SCHOOL INFORMATION MANAGEMENT

Challenges of designing MyST - My School Tool

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ABSTRACT

During our project on Communities, Technology and Participation we chose to study School Information Management as an important means of understanding how the community cancollaborate, with one another and with us, to define and implement their technology needs. The communities of interest are groups of teachers, school officials, monitoring agencies and the software development interest group. The report below describes in the requirements of data and work flow managements in schools, highlights the key issues in the use and development of a system in creating an environment of participative application development for a community for their data management needs. In summarising our findings, we observe that while there is sufficient commonality between schools in terms of the data and work flow processes, any school specific customisation by the school officials is to be encouraged for the schools to feel empowered with such a system. Socio-cultural influences, localization, type and set up of the school and internal dynamics of participative collaboration are various aspects of a schools' “My School Tool”.


1. INTRODUCTION

1.1 Background

Servelots is a web service provider for Small to Medium Enterprises. Founded in 1999 by a group of Computer Scientists, who wanted to provide a cost effective but user friendly software for SME's, our special focus is on the organizations working in the social development sectors. Over the last decade, we have been working on using a home grown software called Pantoto\(^1\), for some of the information organization needs of NGOs and Web portals. A few years ago, Pantoto was used by a group of teachers to configure some of the modules for their school. This lead to Servelots focusing on school information management for teachers. Here we look at the opportunity of developing a software for a wider segment of schools.

Communities, Technology and Participation is a technology and society research project that chose to study school information management and how school governance is influenced by software enabling it. The aspects of e-governance of a school that helps us provide insights on understanding how the community can collaborate, with one another and with us, to define and implement their technology needs. The communities of interest are groups of teachers, school officials, monitoring agencies and the software development interest group. This report describes the requirements of data and work flow managements in schools, highlights the key issues in the use and development of a system in creating an environment of participative application development for a community for their data management needs.

1.2 Objectives

We intended to understand:
- The information management activities at the school level, who the participants are and how the school structure facilitates the information management activity,
- The possibility and capacity at the school level of participating in an exercise of requirements specification for a software that may help with their information management needs.
- The implications of iterative software development based on observations of the software utilization and its general bottom-up process of e-governance at schools.

The understanding of the following are considered essential:
- The whole governance structures of school and higher offices especially in the public education set up which bring out the complexities of data and work flow management and emphasise the pressure points if the system is implemented.
• Determine the school community’s micro-level (individual/isolated) data management needs and issues
• Determine the macro-level or scale of data flow and infrastructural needs.

We were also curious to understand how FOSS process, for sharing the developed software, the requirement specifications and the school specific collaborations, can potentially help in this bottom-up e-governance activity of school information management. In particular, how this approach weighs against any existing proprietary or free, but closed source tools that exist and if it necessarily opens up data management to become more user friendly, develop the sense of ownership and entail participation from all stake holders of the school communities.

1.2 Research Discussion

School Information Management can evoke an understanding of the general need for information management at the school level. Schools are very diverse in their capacities, scale and their needs of engagement with various systems and connected communities. However, school information management implies that it is primarily about the management of its information that is internal to a specific school, such as admission process management and student/staff management. While the schools vary depending on the school system that they belong to, they are likely to be regulated by the policies and monitoring needs of the governing bodies such as the state. The issue of school information management therefore spans a gamut of e-governance structures that can develop comparable-ness to various structural aspects analysable in a general e-governance platform. While most e-governance platforms assume a top-down approach to developing, deploying and delivering services to citizens, it is often in stark contrast to the governance structures that are promoted when technology aspects are not the primary criteria. A debate, therefore, has attempted to discuss and bring forth these issues using various aspects of school information management, which as we said earlier, helps us understand what a bottom-up e-governance platform development can mean.

See Appendix A1 for a discussion based on both available literature and practices, that are familiar from our context, of technology at schools and technology at e-governance.

Our work was motivated by this debate and our earlier work at CHIREC. We intended to iteratively deploy MyST and observe the feedback on technology inputs in this process. This objective was rudely interrupted by an inordinate delay in iteratively deploying the software due to software developer attrition. We then focused on continuing the discovery of various information management aspects at the schools we were interacting with. This has resulted in developing an understanding of the sophistication of information management at the 3 different types of schools we have interacted with, and the cost implications for their school information management needs.

1.3 Scope
The report derives from our interactions with school authorities - Principals, Teachers, Office staff from two Government run schools in Karnataka, since we also needed to draw on the fact that some previous association or rapport established with the school will help us have uninhibited discussions. We also shared and endorsed our findings and elaborated the discussions with NGOs persons who work closely with larger cluster of similar schools.

Low cost private schools, Residential schools, Schools run by the City Municipal Corporation were not part of the Research target audience. It is however safe to assume that our findings to a significant extent will be applicable in these cases also.

The scope of the actual research could be significantly influenced by the socio-cultural dynamics and hierarchy of governance of school administration, and these influences are also indicators of the resilience and flexibility of such a data management system.

Some of the citations are also drawn from the our prior experiences with private schools within the same context -- our experience of implementing a school information management system on Pantoto for a Hyderabad based privately run school - CHIREC - in the year 2007\textsuperscript{2}. The CHIREC case study particularly focused on the School Admissions Work flow and touched upon the importance of developing a system that is independent of the need of programmers for technical support and maintenance. This ensures collaborative participation in evolving the needs of the community and realizing them without dependencies on a Computer Department or another Team.

1.4 Research Methodology

The initial proposal for this project required that we determine the data management needs from the schools' perspective in prototyping their requirements and iteratively developing a system to suit their needs. Some of the changes to the methodology are owing to these factors:

- Teachers, Principals and Officials have a limited vision for what technology can do in helping data management. This may hinder us from understanding every data process there is in schools.
- We were not able to furnish schools with a working prototype of a Data Management system due to a resources issue.

The report draws from the following research methods being used:

- Questionnaire\textsuperscript{3} to understand the exposure to ICT and how relevant is ICT in schools in the opinion of the research audience.
- Semi Structured interviews
- School Visits to physically see ways and means put to use in data management within schools.
- Tools such as Venn diagrams and Time charts from the tool kit of Participatory Rural Appraisal to understand administrative work flows and scheduling.
• We also have studied the printed guidelines, admission forms, reports to structure our understanding of the functioning of Government schools
• Some citations are from Research published on overlapping topics where due credits have been furnished and some others from our prior experiences with Private schools and the Case Study of CHREC co-authored by TB Dinesh.

2. NOTES FROM SCHOOL INTERVIEWS

In an initial interaction we devised a questionnaire to evoke a one-on-one conversation, one question leading to the next or another, in order to get a realistic view of the interviewee's understanding of technology. The responses were not meant to be collected and categorised in large numbers of responses for statistically drawn conclusions:
All questions in the questionnaire can be categorized under these broad headings:
• An assessment of the available technology infrastructure (computers mainly) in the schools and who benefits from it.
• Understanding the frequency and modes of interaction of students, faculty and administrators with computers
• Gathering the extent of knowledge about the basics and latest in computer technology
• Initiating the interviewee to come up with a list of functions / areas in which technology solutions can make them more productive
• Understanding the day-to-day challenges they face in adopting technology either because of manpower related issues or mind blocks.
• Getting a realistic estimate of their interest and availability for computer training and if any trainings are being conducted already.

A second round of interactions were initiated in the form of semi structured interviews to review existing methods in place and schedules that address the data management requirements of a typical schools. We saw ledgers, forms, registers, tables and charts that are used to capture data and summarise reports. We used this as the basis to help them recognise how a technology intervention in this area could help manage large amounts of data in fairly comfortable manner through a small demonstration with Pantoto.

We interacted with 3 different focus groups to understand Data management needs from each of their perspectives:
• Group 1: Principals and School Teachers
  ○ Ms. Irshat Sultana - Cluster Asst. Education Officer, for a cluster of 16 schools (Government, Municipal and Private) and Vice Principal.
  ○ Principal, Government Primary School Basavanagudi.
  ○ Mr. Keshava , Assistant Head Master, Pandavapura, Bangalore Rural District.
• Group 2: Authorities of linked Education Offices
  ○ Mr. Raju - Cluster Resource Person, for a cluster of 100 Government schools in South Bangalore
○ Block Resource Coordinator, South Bangalore Block.

● Group 3 : NGO representatives
  ○ Gautam John - Associate of the Akshara Foundation, Founder of Pratham books, who has extensively worked with Government schools
  ○ Mr. E.S Ramamurthy - Founder member of Sikshana Foundation, who work on learning level improvements in 40 suburban schools in Bangalore.

We sincerely thank these individuals for their time and support during these discussions.

2.1 Key Findings from our School Interviews

The understanding of technology interventions in this group is fairly limited and they see technology intervention in terms of computer labs where the students are taught the use of computers. Their previous experiences with Government lead programmes such as Mahiti Sindhu and ICT Phases lead them to believe that “computers” (analogous to ICT), while could be used as teaching tools have, in reality, alienated the teaching community from their use. Many of these programmes focus on tutoring kids on the use of applications packaged with Proprietary software. An extensive report on this model and in comparison with the FOSS based approach in the neighbouring state of Kerala has been published by IT for Change4.

The lower primary and primary schools in the state of Karnataka, have a system where the teaching staff have to share the load of administrative reporting along with the Principal of the school. A significant portion of a Teacher’s teaching time - close to 1.5 - 2 hrs in 6 hrs of school work - is spent on administrative functions either directly related to the academic work or the additional reporting that is required from the higher offices.

In a particular High School (N.S Lanes Bangalore) visit, where one person is appointed as a clerical staff person, we realised that the Principal (also an Assistant Officer for a cluster of 8 schools) encouraged preserving data in Excel sheets and sublet some of the clerical entry work to a data entry operator who was monitored by the appointed clerk. The importance of database and recording data in this elementary form has brought about a reasonable amount of efficiency in generating data reports for higher offices. While, this is acknowledged by few individuals, there is a general lack of awareness and training about the use of technology for mundane work flows there by furthering the divide between the teachers community and technology.

It is our observation, while it is not certain that a technology intervention in terms of productivity management can benefit this community or not, it is fairly clear that any redundant reporting based on various demands of the system work flows can be eased through an efficiently managed database of records. Several variations of reports and summaries can be drawn from these databases. However, the teachers who feel motivated to use computers either for their personal or professional learning or as teaching aids are very few. Positioning computers as productivity tools in this case could help create attitudinal changes towards technology as well.

In Summary:
<table>
<thead>
<tr>
<th>GROUP 1</th>
<th>Teachers, Principals</th>
<th>GROUP 2</th>
<th>Administrators, Officials</th>
<th>GROUP 3</th>
<th>NGO representatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Several ICT related initiatives have been implemented in schools with limited or no success. All these programmes however are targeted at students and alienate the teaching community. Positioning the use of technology as a tool for improved productivity may help. Teachers tend to spend 30% of their time on Admin related data management.</td>
<td>Most of the data reported that flows to higher offices are summaries pivoted over school level data records. At some higher offices there is some manual data entry that supports consolidation of reports using a Oracle database through a VB with TOAD front end. A facility of computers if provided is seen as a need of the students.</td>
<td>The scale of data management in the public schooling system is quite overwhelming. The case of admin and academic data management is interesting because content management has many players already. If there are initiatives that help in benefiting from technology, it's highly likely that the last mile is not affected yet.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Detailed blog posts have been linked up to this report[^5][^6][^7][^8].

### 2.2 Key Requirements from our School Interviews

Much of the requirements of data and data flows at higher offices stem from the records that are maintained in their logical sub-division of schools. It has been our understanding from our discussions with various school officials that their preference was that any data management requirements should be addressed from the point of view of the schools.

In one conversation, the official mentions how retrieving individual student records for any kind of surveillance or reporting need would be beneficial. In yet another conversation, an official cited the use of “computers” (in his understanding of technology”) as a means to aid teaching. Thus the vision for the use of computers to address their routine data management issues was limited.

During a particular visit, we recorded the fact that at the Block (an administrative unit consisting of about 100-300 schools) office used an Oracle Database, interfaced with through a software-TOAD and Data Entry operators to summarise the data at a computer facility housed within the school and restricted to official use. This challenged our perception of data management support being pervasive through the system. And leads to the understanding that it is the teaching community that is most affected by the indifference to technology.
NGOs approach technology interventions in schools in different ways. Our criterion in choosing to talk to the above mentions NGO representatives was to understand the issues with scale of data management. The common understanding that the Government School teacher spends a significant amount of time on administrative work was endorsed in these conversations.

Some of the inputs from these discussions lead to the understanding that there are several standard reports and templates for certificates or memos that are used in schools. Some of these would be discussed in the sections below.

Turning to Open source and the Educational Applications particularly in the Edubuntu flavour of Linux as teaching aids and resources, seems to be a trend with more NGO partners of schools sharing their experience with us. The basic use of Open office as a productivity tool for lesson Planning and other small scale exercises has also prompted an interest in FOSS.

An compelling inference from our discussions with the NGO representatives was that the “last mile” : data and work flow management from schools to immediate higher offices can easily be ignored and any effort in benefiting the teaching, school administration communities would be a good initiative. However it is essential to elicit the requirements of a system from them in order to make the effort effective.

In Summary:

<table>
<thead>
<tr>
<th>GROUP 1</th>
<th>GROUP 2</th>
<th>GROUP 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers, Principals</td>
<td>Administrators, Officials</td>
<td>NGO representatives</td>
</tr>
<tr>
<td>A few school authorities currently maintain excel databases of their admissions data with the help of the computer teachers. Scheduling classes and making workable time tables is a significant issue that we choose to study as a case.</td>
<td>The school records are the crux of the data work flows both up and down stream the administrative set up of schools. Officials encourage tracking school level data. School surveillance and inspection needs look up on academic data of students.</td>
<td>Most school level data management flows can be classified into : Admin, Academic or Content Third party interventions with school will warrant that the infrastructure for third party applications. FOSS has become popular with donor NGOs who provide hardware &amp; Internet.</td>
</tr>
</tbody>
</table>

2.3 The CHIREC case study - Citations from a Previous Experience

This case study presents an account of a workshop held at CHIREC, a K12 school
in Hyderabad, India. CHIREC is a progressive school with over 1000 students. Teachers develop structures and processes towards the delivery of effective class room experience for the students. CHIREC is a reasonably affluent private school that employs modern teaching methods and technology. They also have a computer department that supports teachers and students with course material and developing some small applications. Students are well versed with the Internet and most of them have a computer at home.

A few of the students are from outside Hyderabad and some from abroad. We approached this school to see if they would find it interesting to enable a process where the school knowledge - that of the student, teachers, staff inclusive - is pooled into a structured, interactive, and networked space. We studied some of their lesson planning processes and suggested approaches to creating a school knowledge base.

A workshop was organized to introduce the teachers to the system where they could collaboratively develop teaching applications. Upon the realization that they would be building the applications, teachers instead voiced their preference for building applications that have been long overdue from the busy computer department. This was quite an unexpected surprise. The teachers decided to go ahead and build applications during the training workshop. This case indicated to us the need for platforms to build applications, and also as how this direction can enable a whole new generation of software builders who are in the right place within the communities for which they build the software.

The teachers had a need for various software applications: admission process management, library catalogues and checkout information, personnel office that caters to students/teachers and parents needs, web-site management, and such. The collective of all these applications, we learnt, is a good way towards enabling the community of teachers to manage their own knowledge. We can foresee that this experience will help them to continuously develop similar applications for their other evolving needs, including handling of lesson plans and such.

It was impressive to observe school teachers get excited and consider their software needs. Each group built an application in just a few hours. After a server was setup they were able to build, maintain, use and share the software with other relevant parties. In spite of the presence of an in house IT support team at the school, it was evident that this system offered empowerment of teachers and staff. People were able to quickly build applications without the need of the computer professionals. The wait time related to requests as well the appropriate customization seriously hinders such persons from taking part in the development of such applications. The IT department also gets liberated from minor customizations that they may perform incorrectly due to their lack of domain knowledge. More importantly, the bottleneck position of such IT staff is a source of frustration for all parties. By removing them from the cycle when appropriate a more efficient and productive system is achieved.

2.4 Summary as key inferences:
While content for learning or to serve as teaching aids is fairly evolved, it doesn't seem as relevant in the public education environment yet owing to language barriers, motivation of teachers towards the use of technology in classrooms and technology infrastructure that can adapt to classroom environments.

School officials displayed a mediocre level of awareness of technology buzz words and how technology could benefit them when we ran them through a questionnaire.

Our exploration, attested as being appropriate with NGOs partnering with schools, reveals that academic and administrative reporting (marks cards, attendance, admissions data, drop-out data) is only partially automated. While some amount of manual data entry and technology support is provided over proprietary software to middle offices to further reports to higher officials, the last mile reporting from schools to block/ward offices takes away a significant part of a teachers' time in the day. Teachers and School administrators could highly benefit from participating in a content management development platform for their needs.

Despite efforts to train teachers and bring them on board a technology savvy school initiative, attitudinal changes will need to be effected to get this community more deeply involved in the use of a system such as - School Information Management. "Do not provide them with a solution for a problem that they do not think exists" was a word of caution received by us. The School Information management and its configuration has to be done in close interaction with the benefactors.

Language and contextual representation of information and data will be of key importance in managing information for Government run school communities.

Private schools on the other hand are more capable of defining their needs and trying to address them. An content management system in their context should enable them with the flexibility of designing their own means of managing their knowledge.

The third round of visits were to understand the governance and reporting structures within the public schooling system. We employed Venn diagrams and Time Charts from the PRA tool kit and identified the the top data issues at each role to determine the priority of solutions if they were to be addressed.

We present findings of this intervention as a user requirements and design understanding in the next section of this report.
Photos from our school visits:
3. DATA MANAGEMENT IN SCHOOL GOVERNANCE

3.1 Brief Overview of School Governance

In order to have a fair understanding of School Governance we employed methods of the Participatory Rural Appraisal: Venn Diagrams, Time charts and Semi Structured Interviews. The sections below summarise our findings.

3.1.1 Roles and Functions

In the administrative establishment of government schools the various stake holders of information are illustrated in the representation below. The size of the Circle indicates the size of the organization and their importance in the system. A look up for these roles has been provided further below:
<table>
<thead>
<tr>
<th>SDMC</th>
<th>School Development and Monitoring Committee</th>
<th>Parents and Principal come together to improve schools. May call on donors / NGOs to participate</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRP</td>
<td>Cluster Resource Person</td>
<td>Messenger between BRC and School for monitoring Academic Resources/Infrastructure. Typically a cluster consists of 15-20 schools/50-100 teachers. A BLOCK may have about 18 - 25 Clusters/ CRPs</td>
</tr>
<tr>
<td>ECO</td>
<td>Education Coordinator</td>
<td>Coordinator for the office of the BEO and serves as a liaison to collect and communicate administrative data. A Block may have about 5 ECOs each incharge of 5 clusters each.</td>
</tr>
<tr>
<td>BRC</td>
<td>Block Resource Coordinator</td>
<td>Coordinator for Academic functions, monitoring, training and accountability for the Block.</td>
</tr>
<tr>
<td>BEO</td>
<td>Block Education Officer</td>
<td>Coordinator for Administrative functions and monitoring for the Block.</td>
</tr>
<tr>
<td>DDPI</td>
<td>Deputy Director of Public Instruction</td>
<td>The office of this administrative position collates information and archives the same for district.</td>
</tr>
</tbody>
</table>

JDPI - Junior Director of Public Instruction, DPI- Director of Public Instruction and CPI- Commissioner of Public Instruction are administrative positions that link the district office with the State’s Ministry of Education.

The intention of this information is to overwhelm the reader and emphasise on the fact that a highly complicated, multi level, bureaucratic structure such as this may lead to several different work flows and accountability structures. While the school as the entry point of information gathering and hence the most significant unit of data mining and management, the larger picture is necessary to understand the scale of information management.

A system designed to suit these roles requires a great deal of flexibility and cannot have rigid work flow definitions that over time and owing to changes in Admin roles and positions may prove to be more of a hassle than a productivity tool.

**3.1.2 Forms, Templates and Workflows**

School Information Management may broadly have three categories of functions:
- Content: the learning material and the function of teaching
- Academic: generally related to assessment of learning, regularity, attendance
- Administrative (Admin): a broad category encompassing various functions of schools.

Here’s a representation of the potential interactions of various user roles with these three functions.

A typical Government school’s annual calendar as prescribed by the Sarva Sikshana Abhiyana (A governing body on curriculum and policy of education for India’s education) appears as below. Note how different activities have been classified under these three headings:

<table>
<thead>
<tr>
<th>Month</th>
<th>Activity</th>
<th>Data dependencies</th>
</tr>
</thead>
</table>
| June  | - Enrollment Drive  
|       | - Distribution of Textbooks, Uniforms  
|       | - Pretest  
|       | - Lesson Planning and Teaching begins | Admissions Data (Admin)  
|       |                                       | Data for Logistics and numbers on distribution (Admin)  
|       |                                       | Preparing Test Papers & Lesson Planning (Content), Scheduling Time tables and class scheduling (Academic) |
| July  | - Remedial Classes  
|       | - 1st Test  
|       | - Teachers Learning Material | Class Scheduling (Academic)  
|       |                                       | Preparation of Test Papers (Content)  
|       |                                       | Creating Learning aids (Content)  
|       |                                       | Evaluation and Tabulation (Academic) |
| Aug   | - Taluk & District Sports Meet  
|       | - Independence Day Celebration  
|       | - Health check up | Data of names and schedule of events upstream and downstream (Admin) |
| Sept  | - Teacher’s Day Celebration  
|       | - World Literacy Day  
|       | - Metric Mela (Teaching Aids) | Organising events (Admin)  
<p>|       |                                       | Teaching Aid Preparations and Celebrating Sir M. Vishveshwariah Day (Content) |</p>
<table>
<thead>
<tr>
<th>Month</th>
<th>Events</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct</td>
<td>Samudaya Datta Shaale, Holidays, SDMC Meeting</td>
<td>Review of Progress of school by Mentors, School Officials and Community. Function held in school at the end of the review. (Admin and Academic) Meeting coordination and review(Admin)</td>
</tr>
<tr>
<td>Nov</td>
<td>Rajyotsava Celebration, Talents Day - Cluster and Taluk level, Metric Mela - Block Level Science Exhibition</td>
<td>Logistics, names and preparation for events (Admin) Metric Mela and Science Exhibition(Content)</td>
</tr>
<tr>
<td>Dec</td>
<td>World Handicap Day, Farmer’s day, Human Rights Day, District level Talents Day, 2nd Test, Metric Mela - District Level, Science Exhibition - District Level, Annual Day</td>
<td>Logistics and organisation of events (Admin) Information on Special Days (Content) Preparation of Test (Content) Administering Test (Academic) Evaluation and Tabulation (Academic)</td>
</tr>
<tr>
<td>Jan</td>
<td>Swami Vivekananda Day, World Youth Day, SC Bose’s Birthday, Republic Day, Martyr’s Day, Children’s census in the nearby community (CPE: Compulsory School Education)</td>
<td>Information on Special days (Content) Reporting on census (Admin)</td>
</tr>
<tr>
<td>Feb</td>
<td>Metric Mela - State level, Talent’s day - State level, Science Exhibition</td>
<td>Logistics and organisation of events (Admin) Metric Mela &amp; Science Exhibition(Content)</td>
</tr>
<tr>
<td>Mar</td>
<td>Women’s Day, 2nd Sem Exams Preparations, 2nd Sem Exams</td>
<td>Information on special days &amp; Preparation of Test (Content) Administering Test (Academic)</td>
</tr>
<tr>
<td>Apr</td>
<td>Evaluation, 2nd Samudaya Datta Shaale</td>
<td>Evaluation and Tabulation (Academic)</td>
</tr>
<tr>
<td>May</td>
<td>First SDMC Meeting</td>
<td>Meeting coordination and review (Admin)</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Consolidation of last year’s students’ data</td>
<td>Consolidation of last year’s students’ data (Admin)</td>
</tr>
</tbody>
</table>

In addition to this table, here was a classification we understood from our interviews with the above mentioned participants:

Content as a function can comprise of any activity that is associated with Teaching or in aid of teaching.

Admin function associated with the role of the office comprises of:

- Maintaining a general register of all admitted students. This serves as a master table for generating a variety of certificates off a pre-defined templates for - Transfer Certificates (TCs), School Leaving Certificate, DOB Certificates, Caste Certificates, Character certificates.
- Records of Teacher attendance, DISE reports, Assets registers, Salaries and Grades/levels. Teacher transfer, Asset transfer, Book transfer, Children transfer information.

Academic function that would involve both the roles of Teachers and Principal

- Records of student attendance
- Records of Marks and report cards
- Audit trails of marks (by HM)
- Time tables and scheduling classes and exams.

While trying to design such a system, it is perhaps better to break out of rigid structures and denote the three boxes - content, academic and admin in a fuzzy manner as below:

There is a significant overlap in academic and admin activities and content, although structured by curriculum, is largely dependent on the abilities of teachers and students to develop and share.

3.1.3 Relationships within the governance structure

A simplified visualisation of the Governance structure spoken about in Section 3.1.1 can be as
represented below. The school is the smallest unit of the administrative complexity and yet is so evolved and complex in itself. In trying to understand administration from within the schools, it is important to know the key stake holders in the schooling system and the nature, load of information exchange happening among them.

The role of the principal / head master is considered to be a critical one, since he/she is required to orchestrate the functioning of the school. It has been cited that the success of a school in every sense depends on how responsible a Principal, especially in the Government school environment is. The diagram below goes to emphasise that the role of the principal is pivotal in the scheme of Administrative Data work flows.

Among the guiding principles of good governance if Participation, Accountability and Transparency were to be considered, the above relationship diagram reveals Participation in terms of the extent of intersection between two stake holders. But accountability and transparency between school authorities (Teachers, Principal) and schooling communities (Parents, School Development and Monitoring Committee, Students), also between school authorities and higher offices (Block Education Office, Block Resource Coordinator, Cluster Resource Person. Education Coordinator) are harder parameters to weigh these relationships by. A few generic observations can be made:

School Authorities with Schooling communities: Much of the initiative for accountability or transparency of information (academic and administrative) has to be driven by school authorities in the Government school scenario. In several cases, the parents usually come from economically poor backgrounds and usually are focused on making ends meet and depend on the schooling system to take care of educating their children, with little or no literacy themselves. School Development and Monitoring committees are comprised of parents (usually influential representatives of the community) and school authorities. In a large numbers of
instances, the SDMC is either dysfunctional or dotted with community politics.

In contrast, private schooling systems need to show high accountability, since the economics of private schooling is based on the fact that “paying for a service drives accountability”

Transparency on both accounts is intimidating to school authorities. From our experience at Chirec and with Governmental organisations (also other than schools) Data systems that are based on the need for bringing in transparency maybe resisted as against flexible systems that allow easy data manipulation and representations.

3.2 Technology Perspective

3.2.1 Scale of Data Management

If the scale of data management be isolated on a per school basis and be an internal system meant to aid school officials provide reports and data in mandated formats, then the scale of the system seems reasonable and manageable. This is one means of implementation.

However, as in the case of government schooling system where schools aggregate into administrative units and consolidation of data and aggregated reporting is required frequently the scale of this system in terms of - number of data records, number of users, number of possible work flows, access control - may seem highly overwhelming.

In case the first of the two methods be adopted, data consistency and integrity become an important consideration at a point of aggregation since ensuring each individual data management system adheres to standard data formats and representations will be required.

From Sarva Sikshana Abhiyana’s (SSAs) last published annual report (2006-2007)\(^\text{10}\) we see there are 47806 government schools in Karnataka with an enrollment of about 87 lac students and about 1.7 lac teachers, aside from the data on Private- aided, unaided and Other schools. Aggregation of data, in ways that are technology devoid, or even produce a report such as this is a huge effort and evidently can’t be updated easily, every year.

3.2.2 Abstraction vs. Customization

The situation that schools tend to function as isolated organisations merely adhering to the guiding principles of curriculum and scheduling, leads to thinking that each school would need a customised data and work flow management system. This also ties in with the comfort of not having a transparent system that would necessitate providing every bit of information.

Technologists tend to design to build transparent systems. They abstract common data and work flow management solutions to provide “one solution for all” and avoid or minimise customization to the extent possible. The reason for this is also because every cycle of
customisation has cost implications that product companies would be unwilling to bear.

The key to providing a useful solution to the problems of data flow management would lie in balancing the tendency of abstraction with the need for customization, an act that is certainly complex and difficult to achieve.

3.2.3 Time Table management - Case Study

From a pure requirements point of view this school module makes a very complex case.

- In a typical Government High School there are 4 core subjects – Maths, Science, Social Studies, English. Kannada and a third language are also taught.
- The core subjects get 5 hours a week, Kannada is taught for 6 hours and the third languages for 4 hours in a week. 3 hours of PT, 2 hours of Art and 2 hours of computer education are a requirement as well
- This is true for all the three grades in high school. With typical teacher student ratios of 1:50.
- Maths, Science and Kannada must be taught in the early hours of the day and no teacher is allotted more than 5 teaching hours in a day or 3 continuous hours of teaching.

Likewise Middle/ Primary schools - Private or Government run are likely to have their own constraints on a system to design time tables.

What makes the design considerations for this module interesting is socio-cultural dynamics that affect such scheduling. Unscheduled holidays, Strikes, Festivals, Teachers unwilling to take up last periods, etc tend to make the scheduling go haywire with the expectation that a Teacher with a leisure period fill in for the absentee, teacher absenteeism continuing to being a problem.

3.3 Key findings

To summarise our understanding of data management of schools given their governance structures:

- A school is a basic administrative unit for data and work flow management.
- School level functions can largely be classified into content, academic or administrative.
- Various stake holders, roles, users, work flows, reporting requirements and access control needs may be determined via detailed analysis.
- Design of a data management system for schools could either be a federated model of isolated systems or a scalable load balanced unique system, either of which come with their own set of implementation challenges.
- A balancing act between abstracted common system for all schools vs. customized systems on a case on case basis would be necessary
4. DESIGN CHALLENGES

4.1 Scale

The scale of the data management system, in the public schooling context, if an integration across the state is required is massive and complex. Robust database design and flexible data structures are key to this design.

Even making the design choice comes with its set of challenges as discussed in section 3.2.1

4.2 Infrastructure

A vast majority of schools (especially government run schools) lack the necessary Infrastructure – hardware, Internet connectivity to create a collaborative network of data hoarding and sharing. Establishing an administrative system would warrant providing for the infrastructure to start with.

4.3 Accessibility

Many government school teachers who are products of the same system are more conversant with the language of instruction i.e., the vernacular language of the state.

Most written literature : guides, forms and templates in Karnataka, are in Kannada and are currently easily accessible to school staff. Any system that would intend to replace the paper based approach must provide language support as a basic accessibility need.

4.4 Open Source paradigm

From our discussions with NGOs (ITfC and Sikshana), we understand that many initiatives are now underway to expose schooling communities to Open Source Software and especially the range of education applications that are packaged with desktop installations.

The possibilities of Open Source Software approach (in Kerala) largely discussed in comparison with proprietary software approach (in Karnataka) leads us to believe in the possibilities of exploring Open source implementations for Data management as well.

While Moodle and School Tool are potential examples for schooling communities embracing open source, the challenge lies in designing a user-configurable system that eliminates the frustrating dependencies on corporations or developer communities.
4.5 Last mile support and services

In all our discussions with NGO representatives, an emphasis was given to the fact that a system that the school does not see as useful will never be used: “Give them what they need and not what you think they need.”

Building a network to support a large intervention of data management systems in schools especially if we want to manage the State Education governance would mean a very large operation in terms of human resources and costs. A decision on scale and feasibility would have to account for minimal Technology support and intervention that would be needed from time to time, especially given the last mile could be a remote village, thousands of miles away from a comfortable developer’s nest. Empowering the last mile with a system would be possible only with sufficient intervention and training.

4.6 Assumptions

This technology intervention when discussed among peer groups, evokes the scepticism of whether teachers, principals, officials have the capability to see benefits or to benefit from a data management system.

We have set aside this scepticism in the above discussions.

We also assume that such a user-configurable system will be able to manage changes within the system seamlessly. However, a field test may have us see things differently.

4.7 Recommendations

With the backdrop that has evolved over this discussion on school governance with a technology perspective, we can provide these recommendations:

- There is probably only a certain level of abstraction that works well in this variation of information management. Any system designed for schools needs to be flexible enough to allow work-arounds and customization and also manage free-flow-data. OODBMS vs. RDBMS to approach database design may be an important consideration.
- User roles and Access control is an important aspect of data management and necessary in closed and small environments such as a school and to ensure faith in the system.
- Role based interfaces need to be carefully defined given such a system will tend to have a large number of work flows and some redundant data.
- Data entry, aggregation/reporting and search should be optimised based on memory of previous inputs to reduce the possibilities of error as far as possible.
- A requirement of this system would be that it should be user configure-able to the extent possible to avoid the frustrating dependencies on IT support.
• In the light of the above point, whether a closed source approach with a commendable level of service and support or an open source approach with greater community involvement, would make better sense, is an important design consideration.

5. CONCLUSIONS

We intended to understand:

• The information management activities at the school level, who the participants are and how the school structure facilitates the information management activity,
• The possibility and capacity at the school level of participating in an exercise of requirements specification for a software that may help with their information management needs.
• The implications of iterative software development based on observations of the software utilization and its general bottom-up process of e-governance at schools. (However, we could not satisfactorily observe this significant aspect for the reasons explained in the report.)

Our observations that summarize the report are:

The information management in public schools are significantly different than in private schools when it comes to the nature of information and the need to manage it. Teachers at public schools are asked to provide reports to the governing officers using a standardized form. Their concern is often about preparing the expected information and submitting the form. Teachers at private schools on the other hand are concerned about using information management for making their every day work more efficient. This makes them more pro-active in specifying the various work-flows and the nature of information pertaining to the activities they are in charge.

The information management skill at private schools versus public schools appear to be significantly different. The computers in public schools are mostly used for training students and the teachers often use paper forms for their everyday information management needs. Private school teachers often use computers for school information management. Teachers using computers and software for information management can be considered as an indication of the infrastructure cost of customization.

Infrastructure and cost of customization

Private schools buy school management software. Often the software buying process involves selecting software from a number of vendors based on affordability and appropriateness of the software for the school's information management needs. Public schools are given information management needs. Although this indicates the nature of initial cost as high for
private schools, when compared to that for public schools, over time we can observe that the information management infrastructure is better at private schools compared to the public schools. And better infrastructure significantly reduces software configuration, maintenance and adaptability while increasing the active participation of teachers in the information management process. Information management software for schools need to cater to micro-level information management needs of teachers, while making it easy to configure reports to higher officers, using standardized forms.

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APPENDIX

A1 Research Questions and Existing Literature

The following is a review of relevant literature and state of development pertaining to the aspects such as e-governance, technology impetus and the market economy, the evolution of the technologies and the culture of learning, and the nature of engagement with and by the several communities of concern.

Technological determinism

[Wikipedia] describes the use of technology on a society, rather than technology being socially conditioned or produced because that society organizes itself to support and further develop a technology once it has been introduced as Technology Determinism.

that the introduction of ICT in schools has repeatedly been pushed forward by different groups outside the school (representatives of computer or network companies, politicians narrowly interested in economic growth etc). Many times it is seen as self-evident that the schools should adapt to the technology rather than the opposite. To see technology as ‘socially constructed’ might facilitate opening up the debate and bringing the discussion of ICT in schools back to the broader political and pedagogical arena: “that the design and adaptation of technology should be part of the political agenda”

Regarding Political agenda and open source, we have the Kerala schools example - although not regarding the school information management - where 25000 schools started using open source software for education at schools.

Evolution of understanding of the utility of ICT is a consequence of technology available in the communities of interest. More over the approach to e-governance appears to impose a parallel structure almost as a necessity, as the availability of technology in society is behind compared to the technology hype among the e-governance deployment enthusiasts. Raman and Bawa discuss the manifestation of socio-political restructuring through e-governance programs for general citizen services (not school related services).

[RZ2010 Interacting with the State via Information Technologies by Dr. Bhuvaneswari Raman and Zainab Bawa]

Government institutions are embedded in social relations in that cooperation, rule adherence, decision-making and maintenance of order take place through what Francis Cleaver suggests
as “the practical adaptations of customs, norms and the stimulus of everyday interactions” (2001: 42). Interactions and relationships between the state and citizens are also mediated by middlemen, government functionaries, elected representatives and networks and are shaped by cultural mores, social norms and conventions (Singerman, 1995).

When ICTs are introduced in governance, technology gets situated and rooted in a wider socio-political context. Pierre Rossel and Mathias Finger (2007) argue for conceptualizing e-governance as a phenomenon of co-production of technology and the state. We extend this proposition further and suggest that forms of embeddedness of both state in society and technology in the state mutually influence the outcomes of e-governance initiatives.

Go beyond the pedagogic deficit

Vasai, et al., ask that larger information management systems be reformed and suggest that information seeking is not information management.

[THE FUNCTIONING OF SELECT ELEMENTARY SCHOOLS IN CHAMARAJNAGAR DISTRICT by Vasavi, et al] report on the elementary schools in an under-developed district asks to reform the larger information management system associated with the school system in order to go beyond the “pedagogic deficit” associated with schools and teachers.

For one, the strongest link which is based on a hierarchical demand is that of teachers having to be accountable to the department primarily in terms of providing data linked to ‘supply side’ dimensions of the education system, and to showing up for meetings or trainings organized by the department. Such data generation is not only time consuming but is also not fully reliable and is not used by teachers or local level systems. Secondly, such data-focused accountability overlooks the need to have teachers accountable for the functioning of schools

There are two things we can read from this: 1. that a system that necessitates information will encourage a system that generates information, and 2. that the teachers cannot be looked at as reliable information providers about their schools even as they are displaced from their traditional social system that respect teacher communities.

Work reshapes everyday

[Learning loss and the education bureaucracy, the indiatogether.org article by A R Vasavi and Rahul Mukhopadhyay] discuss the scenario where the government school system is not a rationally driven and coherent apparatus of state policy. Instead, they say that its everyday work is continuously and varyingly reshaped in the light of social, institutional, and policy related inflections.

For one, although promoted on rules and regulations that are stipulated and based on the delivery of standardised text-books, curricula and rules of functioning, most schools are not
total institutions which closely resemble each other. Rather, each school and its functioning and character are defined by the location in which it is situated and by the agency of the Headmaster/mistress (HM) who runs it. Rather than being rule-governed institutions, schools function by the efforts and interests of different types of HMs; interested, dedicated and sincere HMs develop and sustain good and effective schools despite the structural problems that beset many (problems of access, inadequate teachers, inadequate infrastructure, burden of administration etc). ... the excessive but poorly designed teacher training courses which leave little room for developing independent teaching methods, the multiple programmes that teachers are expected to implement and show in the classes are all reasons for the growing disengagement of teachers from classes and students.

**Governance is stipulated to be bottom-up**


A perusal of the National Plan of Action document (GOI 2003) reflects an emphasis on four broad strategies in terms of organizational rearrangements and management processes for realization of EFA goals within specified timelines in the sub-continent. These strategies are:

1. Decentralized decision-making and management through Panchayat Raj Institutions (PRIs) as well as through school-level community involvement structures like the Village education Committees (VECs) or Parent Teacher Associations (PTAs).
2. Bottom-up planning focusing on specificity of needs of particular geographical locales and their inhabitants that will be subsequently consolidated at the district as the basic unit for anchoring different interventions.
3. Non-proliferation of parallel structures and processes through convergence, with respect to planning, coordination, and programme implementation.
4. A three-tiered monitoring and supervision of progress towards achievement of EFA goals that involve: (a) PRIs and community level structures at the local level, (b) Management Information Systems such as the Education Management Information System (EMIS), and supervision missions, and (c) All India Surveys at the state and national level.

is indicative of the bottom-up information management that is a constitutionally compatible, Panchayat Raj, way of structuring governance.

On hierarchical structures and the need of decentralization, they write

The basic structure of the education system is hierarchical. This pertains to both the programmatic relation between the states and the centre and to the internal hierarchy of any state education department. Such a structure often prevents the adoption of implementation approaches that are local-specific and/or emerge from the needs elicited from lower-level institutions and their functionaries. Both innovations and critical voices that can meaningfully feed into existing approaches, programmes, and plans are ignored in blueprint driven top-down implementation. This logic is sustained and unchallenged in a hierarchy where there
is a significant difference between the voices of the key decision-makers (the Secretary, the Director/Commissioner, and the State Project Director-SRA who are senior officers from the Indian Administrative Services (IAS) cadre) and the functionaries (state level cadre). The stated objectives of participatory planning, bottom-up approaches, flexibility accorded to institutions and programmes to adapt to local specificities remain frozen in the form they had been formulated – plan documents, vision statements, and evaluation reports.

Although periodic expressions of intent to establish local self-governments made their rounds since 1950, the first coherent stipulation for education decentralization can be credited to the passing of the 73rd and 74th Constitutional Amendments (related to the establishment of the Panchayat Raj Acts of 1993). The Central Advisory Board of Education (CABE) 1993 recommended the setting up of Village Education Committees (VECs) at village and school levels and Education Committees (ECs) at the block levels as part of the panchayat system itself. Subsequently, key national programmes such as the District Primary Education Programme of 1994 and the SSA of 2001, which have been supported by international agencies and the 93rd Amendment (Right to Elementary Education), have reiterated the need for such decentralized, community-based structures so as to enhance the efficiency and accountability of elementary education administration.

And they express a concern regarding the information management systems in use:

The information consolidation processes are oriented to State and Central decision-making authorities. The information systems have not been able to act as enabling mechanisms for local-level (either at the district or sub-district level) planning or decision-making.

Software for internal school information management

Schools have long been a target of governance software by 3rd party providers. Such school software has also thrived on the signature of "technological determinism" that appears to have a promise of regularizing an otherwise complex network of governance. Elements of design, scalability and how these re-structure the information management and governance become a fashion statement. Thus adding new-layers of inequalities to the traditional ones in a way that the traditional ones, even those that are democratic, are subjugated to an unhealthy humility - often a reminiscent of similar prevalent attitudes in the culture of governance.

We take a look at SIMS, Schools Information Management System, which has an interesting Wikipedia article. [http://en.wikipedia.org/wiki/Schools_Information_Management_System]

Becta report highlighted the fact that the charges to schools of maintaining current Management Information Systems (MIS) from the dominant supplier has increased up to threefold since 1999. BECTA suggests that many schools and colleges are being charged ever-increasing amounts to maintain their MIS and are not receiving value for the money they spend.

The key issues that also emerged from Becta report were as follows:
For many schools costs are escalating very significantly with charges from the dominant supplier, now between 2.5 and 3 times their 1999 levels. There are very significant barriers to the effective choice by schools/LAs and there is a lack of any significant contractual commitment between the dominant supplier and schools/LAs regarding the timeliness and quality of software provided.

Cost implications and anti-competitive practices are highlighted in this 2009 article. A study of e-governance at schools helps us bring to surface certain dynamics of state of technology market-economics that are harder to expose in a state sponsored e-governance project, as the state sponsored projects often transmute to public-good.

[ http://www.education-today.co.uk/news/fullstory.php/aid/1916/ A375_MILLION__91CREAMED__92_FROM_SCHOOLS.html ] is a complaint to the Office of Fair Trading (OFT) about this then popular software that has these significant points:

For many schools software costs have escalated significantly, with charges from the dominant supplier now between 2.5 and 3 times their 1999 levels; There are very significant barriers to the effective choice by schools/LEAs; and There is a lack of any significant contractual commitment between the dominant supplier and schools/LEAs as to the timeliness and quality of software provided.

Custom Solutions and Generic Systems

There are a large number of products and services developed or marketed by 1000s of business that are school software [ http://google.com/search?q=school+software ]. SchoolTool is one of the few open source options available for school management. SchoolTool is a school information management software that is developed in several attempts over the last decade and it promises an essential set of 4-5 module for school management. Schools do not have inherent in-house capacity to design and develop software for their needs. Some large schools do have a computer department that among various activities of school’s computerisation needs also work with some of the essential administration modules necessarily for school management. [Chirec2007]. Schools basically rely on packaged school software that is marketed to them. Thus the plethora of school software businesses. However, the schools have an inherent capacity to manage their school information and the staff and teachers are typically well aware of their processes as they actively contribute to the paper based school information and its management.

Schools are not Universities

Typically universities have inherent software capacity, thanks to the faculty in their Computer Science departments and the need for several student research projects.

Information management systems at the large Universities that were some of the initial ones
to deploy state of the art information management and collaboration systems had custom development of software by software corporations and have spent millions of dollars on the initial deployments. In 2004, some of the universities started a collaborative development activity that while utilizing in-house skills encouraged a consortium wide open source collaborative development activity called Sakai [http://sakaiproject.org]. Although Sakai is not an administration and information management for universities, but is about the alternative needs of course management and collaboration tools, the life-cycle of custom software as the immediate essential activity, then an attempt to look at the cost implications of custom development as the technological awareness and capacity increases, and making it an open source platform in order maintain to further evolve the platform as new technologies come about is typical presentation of a progress of a software initiation, development and maintenance activity timeline. [ref: Open source as infrastructure draft]

Resurgence of customization based on their own needs

MySIS is an example of an individual university that wants to re-look at the various information management aspects and custom develop a management system based on feedback from experiences of the faculty and students who used the earlier system(s). [ http://www.tilburguniversity.edu/mysis/goals/ and http://www.uvt.nl/mysis/interviews ]. Some of the software development activity is also reflective of the skills available and research interests of the departments at the university.

While some of the modules appear to be typical to other similar universities' needs. We can see that this project is an attempt to allow fine grain control at the college level for some of their periodic workflow changes. Features list includes

**Web delivery, open source, access control management**
**Teacher – student communications**
**Flexibility as the exam workflow process rules change**
**Inter-university, outside communities collaboration**

*MySIS project in itself values other [collaborative] institutions and discusses the establishment of MySIS and thus mutually reinforcing skills and knowledge which can achieve the necessary coordination in the design of our processes.*

We note that, because of this the need for in-house skills is essential for efficient maintenance/update of some activity. Also, the student admissions department is very unsure of the changes and its implication on their work flow and the staff needs that result from changing the system. The old system they know and also ensures that their processes are independent of other information management needs. However, they say that students and faculty are unaware of the progress of admission and enrollment in the old system while the new system allows them to get notifications on the progress of an application.

Social Shaping of Technology
Using the SST terminology, this work can be considered as a glimpse of what democratization of information management has been, that can be supported while ICT enabling them and facilitating them through the advancement of technological innovations. [http://www.rcss.ed.ac.uk/technology/SSTRP.html]

The concerns that are united by an insistence that the 'black-box' of technology must be opened, to allow the socio-economic patterns embedded in both the content of technologies and the processes of innovation to be exposed and analysed (MacKenzie and Wajcman 1985, Bijker and Law 1992). SST stands in contrast to post-Enlightenment traditions which did not problematise technological change, but limited the scope of enquiry to monitoring the social adjustments it saw as being required by technological progress. SST emerged through a critique of such 'technological determinism'. SST studies show that technology does not develop according to an inner technical logic but is instead a social product, patterned by the conditions of its creation and use.