4.1. Introduction

"The problems are solved, not by giving new information, but by arranging what we have known since long.” This famous quote from Ludwig Wittgenstein fits well with today’s scenario of information overload. With the rapid growth in Information and Communication Technology, the information which was before exclusive to the organisations occupied in traditional business is now in digital form, thus being accessible and available to many by means of a range of electronic services in a variety of contexts and formats. It is imperative to organise the data effectively and furthermore realize whether the information is valuable and relevant. The reliability of the information will affect the decision making at all levels of management in the organisation. The primary concern for the organisations, nowadays, is to devise new methods to make the contextual information, which is relevant, available to the user well in time. Information Architecture (IA) is a field adding to the objective of finding necessary information, by providing a comprehensive view on the information flow within an enterprise. It aims to sort through the abundance of information available on every subject, and design the techniques to make it understandable. It makes use of Information Access techniques to meet its goal of organizing the information logically such that the goals of findability and usability are achieved.

There has been a tremendous growth in digital technologies over the last few decades. Education sector is no bar to this development. Higher education institutions have built digital campus to enrich the teaching and learning environment by means of good technical and support facilities. Each application system has separate processes, resulting in barriers in communication and collaborations amongst departments, thus creating information silos. The information and the processes can be integrated seamlessly to build a system which is more effective in terms of accessibility, availability, security and communication and ease for the users.
Digitization of higher education systems in India is still in the nascent stages. Thus IA of a typical Indian University is selected for the study. Research publication is one of the primary processes of the University which needs to be worked upon and is undertaken for our proposed algorithm IIARGA. The existing IA supporting Research Publications of University (IARPU) requires improvement in the areas of search and access of information related to publications done in-house.

This chapter is organised as follows: Section 4.2 defines the Information Architecture. Section 4.3 and 4.4 reflects upon evolution of Information Architecture, how it gained importance and the components of IA, search being one of the major components. Next section 4.5 talks about IA development process in context of IARPU. Section 4.6 is devoted to IA taken up for the present study i.e. IARPU. The Information Architecture of a typical Indian University is discussed and its dataset used for experimentation is discussed. The last section summarises the concepts covered in this chapter.

4.2. Information Architecture

Information architecture forms a significant part of Information Technology (IT) architecture. Several authors have emphasised upon the significance of the magnitude of Data or Information Architecture within IT architecture. IA has been considered as a valuable tool for Information Systems (IS) planning and implementation, specifically for the organisations using information technology as a key instrument (Pai, 2005). Earl (1993) highlighted the importance of strategic management of IT and segmented the field into three domains: Information Technology, Information Systems and Information Management. He highlighted the term architecture in context of four domains of the IT framework: "Computing, Communications, Data and Applications". On similar grounds, different agencies have expressed IT architecture into a number of domains (The Open Group, 2008; Capgemini, 2008; IBM, 2009), wherein Information domain is a primary domain.

The Information Architecture Institute (IAI, 2007) has defined Information architecture as (1) "the structural design of shared information environments" and (2) a community of practice concentrated on conveying principles of design and
architecture to the digital landscape. "IA is a sophisticated map of the information requirements of an organisation. It is a personnel, organisational and technology independent profile of the major information categories used within an enterprise." (Dickson and Wetherbe, 1985). The goal of information architecture is to enable the provisioning of right information in appropriate context to the stakeholders who need it. It provides a mechanism to map the information needs of an organisation, relate them to specific business needs and document their interrelationships.

### 4.3. Evolution of Information Architecture

The simplest definition of Information Architecture is “a process for describing and classifying information. It is the art of expressing a concept or a model of information used in activities that require explicit details of complex systems”. It is made up of two words – “information” and “architecture”. Information is the data which is specific and organised for a particular objective and is presented within a context that makes it meaningful and relevant. Architecture is "the art and science of designing and constructing buildings and other physical structures. It is both the process and product of planning, designing and constructing form." The term architecture, in reference to information technology, refers to the task of system designing. It is a formal description of a system encompassing a detailed framework at the module level which helps in the implementation of the system.

In early times, using computers was considered to be a domain of experts. Internet, in its childhood days, was relatively limited and was largely used by academicians & researchers. Then the web emerged, acting as a catalyst to transform Internet radically (Hinton, 2009). The growth of Web as a global platform resulted in digitisation of information. The pervasive platform has facilitated the user to interact more freely with the digital information. The augmentation of data has led to an amalgam of information and documents over the web. This information overload has also resulted in greater complexities and loss of control over information. Another challenge being faced by the organisations is how to direct people through the huge information base to access what they want in a timely manner. Thus it has become a great necessity to organise this vast data in a manner that it is easily & effectively accessible by the user, according to his needs and demands. Apart from
findability, usability is yet another issue as the user should be able to use the information for his purpose. An Effective Information Architecture is vital to an enterprise as well as a web based system, resulting in high user experience and realization of the goals of findability and usability.

4.4. Components of IA

An IA component is that part of an information system which takes the users nearer to the content. The IA components can be categorised into four broad categories on the basis of structure of information (Morville and Rosenfeld, 2006):

- **Organisation Systems**: the way to classify information (e.g., subject-wise, chronological).
- **Labeling Systems**: the way to mark the information (e.g., scientific term ("Allium") or common terminology ("onion").
- **Navigation Systems**: the way to browse through information (e.g., clicking through a hierarchy or moving directly).
- **Search Systems**: the way to search information (e.g., executing a search query).

Another method of classifying information architecture components based on exploration of desired information is comprised of (Morville and Rosenfeld, 2006): **Browsing Aids**: A predetermined set of paths presented to the users, in order to assist them in traversing through the system, which include organization systems, navigation systems, sitemaps, etc.

- **Search Aids**: These are usually automated equivalents of browsing aids, which display a customised set of results in response to a user-defined query. These include search interface, query language, query builders, retrieval algorithms, and search results.
- **Content and tasks**: These are the embedded components, like headings, embedded links, and embedded metadata that helps in directing users to their destinations.
- **Invisible Components**: "Certain key architectural components are manifest completely in the background; users rarely interact with them. These components often help other components, such as a thesaurus that is used to enhance a search query".
Figure 4.1 shows the categorisation of IA components done on the basis of structure and exploration of information.

![IA Components Diagram](image)

**Figure 4.1: Components of Information Architecture**

Search Systems or Information Organisation and Access (IOA) form an integral component of IA, as access to relevant information is a primary concern (AIIM, 2008; Downey and Banerjee, 2011). Morville and Rosenfeld (2006) emphasised upon the significance of Searching systems as an integral part, as depicted through the following diagram (Figure 4.2).

![Information Architecture Systems Diagram](image)

**Figure 4.2: Information Architecture Systems (Morville and Rosenfeld, 2006)**
4.5. IA Development Process

Information architecture aims at the development of structures that facilitate the flow of useful and relevant information to the user. The organisations are mostly ‘data rich but information poor’ as they lag in accessing useful information from the billions of gigabytes accumulated every day. The problem of information overload could be minimised by developing an effective information architecture, which provides a suitable framework for the information strategy of an organisation.

Researchers have proposed several approaches to build efficient access and retrieval techniques for IA of enterprises. The studies have evolved to handle larger volumes and complexities of information catering to specific enterprises and domains. This study of information access is done to propose solution for recall and precision related IR problems. Time and space being critical constraints, it is indispensible to provide a mechanism to locate and retrieve required information quickly and to avoid information overload. By alleviating information bottleneck, this research helps users with the problem of information access and retrieval on the studied Information Architecture IARPU.

It is of utmost importance to create effective information architecture, so that the user can appreciate the efforts done by the designers and experience a joyful ride into the system. It facilitates the user of the system to step logically into the system convinced that they are getting closer to the required information (Barker, 2005). It can guide in organizing a large amount of information to provide an optimal user experience. Effective information architecture is built by identifying the business goals and constraints, the structure of the content, and the information requirements of the users of the system. Figure 4.3 presents a pictorial representation of the inputs for IARPU.
The goal of the system is to present the user with research documents corresponding to their information needs. The content represents the abstracts from conference or workshops, journal articles, project reports and similar documents. The user are the faculty members, staff, research scholars and students of the University seeking for the information related to research publications.

Figure 4.4 presents the steps to develop an effective IA or improve the effectiveness of existing one. The development process broadly encompasses five steps. The first step is to define the purpose or goals and objectives for the system. The improvements suggested in the existing IA to improve its information content organisation, include the development of searching feature as one of the major tasks. The next step is to define system users. To be effective, IA should reflect the way people think. It is essential that the user is involved in creation of information architecture. The intended users of the IARPU are identified as the faculty members, staff, research scholars and students of the University. The next phase is to decide upon the content – both functionality and information. According to the searching needs of the users, the content or the document categories has been decided. The abstracts from conferences or workshops organised by the University, journal articles and similar documents are considered as the content for IARPU. Then the system’s structure is decided, which is the foundation on which other elements are constructed. In case of web site, the last step is to create an effective visual design which helps the users to create a mental sketch of the system.
Figure 4.4: Steps to develop an Effective IA
4.6. **Modeling Information Architecture of a Typical University: IARPU**

There has been rapid advancements in the digital technologies of educational campus systems. With continuous informationization in higher education, there has been an increase in applications related to teaching, research, management and service. The huge amount of data produced by different processes needs to be managed effectively. The digital campus construction resulted in problems related to sharing and usage of data, integration of application systems and user management (Zhang and Chen, 2011).

The University encompasses a plethora of applications and processes. There was a need for a single platform for data exchange and delivery of information resources. This study focuses on one of the division of the University: research. Research is an integral part of any University. The University promotes research by organizing events like workshops, seminars, symposiums, conferences, etc. Such events can significantly help to create a solid intellectual and philosophical foundation for the field of interest. Papers related to the ongoing research in the field are invited, and selected papers are published in form of proceedings of the conference or in University journal.

This data may be used by the University to invite papers for conferences, journals, tie-ups for joint research in common areas; research scholars may use it for accessing relevant research information, for gaining knowledge about the subject and for finding the author for further discussion. The user may wish to search for internal documents or publications related to a subject from the abstracts database of University conferences and journals to help them gather information on a certain topic produced by their predecessors. These documents would help them as valuable introductory reading which saves time on researching a topic themselves and for carrying the research further. It will assist the students in undertaking project which is unique in nature and help the faculty which have the responsibility of generating new and innovative projects by giving them easy access to previous and current interns thesis work, research assignment’s, fact sheets, etc.
The existing IA lacked in qualitative searching of in-house publications of the University on a common platform. The existing searching solution is time-consuming and inefficient, as different relevant documents may be present at different locations and formats. Thus accessing as well as recovering relevant information becomes a difficult task. Also, this information in digital form is not available at a central location, thus creating information silos. Thus IA of the research division should be such that provides an easy and effective access to all the research papers published by that organisation to the researchers, students and faculty members. The searching feature needs to be developed for a better user experience, which would enable the student and teacher to achieve required information from the developed system. The retrieval system should be effective enough to retrieve relevant documents pertaining to users’ information needs. The focus should be on improving the success rate of query systems by developing highly focused search algorithms customized on the basis of academic specialties.

The document collection was built by collecting the abstracts of the papers received by authors across the country in conferences held by the University in past and from the journal publications of the university. A subset of the complete University’s database of the abstracts is collected for this research study, for which prior permission was sought. The test collection consists of a collection of documents, set of example information requests, and a set of relevant documents for each example information request. The prepared dataset XRR (Extendable Research Repository) contains abstracts from the field of Computer science and Management. A set of queries were framed to seek documents from the prepared data collection. Also, a relevance judgments file was prepared which contain information about the documents relevant to the respective queries. These documents are stored and whenever there is a need, a valid candidate needs to be searched from these documents collection. The query framed may not always return good results. IIARGA helps in improving the results set and return more of relevant documents, thus helping the user to attain satisfaction in the search system.
4.7. Summary

IA plays a significant role in the development of information system. It provides proactive basis for information system development, in order to have a framework for developmental planning & better functionality. It proves beneficial at all levels of management because development of IA reduces cost of collecting, searching, retrieving and maintaining data in long term. Due to changing nature of organisations and growing expectations of the user, it is necessary that the information be organised in such a way that users are facilitated with easy access to information of their interest. An Effective Information Architecture is important to the user of an information System for achievement of his information seeking goals. It establishes an effective dialogue between the user and the system that leads to access of required information effectively and efficiently. This study focuses on building an effective Information Architecture of a typical Indian University by enhancing its searching system related to research division. The Information Architecture (IARPU) under consideration comprises of the data pertaining to abstracts of conferences, seminars, workshops organized by the University and the abstracts of the research papers being published in the journal of the University. These documents would act as valuable introductory reading which saves time on researching a topic themselves, to consult the concerned author and for carrying the research further. The algorithm IIARGA is developed with an aim to improve the retrieval process for the document database of IARPU, resulting in increased satisfaction level of the users of IARPU.