption and use of OA publication as we will do more of OA publishing to showcase our scholarly research findings. However, if the university does not provide an enabling environment, it becomes impossible for many academics. The university should fulfil their part by playing the role that will enhance the adoption and use of OA publishing.

Another respondent acknowledged the need of OA and stated that:

At the moment, there is no written policy that supports OA adoption and use by academic staff in my university (University of ...). Additionally, a plan is in the pipeline on OA legal framework and the university librarians and academic staff from the Faculty of Law has been mandated to be part of the anticipated OA legal framework committee. If the framework has been put into place to support the adoption and use of OA, it would have boosted the morale of academic staff by increasing the adoption and use of OA publishing.

Similarly, another respondent from the third university stated that:

...we need an OA policy. The university management needs to introduce policies that would support and assist the adoption and use of OA publishing in the university community in Nigeria. Academics require some level of support from the Annual Promotion Committee (APC). It seems the lack of a written policy for OA publishing leads to rejection by the promotion committee.

Comments made by university management staff of the three universities suggest that there was no OA policy in any of the selected universities. These findings affirmed the general comments of respondents in the questionnaire that they did not have any knowledge of the existence of an OA policy in their universities. This suggests that the perceived fear of rejection by academic staff could have been totally eradicated if universities could put in place an OA publishing policy.

Furthermore, insights from the respondents suggest that university management's support for the adoption and use of OA publishing could be of significant help to academics in universities in Nigeria. In other words, the university management's role with respect to supporting academic staff’s adoption and use of OA publishing is a key to successful free access to OA publications as well as wide dissemination of research. Having an OA publishing policy in place will motivate academics and alleviate the perceived fear of rejection of OA publication by the university promotion committee. This will increase adoption and use of OA publishing by academic staff.

**Objective 5:** The fifth objective sought to develop a suitable framework that can facilitate the adoption and use of OA publishing by academic staff in universities in Nigeria.

The findings of this study guide the proposed framework that is based on the existing theory—the Unified Theory of Acceptance and Use of Technology. This framework will facilitate and enhance the academic staff adoption and use of OA publishing.

A framework is described as a set of broad ideas and principles taken from the result of empirical findings and relevant literature, and one can be used to structure a subsequent presentation (Reichel & Ramey, 1987). According to Dix (2007, p. 116), a framework is "a general structure that provides an overarching set of concepts and processes." At times, a framework may reflect a model or guide the development of a model or a number of models.

The graphical representation of the proposed framework illustrates the pattern and structure of links among the set of measured variables. It serves as a research device intended to assist a researcher in developing awareness and understanding of the state of adoption and use of OA publishing in Nigeria universities. It also communicates research findings and recommendations for the purpose of effective implementation and promotion of rapid adoption and use...
of OA publishing among the stakeholders, as shown in Figure 1.

In the investigation, the adoption and use of OA publishing was taken as the dependent variable, and awareness, attitude, performance expectancy, effort expectancy, Internet self-efficacy, and facilitating conditions were taken as independent variables, behavioural intention to use taken as an intervening variable. The researcher used a regression analysis to establish the relationship and existence of influence between the measured variables. Factors that influenced the adoption and use of OA publishing and their relationships, based on what was explained in previous sections, are presented as Ho1 to Ho7 below.

**Awareness**

The knowledge or perception of a situation or fact is paramount in any decision to adopt and use new innovation. OA publishing is a new concept that needs to be known before accepting or using this technology based system. According to present and previous studies (Chricing, 2008; Obuh & Bozimo, 2012), awareness plays a vital role and is a key factor influencing the adoption and use of OA publishing (see Ho1)
Ho: There is no significant relationship between awareness and adoption and use of OA publishing

**Attitude**

Attitude can be described as a way of thinking or feeling about something either negatively or positively. Attitude towards adoption and use of OA publishing plays an essential role. Academic staff that develop a positive attitude towards adoption and use of OA publishing will embrace and use it to perform a given task. The findings of current and previous studies (Wickham, 2011; Khalli & Singh, 2012) established that attitude is a determinant in adoption and use of OA publications. Attitude towards OA publishing is a factor influencing the adoption and use of OA publishing and has relationships with other variables (factors). This was established by testing the hypothesis as presented in Ho below:

Ho: There is no significant relationship between attitude and adoption and use of OA publishing

**Performance Expectancy**

Performance expectancy concerns the degree to which a person believes that using OA publishing would improve his or her performance. The current finding was in congruence with previous studies (Al-Qeisi, 2009; Dulle, 2010).

Ho: There is no significant relationship between performance expectancy and adoption and use of OA publishing.

**Effort Expectancy**

Effort expectancy is defined as the degree to which a person believes that using OA publishing would help achieve a set target. The findings revealed that the influence of effort expectancy is not significant. Hence, the findings are not opposing the previous findings (Louho et al., 2006; Butler & Richardson, 2008) which report a high proportion of the respondents to have significantly expressed less effort expectancy towards the usage of new technologies.

Ho: There is no significant relationship between effort expectancy and adoption and use of OA publishing.

**Internet Self-Efficacy**

According to Bandura (1997) self-efficacy is a personal judgments of one's capabilities to organize and execute courses of action to attain designated goals, and Bandura sought to assess its level, generality, and strength across activities and contexts (Schunk, 1991). Internet self-efficacy is personal self-assurance of having capability to use the Internet to achieve specific tasks. Gbaje 2010 established that the Internet is a platform for OA publishing. The present findings support Dulle (2010) in that Internet self-efficacy has significant influence on adoption and use of OA publishing. Besides, both Internet usage skills and self-efficacy have been conceded as key determinants for the effective exploitation of information in the digital environment (Waldman, 2003; White & Gendall, 2005).

Ho: There is no significant relationship between Internet self-efficacy and adoption and use of OA publishing.

**Facilitating Conditions**

According to the current study and previous studies (Oko耶 & Ejikeme, 2011) the role of facilitating conditions in adoption and use of OA publishing is very crucial. Facilitating conditions refer to factors like funding training on ICTs and the Internet, technical support, Internet facilities, and regular electric power that are essential for the successful adoption and use of OA publishing (Christian, 2008; Fatunde, 2008; Njoku, 2016). The current findings corroborate results from previous studies (Dulle et al., 2011; Zhou et al., 2010) that facilitating conditions have significant influence on adoption and use of OA publishing.

Ho: There is no significant relationship between facilitating conditions and adoption and use of OA publishing.

**Behavioural Intention**

Behaviour intention is defined as a person's perceived likelihood or subjective probability that he or she will adopt and use OA publishing. Showing only intention to use might not translate to actual usage of OA publishing.

Ho: There is a significant relationship between behavioural intention and adoption and use of OA publishing.

**OA Legal Policy**

Findings from both the questionnaire and inter-
views revealed that none of the sampled universities has a policy on OA publishing and this has created a perceived problem of rejection of OA publications for promotion and tenure by the constituted University Promotion Committee.

There is a need to establish a policy that will promote acceptance and use of OA publishing by academics. This implementation is possible by incorporating an OA publishing policy into the existing one regarding subscription-based journals. The university authority should ensure that for appointment, promotion, and tenure, OA peer reviewed publications should be considered and given equal treatment as toll-accessed publications. If necessary, precautions should be taken with a better understanding of the relationships that exist among the variables in Figure 1 so that the problem of low adoption and use of OA publishing will be solved. Hence, the visibility and accessibility of research findings will significantly improve the adoption and use of OA publishing.

8. EXPLANATION OF THE FRAMEWORK

The proposed conceptual framework in Figure 1 analysed the interactions between independent variables (awareness, attitude, performance expectancy, effort expectancy, Internet self-efficacy, facilitating conditions) and OA policy interacts with the behavioural intention that serves as a mediating variable and influences the adoption and use of OA publishing. Specifically, the model analyzed the key variable connections as shown in Figure 1 and provided a useful viewpoint for examining variables that influenced the adoption and use of OA publishing by academic staff. With the exception of facilitating conditions, behavioural intention mediates the involvement of all independent variables that influence adoption and use of OA publishing by academics. This proposed framework (see Figure 1) will assist the researcher to figure out how the interactions between independent variables influenced the level of adoption and use of OA publishing. These variables are theoretically associated with the adoption and use of OA publishing. The independent variables are explained as predictors that influence adoption and use of OA publishing (dependent variable). Furthermore, these factors are multi-dimensional and interact with each other. These interactions can play a significant role in the decisions of academic staff either to use or reject OA publishing.

The support for OA publishing will influence facilitating conditions, and this in turn influences Internet self-efficacy because the development of self-efficacy depends on Internet facilities with high Internet bandwidth. This will in turn interact with effort expectancy as a result of self-confidence in the ability to use the Internet with less difficulty. This chain of interactions influences and induces academics to embrace the OA system because of its benefits to aid job performance (performance expectancy) for the set target. The performance expectancy in turn influences the ability to achieve the set target with little effort (effort expectancy) and impacts the development of the right (positive) attitude by academic staff. This will attract an OA campaign which leads to OA awareness, and later influences the formulation of OA policies. Further, an OA policy will trigger and enhance the adoption and use of OA publishing by academic staff.

Academic staff that benefit from the adoption and use of OA publishing will inevitably influence university management to formulate an OA policy that will promote awareness of OA. This in turn will drive the need to intensify more efforts in the OA campaign, with a focus on its benefits that can inform the development of positive attitudes towards OA by academic staff. This chain of interactions influences performance expectancy of academic staff, having realized the benefits of OA to enhance performance on the set target. Further interactions attract academics to use OA, since it requires little effort (effort expectancy) to deliver on the set target. This also encourages academic staff to develop Internet self-efficacy through an enlivened environment (facilitating conditions) that supports OA publishing. These chains of interactions drive more support for OA that will finally lead to the adoption and use of OA publishing. Additionally, each independent variable (OA policy, awareness, attitude, performance expectancy, effort expectancy, Internet self-efficacy) has a direct influence on intention to use OA publishing as indicated by the arrow, and intention to use has direct influence on the actual use of OA publishing. Finally, following each step thoroughly will lead to successful adoption and use of OA publishing (outcome) as shown in Figure 1.
Justification for the Framework

The rationale for this proposed framework are as follows:

- The adoption and use of OA publishing by academics in most universities witnesses a high consumption of OA publications but low patronage of OA publishing outlets;
- Persistence of serial and permission crises in academic libraries;
- Low access and poor visibility of research findings in Africa and Nigeria in particular, and
- Lack of OA policy to encourage the adoption and use of OA publishing by academic staff in universities in Nigeria.

The above justification calls for the development of a framework that assists users to have wider access to information, especially research findings; also, to help stakeholders to appreciate, embrace, and evaluate OA publishing.

9. LIMITATIONS

This study focused on lecturers and librarians (academics) only. The present study used data collection instruments such as a questionnaire and structured interviews for data gathering on the adoption and use of OA publishing.

10. SIGNIFICANCE OF THE STUDY

The significance of this study is three-fold: first, theoretical significance—it adds to the existing literature. Rindova (2011) asserts that the vital reason to conduct a scholarly guided study is to contribute to a theory or develop one. Therefore, this study successfully contributes to theory by identifying new constructs (awareness, attitude, and Internet self-efficacy) to the existing variables of the UTAUT. Second is the societal significance: The study promotes adoption and use of OA publishing, which can facilitate access and wide visibility of research findings to all stakeholders (lecturers, librarians, researchers, and industrialists). Third, it will minimise the persistent serial crisis (shortage of reading materials) in academic libraries. Furthermore, it adds value to the methodological approach by combining quantitative and qualitative techniques. This paper also contributes a framework that improves academics' and other stakeholders' adoption and use of OA publishing.

11. CONCLUSIONS

The use of OA publishing is still in its infancy and more research is required to update its evolving nature. Open access publishing proffers a new scholarly communication model to scholars, researchers, academics, students, and other stakeholders. However, there are various factors that influence the adoption and use of OA publishing. The present study concludes that awareness, attitude, performance expectancy, Internet self-efficacy, and facilitating conditions are determinants of the adoption and use of OA publishing. The findings also revealed that universities did not have OA policies to motivate academics' adoption and use of OA and to alleviate the perceived fear of rejection of OA publications for promotion.

The results show that there are relationships between predictors (awareness, attitude, performance expectancy, effort expectancy, Internet self-efficacy, and facilitating conditions) and adoption and use of OA publishing. Predictors (factors) that potentially influence the successful adoption and use of OA publishing need to be taken into account by university authorities while embracing and using OA publishing. Also, factors that influence adoption and use of OA publishing are explored and presented as a framework.

This study established that all predictors (factors) of OA made a contribution of 62% towards the adoption of OA publishing. The findings imply that all predictors (factors) jointly influence the adoption and use of OA publishing.

12. RECOMMENDATIONS

OA Awareness

Based on the findings, the following recommendations are made: It is recommended that universities should increase OA awareness by assigning reference librarians or scholarly communication officers to provide access to OA publications. Also, libraries should
organise OA monthly awareness programmes.

**Adequate Facilities**

The universities should strengthen the existing ICT facilities by providing/ensuring regular power supply and upgrading Internet bandwidth as well as more funds.

**Training**

To understand and adopt OA publishing effectively, regular training is essential for academic staff. Universities should organise refresher courses for staff on ICTs and Internet searching and for training newly recruited staff. In summary, universities should ensure that all factors leading to successful adoption and use of OA publishing by academic staff are enhanced.

**OA Publishing Policy**

Universities should formulate an OA legal framework that will alleviate academic staff’s fears of rejection of OA publications for promotion and tenure. This can be achieved by ensuring that OA peer reviewed publications are given equal treatment as toll-accessed printed journals.

**ACKNOWLEDGEMENTS**

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Characterization of New Two Parametric Generalized Useful Information Measure

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ABSTRACT

In this paper we define a two parametric new generalized useful average code-word length \( L_{\alpha}^\beta (P; U) \) and its relationship with two parametric new generalized useful information measure \( H_{\alpha}^\beta (P; U) \) has been discussed. The lower and upper bound of \( L_{\alpha}^\beta (P; U) \) in terms of \( H_{\alpha}^\beta (P; U) \) are derived for a discrete noiseless channel. The measures defined in this communication are not only new but some well known measures are the particular cases of our proposed measures that already exist in the literature of useful information theory. The noiseless coding theorems for discrete channel proved in this paper are verified by considering Huffman and Shannon-Fano coding schemes on taking empirical data. Also we study the monotonic behavior of \( H_{\alpha}^\beta (P; U) \) with respect to parameters \( \alpha \) and \( \beta \). The important properties of \( H_{\alpha}^\beta (P; U) \) have also been studied.

Keywords: Shannon’s entropy, codeword length, useful information measure, Kraft inequality, Holder’s inequality, Huffman codes, Shannon-Fano codes, Noiseless coding theorem
1. INTRODUCTION / LITERATURE REVIEW

The growth of telecommunication in the early twentieth century led several researchers to study the information control of signals; the seminal work of Shannon (1948), based on papers by Nyquist (1924; 1928) and Hartley (1928), rationalized these early efforts into a coherent mathematical theory of communication and initiated the area of research now known as information theory. The central paradigm of classical information theory is the engineering problem of the transmission of information over a noisy channel. The most fundamental results of this theory are Shannon’s source coding theorem which establishes that on average the number of bits needed to represent the result of an uncertain event is given by its entropy; and Shannon’s noisy-channel coding theorem which states that reliable communication is possible over noisy channels provided that the rate of communication is below a certain threshold, called the channel capacity. Information theory is a broad and deep mathematical theory with equally broad and deep applications, amongst which is the vital field of coding theory. Information theory is a new branch of probability and statistics with extensive potential application to communication systems. The term information theory does not possess a unique definition. Broadly speaking, information theory deals with the study of problems concerning any system. This includes information processing, information storage, and decision making. In a narrow sense, information theory studies all theoretical problems connected with the transmission of information over communication channels. This includes the study of uncertainty (information) measure and various practical and economical methods of coding information for transmission.

It is a well-known fact that information measures are important for practical applications of information processing. For measuring information, a general approach is provided in a statistical framework based on information entropy introduced by Shannon (1948) as a measure of information. The Shannon entropy satisfies some desirable axiomatic requirements and also it can be assigned operational significance in important practical problems, for instance in coding and telecommunication. In coding theory, usually we come across the problem of efficient coding of messages to be sent over a noiseless channel where our concern is to maximize the number of messages that can be sent through a channel in a given time. Therefore, we find the minimum value of a mean codeword length subject to a given constraint on codeword lengths. As the codeword lengths are integers, the minimum value lies between two bounds, so a noiseless coding theorem seeks to find these bounds which are in terms of some measure of entropy for a given mean and a given constraint. Shannon (1948) found the lower bounds for the arithmetic mean by using his own entropy. Campbell (1965) defined his own exponentiated mean and by applying Kraft’s (1949) inequality, found lower bounds for his mean in terms of Renyi’s (1961) measure of entropy. Longo (1976) developed lower bound for useful mean codeword length in terms of weighted entropy introduced by Belis and Guiasu (1968). Guiasu and Picard (1971) proved a noiseless coding theorem by obtaining lower bounds for another useful mean code-word length. Gurdial and Pessoa (1977) extended the theorem by finding lower bounds for useful mean codeword length of order α; also various authors like Jain and Tuteja (1989), Taneja et al (1985), Hooda and Bhaker (1997), and Khan et al (2005) have studied generalized coding theorems by considering different generalized ‘useful’ information measures under the condition of unique decipherability.

In this paper we define a new two parametric generalized useful average code-word length $L_\alpha^\beta(P; U)$ and discuss its relationship with new two parametric generalized useful information measure $H_\alpha^\beta(P; U)$. The lower and upper bound of $L_\alpha^\beta(P; U)$, in terms of $H_\alpha^\beta(P; U)$ are derived for a discrete noiseless channel in Section 3. The measures defined in this communication are not only new but also generalizations of certain well known measures in the literature of useful information theory. In Section 4, the noiseless coding theorems for discrete channels proved in this paper are verified by considering Huffman and Shannon-Fano coding schemes using empirical data. In Section 5, we study the monotonic behavior of $H_\alpha^\beta(P; U)$ with respect to parameters α and β. Several other properties of $H_\alpha^\beta(P; U)$ are studied in Section 6.

2. BASIC CONCEPTS

Let $X$ be a finite discrete random variable or finite source taking values $x_1, x_2, \ldots, x_n$ with respective probabilities $P = (p_1, p_2, \ldots, p_n), p_i \geq 0 \ \forall \ i = 1, 2, \ldots, n$ and
\[ \sum_{i=1}^{n} p_i = 1. \]  

Shannon (1948) gives the following measure of information and calls it entropy.

\[ H(P) = -\sum_{i=1}^{n} p_i \log p_i \]  

(1.1)

The measure (1.1) serves as a suitable measure of entropy. Let \( p_1, p_2, p_3, \ldots, p_n \) be the probabilities of \( n \) code-words to be transmitted and let their lengths \( l_1, l_2, \ldots, l_n \) satisfy Kraft (1949) inequality,

\[ \sum_{i=1}^{n} 2^{-l_i} \leq 1 \]  

(1.2)

For uniquely decipherable codes, Shannon (1948) showed that for all codes satisfying (1.2), the lower bound of the mean codeword length,

\[ L(P) = \sum_{i=1}^{n} p_i l_i \]  

(1.3)

lies between \( H(P) \) and \( H(P)+1 \), where \( D \) is the size of code alphabet.

Shannon's entropy (1.1) is indeed a measure of uncertainty and is treated as information supplied by a probabilistic experiment. This formula gives us the measure of information as a function of the probabilities only in which various events occur without considering the effectiveness or importance of the events. Belis and Guiasu (1968) remarked that a source is not completely specified by the probability distribution \( P \) over the source alphabet \( X \) in the absence of quality character. They enriched the usual description of the information source (i.e., a finite source alphabet and finite probability distribution) by introducing an additional parameter measuring the utility associated with an event according to their importance or utilities in view of the experimenter.

Let \( U = \langle u_1, u_2, \ldots, u_n \rangle \) be the set of positive real numbers, where \( u_i \) is the utility or importance of outcome \( x_i \). The utility, in general, is independent of \( P \), i.e., the probability of encoding of source symbol \( x_i \). The information source is thus given by

\[ S = [X_1 \ X_2 \ \ldots \ X_n \ \begin{array}{c} p_1 \ p_2 \ \ldots \ p_n \ u_1 \ u_2 \ \ldots \ u_n \end{array}]\quad \text{such that} \quad u_i > 0 \quad p_i > 0, \quad \sum_{i=1}^{n} p_i = 1 \]  

(1.4)

We call (1.4) a Utility Information Scheme. Belis and Guiasu (1968) introduced the following quantitative - qualitative measure of information for this scheme.

\[ H(P, U) = -\sum_{i=1}^{n} u_i p_i \log p_i \]  

(1.5)

and call it as ‘useful’ entropy. The measure (1.5) can be taken as satisfactory measure for the average quantity of ‘valuable’ or ‘useful’ information provided by the information source (1.4). Guiasu and Picard (1971) considered the problem of encoding the letter output by the source (1.4) by means of a single letter prefix code whose codeword's \( c_1, c_2, \ldots, c_n \) have lengths \( l_1, l_2, \ldots, l_n \) respectively and satisfy the Kraft's inequality (1.2), they introduced the following quantity

\[ L(P; U) = \frac{\sum_{i=1}^{n} u_i p_i l_i}{\sum_{i=1}^{n} u_i p_i} \]  

(1.6)

and call it as ‘useful’ mean length of the code. Further, they derived a lower bound for (1.6). However, Longo (1976) interpreted (1.6) as the average transmission cost of the letters \( x_i \) with probabilities \( p_i \) and utility \( u_i \) and gave some practical interpretations of this length; bounds for the cost function (1.6) in terms of (1.5) are derived by him.

### 3. NOISELESS CODING THEOREMS FOR ‘USEFUL’ CODES

Define a two parametric new generalized useful information measure for the incomplete power distribution as:

\[ H_\alpha^\beta (P; U) = \frac{1}{1-\alpha} \log_D \left[ \frac{\sum_{i=1}^{n} u_i p_i^\alpha f_i}{\sum_{i=1}^{n} u_i p_i^\beta f_i} \right] \]  

Where \( 0<\alpha<1,0<\beta \leq 1, p_i \geq 0 \quad \forall i=1,2,\ldots,n, \quad \sum_{i=1}^{n} p_i = 1 \)

**Remarks for (2.1)**

1. When \( \beta=1 \), (2.1) reduces to ‘useful’ information measure studied by Taneja, Hooda, and Tuteja (1985), i.e.,

\[ H_\alpha(P; U) = \frac{1}{1-\alpha} \log_D \left[ \frac{\sum_{i=1}^{n} u_i p_i^\alpha f_i}{\sum_{i=1}^{n} u_i p_i} \right] \]  

(2.2)

2. When \( \beta=1, u_i=1, \forall i=1,2,\ldots,n, \) i.e., when the utility aspect is ignored and \( \sum_{i=1}^{n} p_i = 1 \), (2.1) reduces to Reyni’s (1961) entropy, i.e.,

\[ H_\alpha(P) = \frac{1}{1-\alpha} \log_D \left[ \sum_{i=1}^{n} p_i^\alpha \right] \]  

(2.3)
Characterization of New Two Parametric

III. When $\beta=1$ and $\alpha \to 1$, (2.1) reduces to ‘useful’ information measure for the incomplete distribution due to Bhakar and Hooda (1993), i.e.,

$$H(P, U) = -\sum_{i=1}^{n} p_i \log p_i$$

IV. When $\beta=1, u_i=1, \forall i=1,2,\ldots,n$, i.e., when the utility aspect is ignored, $\sum_{i=1}^{n} p_i = 1$ and $\alpha \to 1$, the measure (2.1) reduces Shannon’s (1948) entropy, i.e.,

$$H(P) = -\sum_{i=1}^{n} p_i \log p_i$$

V. When $\beta=1, u_i=1, \forall i=1,2,\ldots,n$, i.e., when the utility aspect is ignored, $\sum_{i=1}^{n} p_i = 1, \alpha \to 1$, and $\gamma = 1,2,\ldots,n$, the measure (2.1) reduces to maximum entropy, i.e.,

$$H(\gamma) = \log_2 n$$

VI. When $\alpha \to 1$, the measure (2.1) reduces to useful information measure for the incomplete power distribution $\rho^\alpha$ due to Sharma, Man Mohan, and Mitter (1978), i.e.,

$$H^\beta(P, U) = -\sum_{i=1}^{n} p_i u_i^\alpha \log p_i^\beta$$

VII. When $\alpha \to 1, u_i=1, \forall i=1,2,\ldots,n$, i.e., when the utility aspect is ignored, (2.1) reduces to a measure of incomplete power probability distribution due to Mitter and Mathur (1972), i.e.,

$$H(P) = -\sum_{i=1}^{n} p_i^{\gamma} \log p_i^{\beta}$$

Further, we define a two parametric new generalized useful average code-word length corresponding to (2.1) and is given by

$$\ell_\alpha^\beta(P; U) = a_{\alpha} \alpha \log_2 \left( \frac{\sum_{i=1}^{n} u_i p_i^\beta \alpha^{-1}(\frac{\gamma}{\alpha})}{\sum_{i=1}^{n} u_i p_i^\beta} \right)$$

Where $0<\alpha<1, 0<\beta\leq 1, p_i \geq 0 \forall i=1,2,\ldots,n, \sum_{i=1}^{n} p_i = 1$ and $D$ is the size of code alphabet.

Remarks for (2.9)

I. When $\beta=1$, (2.9) reduces to ‘useful’ average codeword length due to Taneja, Hooda, and Tuteja (1985), i.e.,

$$L_\alpha(P; U) = \frac{a_{\alpha}}{1-\alpha} \log_2 \left( \frac{\sum_{i=1}^{n} u_i p_i^\beta \alpha^{-1}(\frac{\gamma}{\alpha})}{\sum_{i=1}^{n} u_i p_i^\beta} \right)$$

II. When $\beta=1, u_i=1, \forall i=1,2,\ldots,n$, i.e., when the utility aspect is ignored and $\sum_{i=1}^{n} p_i = 1$, (2.9) reduces to exponentiated mean codeword length due to Campbell (1965) entropy, i.e.,

$$L_\alpha(P) = \frac{a_{\alpha}}{1-\alpha} \log_2 \left[ \sum_{i=1}^{n} p_i^\beta \alpha^{-1}(\frac{\gamma}{\alpha}) \right]$$

III. When $\beta=1$ and $\alpha \to 1$, (2.9) reduces to ‘useful’ code-word length due to Guiasu and Picard (1971), i.e.,

$$L(P; U) = \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\beta}$$

IV. When $\beta=1, u_i=1, \forall i=1,2,\ldots,n$, i.e., when the utility aspect is ignored, $\sum_{i=1}^{n} p_i = 1, \alpha \to 1$, (2.9) reduces to optimal codeword length defined by Shannon (1948), i.e.,

$$L(P) = \sum_{i=1}^{n} p_i l_i$$

Now we derive the lower and upper bound of (2.9) in terms of (2.1) under the condition

$$\frac{\sum_{i=1}^{n} u_i^\alpha p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\beta} \leq 1.$$  

This is a generalization of Kraft’s inequality (1.2). It is easy to see that when $\beta=1, u_i=1, \forall i=1,2,\ldots,n$, i.e., when the utility aspect is ignored and $\sum_{i=1}^{n} p_i = 1$, then the inequality (2.14) reduces to Kraft’s (1949) inequality (1.2). A code satisfying (2.14) would be termed as a ‘useful’ personal probability code.

Theorem 3.1: Let $\{u_i\}_{i=1}^{n}, \{p_i\}_{i=1}^{n}$ and $\{l_i\}_{i=1}^{n}$, satisfies the inequality (2.14), then the two parametric generalized ‘useful’ code-word length (2.9) satisfies the inequality

$$L_\alpha^\beta(P; U) \geq H_\alpha^\beta(P; U), 0 < \alpha < 1, 0 < \beta \leq 1, \quad (2.15)$$

Where $H_\alpha^\beta(P; U)$ and $L_\alpha^\beta(P; U)$ are defined in (2.1) and (2.9) respectively. Furthermore, equality holds good if
\[ l_i = -\log_D \left[ \frac{\alpha_i^{\alpha}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right] \]  

(2.16)

**Proof:** By Holder's inequality, we have

\[ \left( \sum_{i=1}^{n} x_i^p \right)^{\frac{1}{p}} \left( \sum_{i=1}^{n} y_i^q \right)^{\frac{1}{q}} \leq \sum_{i=1}^{n} x_i y_i \]  

(2.17)

For all \( x_i, y_i > 0, i = 1, 2, 3, \ldots, n \) and \( \frac{1}{p} + \frac{1}{q} = 1, p < 1(\neq 0), q < 0 \text{ or } q < 1(\neq 0), p < 0 \). We see the equality holds if there exists a positive constant \( c \) such that

\[ x_i^p = cy_i^q \]  

(2.18)

Making the substitution

\[ x_i = \frac{\alpha_i^{\alpha}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}, \ p = \frac{\alpha-1}{\alpha} \]

\[ y_i = \frac{\alpha_i^{\alpha}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \text{ and } q = 1 - \alpha. \]

Using these values in (2.17), and after suitable simplification, we get

\[ \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta} \eta_i^{1-q}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \leq \frac{1}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \]  

(2.19)

Now using the inequality (2.14), we get

\[ \left( \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta} \eta_i^{1-q}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right)^{\frac{1}{\alpha}} \leq 1 \]  

(2.20)

Or equation (2.20), can be written as

\[ \left( \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta} \eta_i^{1-q}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right)^{\frac{1}{\alpha}} \leq \left( \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right)^{\frac{1}{\alpha-1}} \]  

(2.21)

Taking logarithms to both sides with base \( D \) to equation (2.21), we get

\[ \frac{\alpha}{\alpha-1} \log_D \left[ \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta} \eta_i^{1-q}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right] \leq \frac{1}{\alpha-1} \log_D \left[ \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right] \]  

(2.22)

Or equivalently we can write equation (2.22), as

\[ \frac{\alpha}{\alpha-1} \log_D \left[ \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta} \eta_i^{1-q}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right] \geq \frac{1}{\alpha-1} \log_D \left[ \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right] \]  

(2.23)

As \( 0 < \beta \leq 1 \), multiply equation (2.23) both sides by \( \beta \), we get

\[ \frac{\alpha}{\alpha-1} \log_D \left[ \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta} \eta_i^{1-q}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right] \geq \frac{\beta}{\alpha-1} \log_D \left[ \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right] \]  

(2.24)

This implies

\[ \frac{\beta}{\alpha-1} \log_D \left[ \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right] \]

Hence the result for \( 0 < \alpha < 1, 0 < \beta \leq 1 \).

Now we will show that the equality in (2.15) holds if and only if

\[ l_i = -\log_D \left[ \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right] \]

Or equivalently we can write

\[ D^{-l_i} = \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \]  

(2.25)

Or we can write

\[ D^{-l_i} = p_i^{\alpha} \left( \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right)^{\frac{1}{\alpha}} \]  

(2.26)

Raising both sides to the power \( \frac{\alpha-1}{\alpha} \) to equation (2.25), and after simplification we get

\[ D^{-(\frac{\alpha-1}{\alpha} l_i)} = p_i^{\alpha} \left( \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right)^{\frac{1}{\alpha}} \]  

(2.27)

Or equivalently we can write

\[ \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} = \left( \frac{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}}{\sum_{i=1}^{n} u_i^{\alpha} p_i^{\beta}} \right)^{\frac{1}{\alpha}} \]  

(2.28)

Taking logarithms both sides with base \( D \) to equa-
Characterization of New Two Parametric

characterization (2.27), then multiply both sides by \( \frac{a^\beta}{(1-a)} \), we get

\[
\frac{a^\beta}{1-a} \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^a}{\sum_{i=1}^{n} u_i p_i^b} \right] = \frac{\beta}{1-a} \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^a}{\sum_{i=1}^{n} u_i p_i^b} \right] \tag{2.28}
\]

This implies

\[ L_\alpha^\beta(P; U) = H_\alpha^\beta(P; U). \] Hence the result

**Theorem 3.2:** For every code with lengths \( l_1, l_2, ..., l_m \) satisfies the condition (2.14), \( L_\alpha^\beta(P; U) \) can be made to satisfy the inequality

\[ L_\alpha^\beta(P; U) < H_\alpha^\beta(P; U) + \beta. \] Where, \( 0 < \alpha < 1, 0 < \beta \leq 1. \tag{2.29} \]

**Proof:** From the theorem (2.1) we have

\[ L_\alpha^\beta(P; U) \text{ holds if and only if } \]

\[ l_i = -\log_b \left[ \frac{p_i^\alpha}{\sum_{i=1}^{n} u_i p_i^\beta} \right], 0 < \alpha < 1, 0 < \beta \leq 1. \]

Or equivalently we can write

\[-\log_b p_i^\alpha + \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] \leq l_i < -\log_b p_i^\alpha + \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] + 1 \]

Now we choose the code-word lengths \( l_1, l_2, ..., l_m \), in such a way that they satisfy the inequality,

\[-\log_b p_i^\alpha + \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] \leq l_i < -\log_b p_i^\alpha + \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] + 1 \]

Consider the interval

\[ \delta_i = -\log_b p_i^\alpha + \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] - \log_b p_i^\alpha + \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] + 1 \]

of length unity. In every \( \delta_i \), there lies exactly one positive integer \( k_i \), such that,

\[ 0 < -\log_b p_i^\alpha + \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] \leq k_i < -\log_b p_i^\alpha + \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] + 1 \tag{2.30} \]

Now we will first show that the sequence \( l_1, l_2, ..., l_m \), thus defined satisfies the inequality (2.14), which is a generalization of Kraft inequality.

From the left inequality of (2.30), we have

\[ -\log_b p_i^\alpha + \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] \leq l_i \]

Or equivalently we can write

\[ D^{-l_i} \leq \left[ \frac{p_i^\alpha}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] \tag{2.31} \]

Multiply equation (2.31) both sides by \( u_i \) then summing over \( i = 1, 2, ..., n \), both sides to the resulted expression, and after suitable operations, we get the required result (2.14), i.e.,

\[ \frac{\sum_{i=1}^{n} u_i p_i^\alpha}{\sum_{i=1}^{n} u_i p_i^\beta} \leq 1. \]

Now the last inequality of (2.30), gives

\[ l_i < -\log_b p_i^\alpha + \log_b \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] + 1 \]

Or equivalently we can write

\[ D^l_i < p_i^\alpha \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] D \tag{2.32} \]

As \( 0 < \alpha < 1, \) then \((-1-\alpha) > 0, \) and \((\frac{1-\alpha}{\alpha}) > 0, \) raising both sides to the power \((\frac{1-\alpha}{\alpha}) > 0, \) to equation (2.32), and after suitable operations, we get

\[ D^\left(-\frac{\alpha}{1-\alpha}\right) < p_i^{\beta(\alpha-1)} \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] D^{-\alpha} \leq \alpha \]

Or equivalently we can write

\[ D^{-l_i(\frac{1-\alpha}{\alpha})} < p_i^{\beta(\alpha-1)} \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] D^{-\alpha} \tag{2.33} \]

Multiply equation (2.33) both sides by \( \frac{u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \), and then summing over \( i = 1, 2, ..., n \), both sides to the resulted expression and after suitable simplification, we get

\[ \frac{\sum_{i=1}^{n} u_i p_i^\alpha}{\sum_{i=1}^{n} u_i p_i^\beta} \leq \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] \frac{1-\alpha}{\alpha} \]

Or equivalently we can write

\[ \frac{\sum_{i=1}^{n} u_i p_i^\alpha}{\sum_{i=1}^{n} u_i p_i^\beta} \leq \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i p_i^\alpha} \right] \frac{1-\alpha}{\alpha} D^{-\alpha} \tag{2.34} \]

Taking logarithms with base \( D \) both sides to the equation (2.34), we get
As $0 < \alpha < 1$, $0 < \beta \leq 1$ then $(1-\alpha) > 0$ and $\frac{a\beta}{1-\alpha} > 0$, multiply equation (2.35), both sides by $\frac{a\beta}{1-\alpha} > 0$, we get

$$
\frac{a\beta}{1-\alpha} \log_0 \left[ \frac{\sum_{i=1}^{n} u_i p_i^{1-\alpha} (\frac{a\beta}{1-\alpha})^{\beta}}{\sum_{i=1}^{n} u_i p_i} \right] < \frac{1}{\alpha} \log_0 \left[ \frac{\sum_{i=1}^{n} u_i p_i^{1-\alpha} (\frac{a\beta}{1-\alpha})^{\beta}}{\sum_{i=1}^{n} u_i p_i} \right] + \frac{1-\alpha}{\alpha}
$$

(2.35)

This implies

$$L^\alpha_\beta(P;U) < H^\alpha_\beta(P;U) + \beta.$$ 

Hence the result for $0 < \alpha < 1$, $0 < \beta \leq 1$.

Thus from above two coding theorems, we have shown that

$$H^\alpha_\beta(P;U) \leq L^\alpha_\beta(P;U) < H^\alpha_\beta(P;U) + \beta.$$

Where $0 < \alpha < 1$, $0 < \beta \leq 1$.

In the next section we verify the noiseless coding theorems by considering the Shannon-Fano coding scheme and Huffman coding scheme by taking an empirical dataset.

4. ILLUSTRATION

In this section we illustrate the veracity of the theo-

<table>
<thead>
<tr>
<th>Probabilities $p_i$</th>
<th>Huffman Codewords</th>
<th>$l_i$</th>
<th>$u_i$</th>
<th>$\alpha$</th>
<th>$\beta$</th>
<th>$H^\alpha_\beta(P;U)$</th>
<th>$L^\alpha_\beta(P;U)$</th>
<th>$\eta = \frac{H^\alpha_\beta(P;U)}{L^\alpha_\beta(P;U)} \times 100$</th>
<th>$H^\alpha_\beta(P;U) + \beta$</th>
</tr>
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<tbody>
<tr>
<td>0.41</td>
<td>00</td>
<td>1</td>
<td>1</td>
<td>0.9</td>
<td>1</td>
<td>1.987</td>
<td>2.012</td>
<td>98.757%</td>
<td>2.987</td>
</tr>
<tr>
<td>0.18</td>
<td>000</td>
<td>3</td>
<td>5</td>
<td>0.9</td>
<td>0.9</td>
<td>1.654</td>
<td>1.874</td>
<td>88.260%</td>
<td>2.554</td>
</tr>
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<td>0.15</td>
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<td>3</td>
<td>1</td>
<td>0.8</td>
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<td>2.016</td>
<td>2.079</td>
<td>96.969%</td>
<td>3.016</td>
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<td>2</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.1</td>
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<td>4</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>0.03</td>
<td>0111</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Probabilities $p_i$</th>
<th>Shannon-Fano Codewords</th>
<th>$l_i$</th>
<th>$u_i$</th>
<th>$\alpha$</th>
<th>$\beta$</th>
<th>$H^\alpha_\beta(P;U)$</th>
<th>$L^\alpha_\beta(P;U)$</th>
<th>$\eta = \frac{H^\alpha_\beta(P;U)}{L^\alpha_\beta(P;U)} \times 100$</th>
<th>$H^\alpha_\beta(P;U) + \beta$</th>
</tr>
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<tr>
<td>0.41</td>
<td>001</td>
<td>2</td>
<td>6</td>
<td>0.9</td>
<td>1</td>
<td>1.987</td>
<td>2.217</td>
<td>89.625%</td>
<td>2.987</td>
</tr>
<tr>
<td>0.18</td>
<td>01</td>
<td>2</td>
<td>5</td>
<td>0.9</td>
<td>0.9</td>
<td>1.654</td>
<td>2.014</td>
<td>82.125%</td>
<td>2.554</td>
</tr>
<tr>
<td>0.15</td>
<td>100</td>
<td>3</td>
<td>1</td>
<td>0.8</td>
<td>1</td>
<td>2.016</td>
<td>2.226</td>
<td>90.566%</td>
<td>3.016</td>
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<td>101</td>
<td>3</td>
<td>2</td>
<td></td>
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<td></td>
<td></td>
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<tr>
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<td>110</td>
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<td>4</td>
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<td></td>
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<tr>
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<td>111</td>
<td>3</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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</table>
Charaterization of New Two Parametric

Using Huffman coding scheme the values of \( H_{\alpha}^\beta (P; U) \), \( H_{\alpha}^\beta (P; U) + \beta \), \( L_{\alpha}^\beta (P; U) \) and \( \eta \) for different values of \( \alpha \) and \( \beta \) are shown in the following table 1.

Now using Shannon-Fano coding scheme the values of \( H_{\alpha}^\beta (P; U) \), \( H_{\alpha}^\beta (P; U) + \beta \), \( L_{\alpha}^\beta (P; U) \) and \( \eta \) for different values of \( \alpha \) and \( \beta \) are shown in the following table 2.

From Tables 1 and 2 we infer the following:
1. Theorems 3.1 and 3.2 hold both the cases of Shannon-Fano codes and Huffman codes, i.e. \( H_{\alpha}^\beta (P; U) \leq L_{\alpha}^\beta (P; U) < H_{\alpha}^\beta (P; U) + \beta \), where \( 0 < \alpha < 1, 0 \leq \beta \leq 1 \).
2. Huffman mean code-word length is less than Shannon-Fano mean code-word length.
3. Coefficient of efficiency of Huffman codes is greater than coefficient of efficiency of Shannon-Fano codes; i.e., it is concluded that Huffman coding scheme is more efficient than Shannon-Fano coding scheme.

5. MONOTONIC BEHAVIOR OF THE TWO PARAMETRIC NEW GENERALIZED ‘USEFUL’ INFORMATION MEASURE \( H_{\alpha}^\beta (P; U) \)

In this section we study the monotonic behavior of the new two parametric generalized ‘useful’ information measure \( H_{\alpha}^\beta (P; U) \) given in (2.1) with respect to the parameters \( \alpha \) and \( \beta \).

Let \( P=(0.41, 0.18, 0.15, 0.13, 0.10, 0.03) \) be a set of probabilities. Assuming \( \beta=1 \) we calculate the values of \( H_{\alpha}^\beta (P; U) \) for different values of \( \alpha \) as shown in the following table 3.

Next we draw the graph of the table (3) and illustrate from Figure 1 that \( H_{\alpha}^\beta (P; U) \) is monotonic decreasing

<table>
<thead>
<tr>
<th>( \alpha )</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>( H_{\alpha}^\beta (P; U) )</td>
<td>2.260</td>
<td>2.221</td>
<td>2.182</td>
<td>2.146</td>
<td>2.112</td>
<td>2.078</td>
<td>2.047</td>
<td>2.017</td>
<td>1.988</td>
</tr>
</tbody>
</table>

![Fig. 1 Monotonic behavior of \( H_{\alpha}^\beta (P) \) with respect to \( \alpha \) for fixed \( \beta=1 \)]
Table 4. Monotonic Behavior of $H_\alpha^\beta (P; U)$ with respect to $\beta$ for fixed $\alpha=0.8$

<table>
<thead>
<tr>
<th>$\beta$</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_\alpha^\beta (P; U)$</td>
<td>0.026</td>
<td>0.102</td>
<td>0.222</td>
<td>0.383</td>
<td>0.580</td>
<td>0.811</td>
<td>1.072</td>
<td>1.361</td>
<td>1.677</td>
<td>2.017</td>
</tr>
</tbody>
</table>

Fig. 2 Monotonic behavior of $H_\alpha^\beta (P; U)$ with respect to $\beta$ for fixed $\alpha=0.8$

with increasing values of $\alpha$.

Now assuming $\alpha=0.8$ we calculate the values of $H_\alpha^\beta (P; U)$ for different values of $\beta$ as shown in the following table 4.

Next we draw the graph of the table (4) and illustrate from Figure 2 that $H_\alpha^\beta (P; U)$ is monotonic increasing with increasing values of $\beta$.

6. PROPERTIES OF THE NEW TWO PARAMETRIC GENERALIZED ‘USEFUL’ INFORMATION MEASURE $H_\alpha^\beta (P; U)$

In this section we will discuss some properties of the two parametric new generalized ‘useful’ information measure $H_\alpha^\beta (P; U)$ given in (2.1):

Property 6.1: $H_\alpha^\beta (P; U)$ is non-negative.

Proof: From (2.1), we have

$$H_\alpha^\beta (P; U) = \frac{\beta}{1-\alpha} \log \left[ \frac{\sum_{i=1}^{n} u_i p_i^\beta}{\sum_{i=1}^{n} u_i} \right], 0<\alpha<1, 0<\beta<1.$$

From Tables 1 and 2, it is observed that $H_\alpha^\beta (P; U)$ is non-negative for given values of $\alpha$ and $\beta$.

Property 6.2: $H_\alpha^\beta (P; U)$ is a symmetric function on every $p_i, i=1,2,3,\ldots,n$.

Proof: It is obvious that $H_\alpha^\beta (P; U)$ is a symmetric function on every $p_i, i=1,2,3,\ldots,n$, i.e., $H_\alpha^\beta (p_1 u_1, p_2 u_2, \ldots, p_{n-1} u_{n-1}, p_n u_n) = H_\alpha^\beta (p_n u_n, p_1 u_1, p_2 u_2, \ldots, p_{n-1} u_{n-1})$.

Property 6.3: $H_\alpha^\beta (P; U)$ is maximum when all the events have equal probabilities.
Characterization of New Two Parametric

Property 6.4: $H^\theta_\alpha(P; U)$ satisfies the additivity of the following form:

$$H^\theta_\alpha(P * Q; U) = H^\theta_\alpha(P; U) + H^\theta_\alpha(Q; U)$$

Where $(P * Q; U) = (p_1 q_1, ..., p_n q_m, p_2 q_1, ..., p_n q_m, ..., p_n q_1, ..., p_n q_m; U)$

Proof: Let $H^\theta_\alpha(P * Q; U) = H^\theta_\alpha(P; U) + H^\theta_\alpha(Q; U)$

Taking R.H.S= $H^\theta_\alpha(P; U) + H^\theta_\alpha(Q; U)$

$$= \frac{\beta}{1-\alpha} \log \left( \frac{\sum_{i=1}^{\alpha} u_i p_i^\theta}{\sum_{i=1}^{\alpha} u_i} \right) + \frac{\beta}{1-\alpha} \log \left( \frac{\sum_{i=1}^{\alpha} u_i q_i^\theta}{\sum_{i=1}^{\alpha} u_i} \right)$$

$$= \frac{\beta}{1-\alpha} \log \left( \frac{\sum_{i=1}^{\alpha} u_i p_i^\theta}{\sum_{i=1}^{\alpha} u_i} \right) + \frac{\beta}{1-\alpha} \log \left( \frac{\sum_{i=1}^{\alpha} u_i q_i^\theta}{\sum_{i=1}^{\alpha} u_i} \right)$$

Since the second derivative of $H^\theta_\alpha(P; U)$ with respect to $p_i$ is negative on given interval $p_i \epsilon [0,1], i = 1,2, ..., n$, as $\beta = 1, \alpha \rightarrow 1, u_i = 1, \forall i = 1,2, ..., n$, i.e., when the utility aspect is ignored, and $\sum_{i=1}^{\alpha} p_i = 1$, therefore,

$$H^\theta_\alpha(P; U)$$

7. CONCLUSION

In this paper we define a new two parametric generalized ‘useful’ entropy measure, i.e., $H^\theta_\alpha(P; U)$. This measure also generalizes some well-known information measures already existing in the literature of ‘useful’ information theory. Also we define a new two parametric generalized ‘useful’ code-word mean lengths, i.e., $L^\theta_\alpha(P; U)$ corresponding to $H^\theta_\alpha(P; U)$, and then we characterize $L^\theta_\alpha(P; U)$ in terms of $H^\theta_\alpha(P; U)$ and showed that

$$H^\theta_\alpha(P; U) \leq L^\theta_\alpha(P; U) + \beta.$$

where $0 < \alpha < 1, 0 < \beta \leq 1$

Further we have established the noiseless coding theorems proved in this paper with the help of two different techniques by taking experimental data and showed that Huffman coding scheme is more efficient than Shannon-Fano coding scheme. We have also studied the monotonic behavior of $H^\theta_\alpha(P; U)$ with respect to parameters $\alpha$ and $\beta$. The important properties of $H^\theta_\alpha(P; U)$ have also been studied.

REFERENCES

Belis, M., & Guisau S. (1968). A quantitative-qualitative


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**Fig. 1** Distribution of Authors Over Publication Count

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<th>Time Period Study</th>
<th>Data</th>
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<td>Reeves[a (2002)</td>
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<td>597 papers in 3 SSCI journals</td>
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<td>Jones &amp; Wilson[b (2011)</td>
<td>2000 - 2009</td>
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