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Review of Education management and monitoring system at school and sub-national level

Report for EMIS in Andhra Pradesh

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Stakeholders directly participating in this review

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The research would not have been possible without the ongoing and constant support and coordination of the UNICEF Regional Office of South East Asia (ROSA) – in particular, the Education Specialists, Ivan Coursac and Frank van Cappelle, who participated in all phases of the work including drafting of each country report. The consultant would also like to thank the UNICEF India Education Team, in particular Chief of Education Terry Durnnian, Education Specialist Ramachandra Rao Begur, Sukanya Subramanium and Ganesh Nigam (UNICEF Consultant), for coordinating the work in India, as well as Muntnuru Sarma the Andhra Pradesh consultant for support throughout the visit. A word of thanks also goes to other ROSA staff, particularly those in the Planning and Monitoring team. The time-availability and the openness of the Commissioner of the Department of School Education, directors, heads of departments and other staff were instrumental in informing the analyses and formulation of recommendations. The EMIS unit have been an excellent facilitator of the Review: not only did staff provide highly relevant presentations, they also reflected on the EMIS development from a historical perspective and were able and willing to share some critical opinions. These critical views were exceptionally valuable and are reflected in the conclusions and recommendations of the report.

The school level is where equitable access and the quality of education service delivery must be measured. So it has been exceptionally meaningful to listen to the experiences of staff working at school and District and Mandal levels[1]. These staff should continue to inform the development of EMIS[2], so that these systems become relevant not only at macro level, but also for individual schools.

Lastly, the author would like to acknowledge the diligent support of Cambridge Education trading as Mott MacDonald, which provided technical assistance to, and management oversight for the Review. In particular Sophie Archambault the Project Manager and Douglas Drew the Team Leader of the review.

[1] Classifications for sub-state administrative regions.

[2] Which includes School Management Information Systems (SMIS)

UNICEF[3]

UNICEF supported this research through the efforts of the UNICEF Regional Office for South Asia (ROSA), India Country Office and the local state office of Andhra Pradesh.

UNICEF ROSA works with partners in the region to address the challenges that keep children out of school. UNICEF programmes ensure children from the most marginalized communities get an opportunity, empowering them with the skills to learn and become active and employable citizens.

Geographically UNICEF ROSA works in Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Within each of these countries, UNICEF ROSA work in the areas of Health, Education, Nutrition, Education, Water, Sanitation and Hygiene, Child Protection, Adolescent Development and Participation, Gender Equality, Social Policy and Inclusion, Communication for Development, Emergency and Humanitarian Action, Planning and Monitoring and Evaluation.

Figure 0.1: UNICEF ROSA Headline Results 2018 to 2021[4]



UNICEF has supported various aspects of EMIS development in these countries, either directly or through collaboration. UNICEF has also supported numerous studies which either promote or use EMIS and EMIS data. For example, UNICEF has recently supported studies on out-of-school children in Bangladesh, India, Pakistan and Sri Lanka, which relied heavily on EMIS and household survey data to help identify those children and their characteristics who are at risk of dropping out and who were out of school. The Out-of-of-School Children Initiative was a collaboration with the UNESCO Institute for Statistics (UIS) and host governments.

[3] Adopted from: https://www.unicef.org/rosa/. Accessed on 15 January 2020

[4] Source: https://www.unicef.org/rosa/what-we-do

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Acronyms

AP	Andhra Pradesh
ASEAN	Association of Southeast Asian Nations
ASER	Annual Survey of Education
DQAF	Data Quality Assessment Framework
CFMS	Comprehensive Financial Monitoring system
CRP	Cluster Resource Person
DCR	Digital Class Rooms
DEO	District Education Office
CCE	Continuous Comprehensive Review
EAPRO	East Asia and Pacific Regional Office for UNICEF
EGMA	Early Grade Maths Assessment
EGRA	Early Grade Reading Assessment
EMIS	Education management information system(s)
EAPEAX	Andhra Pradesh E-Knowledge Exchange
ESP	Education Sector Plan
GER	Gross Enrolment Rate
GIS	Geographic Information System
HM	Headmaster
HMIS	Higher education management information system
HEMIS	Health management information system
HRIS	Human resource information system(s)
HRMIS	Human resource management information system(s)
INGO	International NGO
ICT	Information Communication Technology
ISCED	International Standard Classification of Education
ITEC	Information Technology and Communication Department
KGBV	Kasturba Gandhi Balika Vidyalaya
KPI	Key Performance Indicator
KPM	Key performance monitoring
MDM	Mid-Day Meal
MEO	Mandal Education Office
MICS6	Multiple Indicator Cluster Survey
MIS	Management information system
MoE	Ministry of Education
MoU	Memorandum of Understanding
MRC	Mandal Resource Centre
NAS	National Achievement Survey
NER	Net Enrolment Rate
NGO	Non-governmental organization

OECD	Organisation for Economic Co-operation and Development
OOSC	Out-of-school children
OTET	Office of Teachers Eligibility Test
PAL	Personalised adaptive learning
PC	Parents committee
PIRLS	Progress in International Reading Literacy Study
PISA	Programme for International Student Assessment
QR	Quick Response
RTGS	Real Time Governance System
ROSA	UNICEF Regional Office of South Asia
SABER	The System Approach for Better Education Results
SAS	Student Assessment System
SDG	Sustainable Development Goal
SEA-PLM	Southeast Asia Primary Learning Metrics
SIMS	School information Management System (The Andhra Pradesh System)
SMIS	School Management Information System (International Terminology)
STMS	School Transformation Monitoring System
SWOT	Strengths, weaknesses, opportunities and threats
TIMSS	Trends in International Mathematics and Science Study
TIS	Teacher Information System
TTSS	Teacher Training Support System
TVET	Technical and vocational education and training
UDISE+	Unified District Information System
UIS	UNESCO Institute for Statistics
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children’s Fund
USD	United States Dollar
VCR	Virtual Class Rooms

Glossary

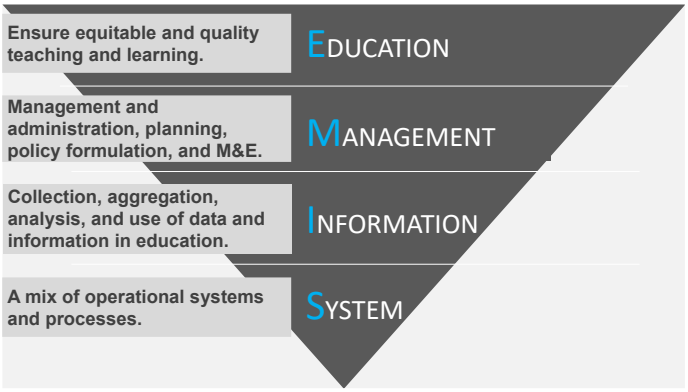
Administrative data:	Admin data are data collected as part of the routine provision of a service. In the context of EMIS this includes all school and student data, including student management data, student learning data, school finance data, etc.
EMIS:	An education management information system (EMIS) is the system that manages education information. As mentioned above, in different contexts this system may be referred to by a different name. An EMIS can manage a wide range of data, including: student information (demographics, enrolment, discipline and other functional elements); instructional/learning information (assessment and achievement data, teacher evaluations, curriculum effectiveness data and other elements related to progression through school); longitudinal data; and business intelligence (financial and human resource data, strategic metrics, etc.).
Local:	This refers to all the administrative subdivisions that fall under the sub‐national level. For example, municipalities, counties, districts, communes, etc
Metadata:	A set of data that describes and gives information about other data
National:	This refers to the whole country. In the survey, the national level refers to legislation mandated by the central government
School Management Information Systems (SMIS):	Refer collectively to all activities of collection, digital capture and use of data at the school level, for the purpose of managing school operations and for school planning purposes. Data from SMIS are also a potential source for feeding data to the state EMIS. An electronic SMIS can be an independent system, or an extension of the EMIS, and may also include school management and administrative functions (such as admissions, automated reporting, accounting, staff management, etc.)
Sub-national:	This refers to administrative levels that fall below the national level. For example: the country of India is divided into states, districts and blocks. In Andhra Pradesh Mandals replace blocks as the lowest formal administrative level.

Executive summary

UNICEF Regional Office for South Asia (ROSA) has conducted a comprehensive review of two EMIS experiences with sub-national and school level components in South Asia in order to identify key factors that influence the capacity of EMIS to impact on school efficiency and more specifically to address the issue of identifying children at risk of dropping out more efficiently. The review identified Andhra Pradesh (AP) as a good example of an EMIS which has included actions to improve efficiency, quality and equity, particularly at the school level, from which we can draw lessons learned for strengthening EMIS in the region.

AP state was selected as it was considered to be amongst the most advanced EMIS in the region and had been operational for many years. AP is also a large state consisting of almost 50 million people and has a mix of both urban and rural schools which will help give specific insights into methods used to address challenges inherent in remote and rural areas and in a low middle-income context.

Figure 0.1: EMIS conceptual diagram



For this Review, EMIS has been defined as a mix of operational systems and processes, increasingly supported by digital technology, that enables the collection, aggregation, analysis and use of data and information in education, including for management and administration, planning, policy formulation, and monitoring and evaluation (see Figure left). The School Management Information System (SMIS) in Andhra Pradesh is termed School Information Management System (SIMS) and is considered to be the EMIS in its entirety rather than a separate component of it.

The findings from this review are intended to help guide national and state governments to improve education management, monitoring and planning at national, sub-national and school levels, and subsequently improve efficiency, quality and equity by drawing on lessons learned from the two reviews. This review also provided specific advice to Andhra Pradesh and aims to help the government determine areas for further improvement and provide recommendations for further development of the EMIS.

Review purpose, objectives and intended users

The purpose of this review is to understand the existing efforts in development and implementation of EMIS which improve education management, monitoring and planning at national, sub-national and school levels, and subsequently improve efficiency, quality and equity.

The review has been designed to identify the strengths and limitations of the AP State SIMS and identify lessons which can be drawn for the improvement of the system as well as other monitoring and management systems in the region. The review has identified the constraints, institutional, organisational, financial and technical aspects required for scale up and wider use of the SIMS

within the socio-economic and capacity constraints of AP State. The review has also attempted to identify the socio-cultural aspects which may have had a positive or negative impact on development and deployment of the SIMS. The review has also examined the impact of the SIMS on school efficiency, by reviewing progress made in terms of teacher and student attendance, student survival rates and drop-outs, or any other relevant progress which could be attributed to the system's use.

This review hopes to capture the lessons learned with the aim of assisting development partners to better support the development and effective use of existing and emerging education monitoring and management systems in South Asia. The intended users of this review are UNICEF, other development partners and governments who can learn from and build on existing efforts in the development and implementation of such systems.

Review Methodology

This review took place between April 2019 and January 2020. The review focussed on the EMIS operated in the Department of School Education and its relationship to the national systems. The implementation of the EMIS at district, block, cluster office and school levels were reviewed. An review study was undertaken of EMIS in six countries with the objective of selecting two countries for the focal study between April 2019 and October 2019. Andhra Pradesh was selected as a focal country based on the quality and coverage of its SIMS. The review methodology was based upon aspects of the EMIS review methodologies of DQAF[5], SABER[6] and Monitoring Education Participation - Framework for Monitoring Children and Adolescents who are Out of School or at Risk of Dropping Out[7]. The methodology was piloted during the review study and refined upon field work in Andhra Pradesh. Field work in Andhra Pradesh was conducted in November 2019 and data analysed and findings documented in January 2020.

The review required responses to questions concerning **Use and impact** (institutional and socio-cultural dimensions) and **Technical** aspects of the SIMS. Both quantitative and qualitative data collection and analysis methods were used to obtain relevant information for each review dimension, from a range of stakeholders at different levels. Questions were included **Descriptive and Normative questions** which collectively responded to themes under each area identified.

This included planning face-to-face meetings with key-stakeholders, planning visits to the EMIS and planning departments offices, organizing focus group discussion with key informants, and organizing field visit to collect information at sub-national, district and school level. A designated Department of School Education focal point handled the scheduling of meetings with all Department of School Education parties, with District Offices, and with schools.

Primary data collection involved a survey completed by the Department of School Education followed by focused interviews with EMIS administrators at the different levels as well as with school directors/head teachers and teachers in selected schools. Secondary data included an extensive review of literature referenced throughout this document. Documents referenced were wide ranging and included prior research, reviews and evaluations conducted on EMIS as well as budgets, plans and statistical publications produced by the Department of School Education in Andhra Pradesh. Data referenced in the report is obtained from the Department of School

[5] UNESCO (2019) *Ed-Data Quality Assessment Framework (Ed-DQAF)*

(Ed-DQAF) to Evaluate Administrative Routime Data Systems: Manual for the Conduct of an Evaluation by a National Technical Team, http://uis.unesco.org/sites/default/files/documents/training-workshop-manual-data-quality-assessment-framework-2017-en_0.pdf, accessed on 20 January 2020

[6] Abdul-Hamid, H, SABER EMIS Framework Paper (World Bank, 2014)

[7] UNICEF and UNESCO Institute for Statistics. (2016, December). *Monitoring Education Participation : Framework for Monitoring Children and Adolescents who are Out of School or at Risk of Dropping Out*, retrieved from http://uis.unesco.org/sites/default/files/documents/monitoring-education-participation.pdf.

Education. Triangulation of data was not possible with the exception of site visits as the Department of School Education is the sole source of education statistics for AP State.

Main Findings and Conclusions

The main findings and conclusions reflect the review objectives detailed in section 2.1 concerning the purpose and objectives of this review.

AP state has undertaken significant transformative initiatives to modernise and improve the education system throughout the state and ensure greater equality and quality throughout. The School Information Management System (SIMS), developed by Andhra Pradesh, plays a vital role in the monitoring and evaluation of all initiatives. EMIS and SMIS are one system in Andhra Pradesh termed SIMS. SIMS covers public and private primary, lower secondary and upper secondary schools. It excludes pre-primary schools, and other education programmes including Technical and Vocational Education and Training (TVET), Higher Education and Nonformal education. There are plans to include the TVET sector as part of SIMS.

Both public and private schools are mandated to use SIMS in AP State so the data available is identical for both. Indicators published through Department of School Education websites do not highlight disparities between public and private schools however analytical planning documents such as the Samgra Shiksha plan for 2019-2020[8] disaggregate some data by public and private schools. However, most indicators are published for either the public sector, for use in public sector planning, or reference the private sector when assessing the requirements of the public sector provision of schooling.

SIMS is a highly developed transactional and management system which records detailed daily information on staff, students, facilities and resources supplied to schools. SIMS is highly integrated and rationalized and as a result, each data point is collected once only. Access to relevant elements of the EMIS is granted to schools via a desktop portal and a range of purpose specific mobile applications. Annual data is warehoused in accordance with the national standard for UDISE+ data[9].

The data which is captured through SIMS is used as a single source database for many purposes. The equity related data on students are rich and include 63 parameters on each child. In addition, process information such as the health, wellbeing and attendance of a child is monitored through SIMS and SIMS stores detailed information on the learning outcomes of each student. This level of data gives significant capacity for comprehensive equity analysis.

Education Data is available on a diverse range of websites maintained at the national level through the Ministry of Human Resource Development (MoHRD) and at the state level through the Department of School Education and the State government of Andhra Pradesh. There is scope to consolidate these websites and streamline presentation to enable educationalists and the pubic to more easily navigate the websites and locate relevant data. Data is now always up to date, particularly through the MoHRD websites where the latest data is 2016/17 for many published indicators.

Determine the requirements and constraints of the systems for scale-up and wider use, especially at the lowest level admin and school levels, and in contexts with limited ICT infrastructure.

[8] Andhra Pradesh Department of School Education (2019) *Samgra Shiksha plan 2019-2020,*

[9] Source: http://udiseplus.gov.in/informationDetails.action?fileId=2

SIMS is maintained and developed under an annual service agreement of 140,000 USD with a semi-private company, TATA IT[10]. The Department of School Education manages the TATA IT team, confirms all requirements of SIMS and is responsible for ensuring staffs utalise SIMS. SIMS is accessible at the school level, however many schools lack adequate facilities to access SIMS directly. To accommodate this, the Department of School Education has institutionalised a cascaded structure of operation and support to enable ongoing capacity development to all staff and to ensure that all schools can manage data for SIMS. At least one day a month is allocated to mentoring staff at all levels of education to school level. When a new application is introduced staff allocate time required for mentoring and training in the new functions. This is undertaken as part of the supervisory and management role each unit plays. Thus, the need for large scale training has been eliminated, ensuring that SIMS had greatly reduced operational costs when compared to EMIS deployments which encourage large recurrent training exercises in order to ensure sustainability[11].

SIMS employs mobile applications to engage teachers and headmasters in schools. The Department of School Education ensured schools have a monthly allowance for mobile connectivity and thus mobile applications were easily accessible to staff in schools with poor infrastructure and which lacked capacity to engage the desktop version of SIMS.

The combination of factors above has ensured that SIMS is a reasonable cost deployment. The Department of School Education supplied figures which indicated that annual operational costs for SIMS were 1,418,767 USD and the total cost between 2015 and 2019 was 6,402,020 USD. SIMS has had a large impact on the effectiveness and operation of the education system in AP state. SIMS has reduced the paperwork and time required to process tasks and improved the transparency of functions such as leave applications, student transfers, requests for textbooks and other resources. The data on individual children and teachers has enabled targeted provision of resources which the Department of School Education estimates to be 38.5 Million USD[12] to date. Applications such as Nedu-Nedu, which publishes photographs concerning the condition of facilities in schools, helped encourage efficiency, transparency and awareness[13]. E-Hazar has contributed towards increasing teacher attendance from 27.5% in August 2017 to 97.2% in February 2018, as reported by the Department of School Education[14]. The gains reported by the Department of School Education significantly outweigh the costs of operating the system.

It is difficult to compare these costs to other EMIS as literature and analysis on the cost analysis of EMIS in comparative environments is sparse. There is little agreement in the literature as to the cost of administrative and other government systems required to support education development in different countries. This may have to do with the wide range of factors involved such as purchasing power parity, rapid evolution of information technology, and associated costs and changes to modes of deployment of systems[15].

[10] Enterprise applications are about the display, manipulation, and storage of large amounts of often complex data and the support or automation of business processes with that data. Source: Martin Fowler, Patterns of Enterprise Application Architecture (2002). Addison Wesley

[11] The Department of School Education claim that mentoring costs are part of regular meetings and that IT Cells have evolved from earlier data cells used to support UDISE and prior data collection efforts and thus do not add to the cost of operating the education system.

[12] Reported by the Department of School Education.

[13] Via the School Transformation Monitoring System (STMS) application and portal

[14] Other activities and policies also contributed such as increased renumeration for teachers and improved performance monitoring.

[15] UNESCO. (2018). *Working Papers on Education Policy Re-Orienting Education Management Information Systems (EMIS) towards inclusive and equitable quality education and lifelong learning*, Working Paper 5.

Aside from the capacity and infrastructure requirements there are other requirements which must be in place including a robust system of personal identification. Data contained in SIMS is based on individual teachers and students. Persons are verified by household census and each individual has a national identification called the Aadhaar number (UIDAI)[16]. Each data point is collected once into an integrated set of government systems which includes SIMS. Thus, data on each individual is constantly verified at service delivery points such as schools and through processes such as Mid Day Meal and Textbook allocation. Using this data, resources can be targeted towards individuals to support gender and equity driven initiatives such as in the case of Bicycles being allocated to disadvantaged girls and disadvantaged girls being allocated to residential girls schools[17].

The review concludes that SIMS is highly sustainable and has been fully adopted by the staff at all levels of government.

Determine the key technical aspects required (existing and yet to be developed) for the successful implementation of the system and more broadly – extrapolating from the evaluation findings – for other monitoring and management systems.

Key technical aspects which have led to successful implementation include:

a) A focus on ensuring data systems are compatible with policies and programmes of the Department of School Education and that data must be reported and used in all aspects of education planning and management from school development plans to the state education plan[18].
b) Complimenting development of a web and mobile enabled system with state initiatives for connectivity at the school level thus ensuring actors at the school level can engage with SIMS.
c) Encouraging interoperability of government systems and promoting a policy of collecting each data point only once.
d) Striving for granular data such as data on individual assets, staffs and students and ensuring, where feasible, that data is verifiable.
e) Outsourcing development and management of SIMS to a professional organisation, TATA IT, experienced in enterprise software development and deployment. This enabled immediate development to occur without the years required to develop skills inhouse.
f) Building ongoing mentoring in SIMS into existing job roles and functions thus ensuring continuous capacity development without the need to apply for funds for large scale training exercises.
g) Ensuring SIMS has capacity for monitoring use and data currency and ensuring these are monitored at each level of government.

Determine the key institutional, technological, financial and socio-cultural aspects which have positively or negatively shaped the use and impact of the system.

Strong top down leadership both within the Department of School Education and through the Chief Ministers Office of Andhra Pradesh combined with a clear vision of state information systems have guided development of SIMS. A willingness to commit funds to the successful

[16] The Aadhaar is a 12-digit unique identity number that can be obtained voluntarily by residents or passport holders of India, based on their biometric and demographic data. The data is collected by the Unique Identification Authority of India (UIDAI), a statutory authority established in January 2009 by the government of India, under the jurisdiction of the Ministry of Electronics and Information Technology, following the provisions of the Aadhaar (Targeted Delivery of Financial and other Subsidies, benefits and services) Act, 2016. Aadhaar is the world's largest biometric ID system. Source: https://uidai.gov.in/about-uidai.html

[17] Through the Kasturba Gandhi Balika Vidyalaya (KGBV) programme.

[18] Andhra Pradesh Department of School Education (2019) *Samgra Shiksha plan 2019-2020,*

transformation of systems requires foresight and commitment as gains may not be realised for some years post transformation.

Ensuring systems compliment policies and programmes to ensure they can be properly and efficiently monitored and managed has been instrumental in the success of the systems. This ensures that data is used and constantly verified with in turn improves the confidence of stakeholders in the data and the systems.

A willingness towards data transparency and openness has also contributed. A large amount of sensitive data is openly published on AP State websites such as the condition of school buildings and facilities and the daily attendance of teachers[19]. This openness has helped promote data accuracy and verifiability and increased the accountability of the education system.

A willingness and openness to collect and use detailed information on individuals has positively impacted the system. However, detailed information on each individual has raised issues of privacy and the rights of the individual and have emphasised the need to develop a strong regulatory framework to safeguard sensitive digital information about individuals.

Evaluate the impact of the system's use on school efficiency, by reviewing progress made in terms of teacher and student attendance, student survival rates and drop-outs, or any other relevant progress which could be attributed to the system's use

SIMS has helped address the issue of Out of School Children (OOSC). Accurate data on individual children in and out of school available through SIMS, combined with annual enrolment drives using applications such as Badiki Podam, have helped reduce recorded OOSC throughout the state from 889,000 in 2016 to approximately 89,000 in 2019[20]. 380,556 OOSC were enrolled in school between 2014/15 and 2020/21. SIMS has also been used to help address some of the barriers encountered by OOSC. SIMS was used to calculate and disburse pro-poor allocations to families sending their children to school.

AP State are also piloting innovative methods of utilising the large amount of data stored on each individual child to address the issue of dropout. SIMS has also enabled the piloting of sophisticated programmes designed to reduce the likelihood of a child dropping out. The Vidyarthi Nestham programme, which combines dropout prediction with monitored interventions designed to reduce the chance of a child dropping out, reflects the emphasis AP state places on ensuring data systems are an integral part of practical and tangible processes to achieve desired results.

Whilst retention is accurately monitored through SIMS, it should be noted that it is a combination of policies and programmes that have resulted in dropout reductions. Under the Sarva Shiksha Abhiyan Programme some of the interventions include (1) Implementation of activity based and child centric teaching learning process by building the capacities of teachers (2) Supply of children literature to schools (3) Involvement of community in school activities (4) Release of various types of grants to schools (5) Implementation of specific programmes for the education of focused groups like girls, SC/STs, minorities and urban deprived (6) Establishment of KGBVs for the education of girls belonging to disadvantaged groups (7) Supply of free textbooks, uniforms and providing Mid-day meal to the children. Collectively these have been attributed by the Department of School Education to increasing retention of children in elementary school from 74.18% (Gender Parity Index (GPI) 0.99) in 2013/14 to 88.53% (GPI 0.97) in 2017/18[21], [22].

[19] Aggregated to school level and regional levels

[20] A large percentage of this reduction were children who were no longer living in the state, were incorrectly recorded as OOSC or had passed away.

[2121] Although GPI is slightly lower in 2017/18, it should be noted that retention of both genders has increased significantly since 2013/14.

[22] Andhra Pradesh Department of School Education (2019) *Samgra Shiksha plan 2019-2020,*

SIMS has provided detailed and robust data for planners and decision makers at all levels of government. The data is used for the creation and monitoring of school development plans, and plans and expenditure are monitored by Parent Committees (PC). Macro level equity analysis of indicators is possible through UDISE and through RTGS however the information is not presented in easy to digest formats and equity issues are not highlighted visibly. Equity analysis is undertaken extensively though the main analytical publication, the Samgra Shiksha plan for 2019-2020. Equity analysis helps inform policies and programmes designed to target disadvantaged groups such as the Kasturba Gandhi Balika Vidyalaya (KGBV) residential girls' secondary school programme. Equity analysis usually includes by gender, wealth, disability, special needs, quality of service provision and location (urban and rural). Other forms of equity analysis are less common.

In such a data driven approach to monitoring, planning and resource allocation, robust methods of data verification are essential. AP State has robust methods surrounding child and teacher data but there is capacity to increase verification processes for school facilities and resources such as pedagogical materials. In environments where positive data leads to rewards and without strong verification processes there is also a risk that school HM and teachers may manipulate data to promote a positive impression.

Lessons Learned for Application to Other Environments in South Asia[23]:

Determine the strengths and limitations of the systems, from which lessons can be drawn for the improvement of the system as well as other monitoring and management systems in the region.

SIMS provides an effective and sustainable example of an integrated EMIS / SMIS which is feasible in a low middle-income environment. There are lessons which can be learnt from its development and deployment which are elaborated at the conclusion of this report and which include:

- The commitment, direction and engagement of the highest levels of management are essential to reforming EMIS.
- The use of public and private partnerships in the development and operation of the EMIS can help enable more professional, rapid and successful deployment of EMIS to school level.
- SIMS highlights the importance of development EMIS to accommodate job functions, roles and responsibilities at all levels of government and to adjust job roles and functions as new possibilities emerge through deployment of information systems. This is particularly important when deploying school level systems in environments where capacity to engage directly with the systems to school level may be limited. AP State have developed an effective and cost-effective support mechanism by ensuring IT cells at each level of government and then adjusting the Cluster Resource Persons (CRPs) to help support schools in the use of SIMS which fall under their management. AP state have also adjusted job functions to ensure mandated use of the SIMS and its applications for specific administrative, planning and monitoring functions.
- For EMIS such as SIMS to be effective it must be combined with other programmes. AP state success with increasing student retention was a result of combining robust monitoring with many interventions to help increase participation and retention and reduce dropout.

[23] Responding to the review objective “Capture in the evaluation report all these lessons learned, covering technical, institutional, financial and socio-cultural dimensions, which would enable development partners to better support the development and effective use of existing and emerging education monitoring and management systems in South Asia.”

- Consideration to the cascaded model of training emphasised continuous on the job mentoring and training over costly and ineffective large-scale training exercises.
- The use of targeted mobile applications can help engage actors at the school level despite having low capacity to engage fully with a SIMS. This was demonstrated effectively by SIMS which utilises 16 mobile applications to ensure teachers and HM engage with SIMS on a daily basis for specific purposes.
- SIMS should be developed based on individual pupil and teacher data. Data systems based on individuals inherently provide more accurate and detailed data than those based on aggregate data and can enable enhanced equity analysis.
- The extensive data that SIMS stored on each individual child emphasised the need to have a robust regulatory framework to safeguard sensitive digital information concerning individuals.
- In environments where positive data leads to rewards and without strong verification processes there is also a risk that school HM and teachers may manipulate data to promote a positive impression.

Recommendations

Recommendations are elaborated in more detail at the conclusion of this report.

Recommendations for Andhra Pradesh State for Further Development of SIMS

AP state has a clear direction and path for its SIMS which emphasised use in many school administrative, planning and monitoring functions. It is an advanced system, and as such recommendations to improve it are few, beyond what is already known within AP State.

- Improved analysis of SIMS data on individual children and teachers to identify and target disparities for strategic planning. With 63 parameters stored on each child as well as attendance and learning outcome data there is a very large capacity to use data to highlight disparities at the mandal, district and state level and readjust programmes to suit. There is scope to improve strategic analysis. Developing Mandal, District and State level capacity to identify disparities in data would help identify targeted programmes which may assist further.
- Integration of SIMS with other forms of education including non-formal and Technical and Vocational Education and Training (TVET) to ensure a more wholistic picture of the education system and the progress of each individual child in all forms of education.
- Continued focus on improved access to SIMS for teachers and HM in schools which lack adequate capacity to interact with the system directly. The enhancement of mobile applications to feedback information on the status of the school and alerts for actions required by the school will help engage HM and teachers further in the system.
- The extensive data that SIMS stored on each individual child emphasises the need to develop robust regulatory frameworks to safeguard sensitive digital information concerning individuals.
- Digitisation of school development plans and improvement of the school report card to show longitudinal data and to highlight priorities for development or action. The school report card could be better aligned with the school development plan and the plan digitised into SIMS to enable better automated reporting against the plan using SIMS data.
- Improved methods of communicating school and regional progress and development with the broader community such as through community school report cards which can be easily understood by the public and can be used to encourage public contribution or participation in local school development[24].

[24] The Illinios State School Report card provides a good example of a report card based on EMIS data suitable for public consumption. Source: https://ilhonorroll.niu.edu/, accessed on 29 January 2020

- As the capacity to deploy the system evolves, enable parental access to SIMS so that parents can view the academic and attendance record of their child. There is scope to enhance communication between parents and teachers using SIMS to send alerts to parents such as concerning examination results and absenteeism.
- There is scope to develop applications which help to feedback information to teachers on the pedagogical outcomes of individual children to enable more targeted learning to take place. AP state are piloting this through Virtual Class Rooms (VCR) and Personalised Adaptive Learning (PAL) but there is also scope to feedback information based on examination results for schools which lack adequate facilities to access such systems.
- Education Data is available on a diverse range of websites maintained at the national level through the Ministry of Human Resource Development and at the state level through the Department of School Education and the State government of Andhra Pradesh. There is scope to consolidate these websites and streamline presentation to enable educationalists and the pubic to more easily navigate the websites and locate relevant data.

Determine UNICEF's relative strengths and weaknesses in supporting Governments in the design, development and adoption and use of such systems, and thus to outline on which aspects UNICEF is well positioned to lead, and on which others UNICEF is not yet where it needs to be.

UNICEF's strengths lie in its extensive experience working with governments to strengthen education information systems and utilise data in sector analysis and planning. UNICEF has extensive expertise in strengthening systems to help identify the most vulnerable and ensure no child is left behind. UNICEF also has expertise in measuring the child friendliness of schools and assisting governments to record and use that data to monitor progress towards and to ensure development of inclusive, safe and functional schools.

The following recommendations pertain to UNICEF country and international offices and are based on UNICEF's strengths in supporting Governments in the design, development and adoption and use of EMIS / SIMS:

- Assist Andhra Pradesh and the Government of India to better promote and share SIMS with other states of India. Documenting the different aspects of SIMS and determining what may be shared for public access would potentially assist other states of India, who may lack resources, to better develop their EMIS.
- Promote the experience of Andhra Pradesh SIMS at national and international forums. Andhra Pradesh presents the case of a SIMS devolved to school level in a lower middle-income environment. The approach to development and deployment can offer examples of best practice from which other countries of similar economic and social development may benefit.
- Assisting Andhra Pradesh to undertake analysis of SIMS data and promote its use in strategic planning. UNICEF can assist the Department of School Education to identify bottlenecks and gaps by social group, gender, management of schools and other parameters to determine factors of exclusion which could be applied to planning and monitoring of the education system within AP state. UNICEF can also help build the capacity of AP state to use data in longitudinal analysis to help inform longer term sector analysis and planning (3-5 years).
- Assist the MoHRD and AP State to improve the communication of data with the public and other stakeholders. UNICEF can work with the government of India at the national and state level to continue to improve the presentation and timeliness of data and its accessibility and understandability.
- Assist AP State to improve the monitoring and planning of Child Friendly schools using SIMS. UNICEF has developed a framework for rights-based, child-friendly educational systems and schools that are characterized as "inclusive, healthy and protective for all children, effective

with children, and involved with families and communities - and children" which can be applied to the monitoring of schools and in improving school development planning.

Recommendations concerning further work which may result from this Review

- Study the transition from aggregate EMIS to EMIS which track individual children and which function effectively to school level as SIMS. A detailed study into the transition process could help confirm the factors which contributed to a successful transition and identify further factors that could ensure success.
- Study the specific design features, processes and functions supported through SIMS which are most useful in impacting pedagogical outcomes and school development. SIMS has the possibility to facilitate positive interventions for the individual student. However, identifying the design features, processes and functions that are more likely to provide the greatest impact would help other countries deploy SIMS in a low to middle income environment.
- Study into effective public and private partnerships to develop and support EMIS. As noted in this study, MoE may struggle to adapt to and fully utilise information technology. Forming partnerships with private organisations whose core business is the development and deployment of such systems can have both a positive and potentially a negative impact. A study of successful partnerships such as that evident in AP State may help better determine the principals and requirements for effective partnerships.

Recommendations relating to the Review methodology

The recommendations set out below relate specifically to the methodology of this review and are applicable to UNICEF or other international and national development partners[25] interested in supporting EMIS development in general or with a specific focus on enabling national systems for Student Tracking.

- Ensure adequate time and resources for a full review: EMIS are becoming increasingly complex and now include consideration for School based systems, Student Tracking, Human Resource Development, Financial Management and greater interoperability with other government systems. A comprehensive review can help form a wholistic picture of how such EMIS have been developed and function to serve all areas of the education system, but such systems also require substantial resources to review and evaluate effectively.
- This review also highlights the need to constantly revise the methodologies for the review and evaluation of EMIS. As EMIS evolves to become increasingly complex, often being comprised of multiple operational systems and usually involving a large number of stakeholders spread across different agencies, there is a need to regularly revise the tools such as SABER and DQAF for review and evaluation of EMIS. There is also a need to harmonise the methodologies presently being employed to create a universally recognised standard for evaluation which can result in less subjectivity being applied to reviews and evaluations.
- The approach to this review complemented methodologies such as SABER and DQAF and enabled focus on the perspectives of actors at the school level. The review questions developed for this review helped focus it on uses of EMIS data at school and local levels and helped identify factors in the EMIS leading to improve school access, equity and quality. Further developing this methodology may prove a useful complement to enhance existing methodologies such as DQAF and SABER.

[25] International development partners include agencies (such as UNICEF, the UNESCO Institute for Statistics (UIS), UNESCO, Department of Foreign Affairs and Trade (Australian Government) (DFAT), and the World Bank) supporting EMIS development at the global level. National development partners may include NGOs, commercial partners and others active at the national level supporting EMIS development within countries.

1 Background and context[26]

1.1 Background

According to UNESCO Institute of Statistics (UIS), in South Asia, there are a total of 12.4 million out-of-school children of primary school age and 16.5 million children of lower-secondary school age who do not attend school and are thus deprived of their right to education[27].

In the recent past, considerable funding and efforts have gone into improving national education monitoring systems, specifically education management information systems or EMIS. However, these efforts have largely focused on improving the development of the EMIS at national level, and not its use or usefulness at sub-national and school levels. This is problematic, because it is at sub-national and school levels where information collected on children at risk of dropping out is actually put to use, and where equity gaps (such as inequities in school resources and availability of qualified teachers) can be addressed.

In addition, many countries devolve more and more decision power to the sub-national administration levels and grant more and more autonomy to schools themselves (such as in Nepal and Pakistan). This reinforces the need for efficient information management systems that should be user-friendly enough in their design to encourage and facilitate their use for local-level management, while minimising requirements for capacity development and placing unreasonable expectations of ICT and data expertise on local level stakeholders.

The overall purpose of these systems is to improve education management, monitoring and planning at national, sub-national and school levels, and subsequently improve efficiency, quality and equity. More specifically, some of the purported concrete achievements that have been claimed include the following:

- Improving the identification of routinely absentee students and more broadly students at risk of dropping out, and subsequently addressing such issues more systematically and effectively.
- Reducing both student and teacher absenteeism.
- Improved identification of out-of-school children.
- Exposing and addressing systemic corruption, including identification of “ghost” schools, staff members and students, allowing for corresponding financial allocations to be used elsewhere.
- GIS mapping of education institutions to identify areas where children are deprived of education opportunities.
- Dashboards and reporting systems to better identify and analyse education inequities at different levels, such as inequities in school financing, distribution and availability of resources and qualified staff.
- Improving efficiencies in data collection, freeing up staff time at sub-national and school levels for other tasks.
- Improved exchange of information across sectors (e.g., education, health, population), improving cross-sector coordination especially regarding initiatives and interventions for disadvantaged children (e.g., children with disabilities, poor children).
- Improving the accuracy and reliability of data for planning and decision making.

[26] Parts of this section are adapted from: UNICEF (2019) *Review of EMIS that Track Individual Student Data Consolidated Report*, 15 October 2019, Shoobridge J.A.

[27] UIS Sept 2019, Factsheet no.56

- Automating the production of custom reports and snapshots of the performance of the public education system at different administration levels (school level, district level, provincial level etc), through school report cards.
- Increasing community awareness of school performance, school life, school improvement plans, etc., by producing regular community level information products, such as school posters (like in Punjab in Pakistan) or community level school profiles (Nepal).

While there is no doubt that monitoring and management systems play an essential role in achieving the above, there is also no guarantee that they will be used effectively for such purposes. Moreover, there has not been a systematic review of such systems in South Asia from the point of view of their impact on improving education efficiency, quality and equity. Such a review is also relevant because thus far, such systems have largely been implemented in contexts with well-developed ICT infrastructure and well-funded schools. Countries, regions and schools which could most benefit from such technologies, i.e. those with the greatest inequities, most out-of-school children and highest risk of dropout, are those that are least likely to have an effective, well-functioning education management information system. As these systems continue to proliferate through South Asia at both national and sub-national levels, it is increasingly important to evaluate and reflect on their potential impact, bottlenecks faced, and lessons to be learned from their implementation – both from the successes as well as the failures.

There are also potential negative impacts of introducing such systems, such as:

- Significantly increasing the risk that private information regarding individual students and their families is exposed.
- Reducing efficiencies, such as by requiring school teachers to spend more time on administration and filling forms, reducing the time they are available for teaching.
- Creating bottlenecks at various stages of data collection, dissemination and use, due to the complexity of the technology and lack of ICT skills of users. Moreover, the technology itself can be a factor creating more disparities between geographical areas that are well connected and with a high level of infrastructure development, and other more disadvantaged areas where lack of infrastructure prevent exposure to such tools for better management, and/or where there is a lack of capacity to use such tools.
- Reduced ownership and use of information at school and sub-national levels, due to the centralisation of information and one-way information flows to the national (or regional) level, without information or reports going back down to sub-national and school levels.
- Lack of sustainability, by introducing (high) long-term recurring costs for the maintenance of such systems.
- Resistance from education officers or teachers who may view transparent information systems and improved monitoring tools as overly draconian or counter to their own interests.

Without learning and building on existing efforts in the development and implementation of such systems, there is a risk of wasted efforts and funding (including from governments, UNICEF and development partners) when the same mistakes are made or bottlenecks are encountered with each development and implementation of such a system, as well as for each time such efforts are engaged in ‘reinventing the wheel’ rather than building on existing well-established methodologies, frameworks, and/or technologies. Furthermore, there is also a risk of delaying progress in meeting UNICEF’s objectives in improving equity and access to quality education in the region.

This review then seeks to understand the existing efforts in development and implementation of EMIS which improve education management, monitoring and planning at national, sub-national and school levels, and subsequently improve efficiency, quality and equity. This will help

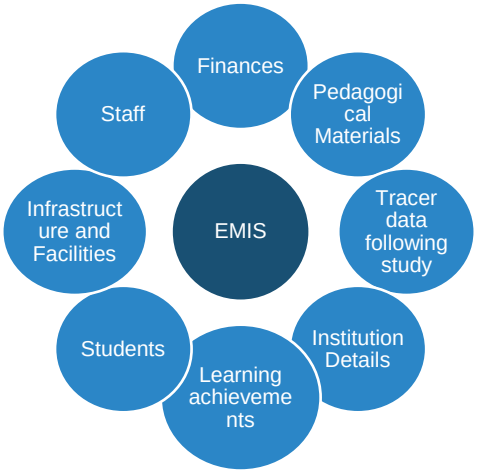
development partners such as UNICEF and governments learn from and build on existing efforts in the development and implementation of such systems.

1.2 EMIS in the global context

EMIS can be defined as the ensemble of operational systems and processes, increasingly supported by digital technology, that enable the collection, aggregation, analysis, and use of data and information in education, including for management and administration, planning, policy formulation, and monitoring and evaluation. This definition insists on the systemic nature of EMIS — a fact which is often overlooked in efforts to reinforce government information systems[28].

A comprehensive EMIS is defined as not only including **administrative and pupil data**, but also **financial**, **human resources**, and **learning data**, as well as data on graduates and non-graduates after completion of study. This information should be available both at the individual and aggregate level, and should be used for policy analysis and formulation, planning, monitoring and management at all levels of an education system[29]. An EMIS is a system of people, technology, models, methods, processes, procedures, rules and regulations that function together to provide education leaders, decision-makers and managers at all levels with a comprehensive, integrated set of relevant, reliable, unambiguous and timely data and information to support them in completion of their responsibilities[30].

Figure 1.1: Elements of an EMIS covering all subsectors of the education sector[31]



The type of data entered into the system needs to follow a clear logic and a defined methodology and have a well-defined purpose. A successful EMIS is credible, operational in planning and policy dialogue, as well as in teaching and learning. It produces and monitors education statistics within an education system and has a multifaceted structure, comprising the technological and institutional arrangements for collecting, processing and disseminating data[32]. It is crucial for tracking changes, ensuring data quality and timely reporting of information, and facilitating the utilization of information in decision-making.

An MIS is designed to assist managerial and professional workers by processing and disseminating vast amounts of information to managers organization-wide[33]. An MIS provides information for management activities carried out within an organization. The information is

[28] UNESCO, *Working Papers on Education Policy Re-orienting Education Management Information Systems (EMIS) towards inclusive and equitable quality education and lifelong learning* (Working Paper 5, 2018).

[29] Abdul-Hamid, H, *SABER EMIS Framework Paper* (World Bank, 2014).

[30] UNESCO, *Education for All by 2015: will we make it? EFA global monitoring report* (Paris: UNESCO, 2008).

[31] Tracer studies can be defined as retrospective analyses of graduates through a standardised survey, which takes place sometime after graduation (normally between 6 months and 3 years). Tracer studies are also known as graduate surveys, alumni surveys, or graduate tracking. Source: *ETF Tracers Studies Evaluating the Impact of Training Programmes*, Skills Anticipation Background Note, European Training Foundation (ETF), February 2017, https://www.etf.europa.eu/sites/default/files/m/CEDE612F00BFF6B3C12581A600278816_Tracer%20studies.pdf

[32] Abdul-Hamid, H, *SABER EMIS Framework Paper* (World Bank, 2014).

[33] Alavi, M., and Leidner, D, 'Knowledge management systems: Issues, challenges, and benefits', *Communications of the Association for Information Systems*, 1(7), 1999.

selected and presented in a form suitable for managerial decision-making and for the planning and monitoring of the organization's activities. An MIS in the education sector (i.e. an EMIS) can be used to support education managers to make strategic, tactical and operational decisions.

EMIS can help provide accurate, comprehensive and timely data collection, which can promote more rational and effective education policy-making. This can result in improved decision-making regarding: the volume and allocation of public financing, the best way to reach children most in need (due to socioeconomic circumstances, special needs, etc.), staff recruitment and training, and quality and adherence to standards[34].

1.3 The Sustainable Development Agenda and the expanded vision of EMIS[35]

The post-2015 Sustainable Development Agenda marks a substantial shift from the preceding Millennium Development Era. This is also true for the overall education agenda. The main focus for the education sector under the Millennium Development Goals was on ensuring access, participation and completion of primary education, as well as achieving gender parity in primary, secondary and higher education[36]. In contrast to this, the three main focus areas for the education sector under the SDGs are the measurement of learning outcomes, improved measurement of equity in education, and a focus on lifelong and alternative means of learning[37]. The explicit focus on **equity in education** implies that, in addition to reporting national averages, the selected education indicators should also be reported across different sections of the population, such as by wealth, religion, gender, ethnicity and disability status, amongst others[38]. EMIS should be sufficiently dynamic to enable the monitoring of groups that are often overlooked in administrative systems, such as street children, refugees, stateless children and children of migrant workers.

The indicators measuring progress towards the education goals specified in the SDGs are reported at four different levels[39]: global, thematic, regional and national. Given the priorities stated in the SDGs, as well as the multiple levels of monitoring and evaluation, it is necessary to invest in better data and monitoring and evaluation systems. Currently, there are two main issues with data. Firstly, there is not enough high-quality data available, and, secondly, much of the data that are produced are either not used or are not in a format/state that allows the data to be used[40].

Many countries are adopting the 'expanded vision of education', which incorporates the vision encapsulated in SDG 4: 'Quality education and lifelong learning opportunities for all are central to ensuring a full and productive life to all individuals and to the realization of sustainable development'[41]. It is therefore important that EMIS manage information on all subsectors of education, ranging from early childhood education, to vocational education and non-formal

[34] Ishimine K., Tayler C., Bennett J., 'Quality and Early Childhood Education and Care: A Policy Initiative for the 21st Century', *International Journal of Child Care and Education Policy*, November 2010, Volume 4, Issue 2, pp. 67–80.

[35] This section draws on information contained in the following publication: UNESCO (2019) *The Role of Education Management Information Systems in Supporting Progress towards SDG 4: Recent Trends and International Experiences*, Jim Shoobridge, Global Partnership for Education, in publication.

[36] UIS (2016) *Sustainable Development Data Digest, Laying the Foundation to Measure Sustainable Development Goal 4* (UIS UNESCO, 2016).

[37] Such as non-formal education and TVET.

[38] UIS, *Country readiness to monitor SDG 4 education targets: Regional survey for the Arab States* (UIS, 2016).

UIS, *Country readiness to monitor SDG 4 education targets: Regional survey for the Asia and Pacific region* (UIS, 2016).

[39] Sustainable Development Solutions Network, *Indicators and a Monitoring Framework for the Sustainable Development Goals Launching a data revolution for the SDGs* (a report by the Leadership Council of the Sustainable Development Solutions Network: Revised working draft (Version 6), 18 February 2015).

[40] UN, *Report on data gaps – A world that counts: mobilising the data revolution for sustainable development* (The United Nations Secretary-General's Independent Expert Advisory Group on a Data Revolution for Sustainable Development, 2014), http://www.undatarevolution.org/wp-content/uploads/2014/11/A-World-That-Counts.pdf

[41] https://unstats.un.org/sdgs/report/2017/goal-04/, accessed 28 March 2018

education. Detailed information should be accessible in order to enable predictions concerning the potential workforce, and to ensure that all people have access to education at any age. This places an increasing requirement on EMIS to be able to track an individual's progress through the whole education system and emphasizes the need for systems to be able to report on data longitudinally. The resulting design of EMIS is likely to be more complex and more integrated in terms of subsector data.

The drive to achieve global targets and participate in education in global initiatives such as the International Standard Classification of Education (ISCED) and SDG 4 has influenced both the structure of education plans, the use of key concepts and targets, and the goals by which a plan is measured. Global goals and targets help illustrate how far from a global target a country is, and national standards provide a frame of reference for progress at the country level. This places increasing requirements on EMIS to be developed to respond to local planning, budgeting, monitoring, evaluation and administrative needs, whilst at the same time conforming to international standards so as to enable comparison of data obtained through the EMIS with other regions and countries through globally recognized education indicators. EMIS should conform with international standards for data and education indicators, such as internationally recognized definitions of indicators of indicators[42], the education data standards of ISCED[43] and the requirement to monitor core SDG 4 indicators.

Emerging evidence shows that large numbers of children are in school, but are not learning[44], despite considerable investment in school infrastructure, training teachers, and learning materials. The new SDG4, presents huge opportunities as regards meeting this challenge, through a strategic shift towards equitable quality education for all. This shift is essential. There has already been substantial work undertaken to determine how SDG 4 can be measured and which countries are prepared and able to effectively monitor against the indicators required as part of SDG 4[45].

There is also greater recognition that a complex interplay of socioeconomic factors influences learning outcomes. These include but are not limited to : individual and family characteristics of students, such as gender, age, language spoken at home, preschool attendance, activities prior to attending school, engagement and out-of-school tuition, parental literacy and local governance, school management, community engagement and social accountability. In addition, the type of school, the location of the school and the resourcing available to the school that the student attends also contributes to child learning outcomes[46]. Also important to the broader scope of child learning is information concerning child nutrition, clean water and sanitation[47].

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[42] Organisation for Economic Co-operation and Development (OECD) *Indicators database* (OECD, 2015). Available at http://www.oecd.org/education/database.htm

[43] ISCED belongs to the United Nations International Family of Economic and Social Classifications, which are applied in statistics worldwide with the purpose of assembling, compiling and analysing cross-nationally comparable data. ISCED is the reference classification for organizing education programmes and related qualifications by education levels and fields. ISCED is a product of international agreement and is adopted formally by the General Conference of UNESCO Member States.

[44] ASER (2016), *Improving Quality Education and Children's Learning Outcomes and Effective Practices in the Eastern and Southern Africa Region Report*, UNICEF ESARO, Australian Council for Education Research (ASER), 2016

[45] UNESCO UIS, *Country readiness to monitor SDG 4 education targets: Regional survey for the Arab States* (UIS).

UNESCO UIS, *Country readiness to monitor SDG 4 education targets: Regional survey for the Asia and Pacific region*, (UIS)

[46] ACER, *Improving Quality Education and Children's Learning Outcomes and Effective Practices in the Eastern and Southern Africa Region Report* (UNICEF ESARO, ACER, 2016).

Grantham-McGregor, S.M, Powell, C.A, Walker, S.P, Himes, J.H., 'Nutritional supplementation, psychosocial stimulation, and mental development of stunted children: the Jamaican Study', *Lancet* 1991 Jul 6;338(8758), pp. 1–5.

[47] Grantham-McGregor S.M, Powell C.A, Walker S.P, Himes J.H (1991) *Nutritional supplementation, psychosocial stimulation, and mental development of stunted children: the Jamaican Study*, Lancet. 1991 Jul 6;338(8758):1-5.

The SDG agenda has also focused on the need to view social development holistically. For example, many countries are now starting to monitor early childhood development, which includes indicators derived from child protection, health, education, water, and sanitation and other sectors[48]. This emphasizes the need for a coordinated and rationalized approach to data and emphasizes inter-sectorial coordination and cooperation. Schools can play a focal role in supporting services for other ministries[49], and can also report on key indicators relevant to other ministries[50].

Therefore, in order to properly monitor child learning and address barriers preventing effective child learning, analysis of detailed information concerning the child and their family, the learning environment, as well as the national and regional socioeconomic factors, is required. According to the OECD, better data can help reduce inequity in education, including early childhood education, in multiple ways, including[51]:

- Identifying and providing systematic help to children at risk of not achieving academic and social goals;
- Directing resources to the schools, students and teachers with the greatest needs;
- Setting concrete targets for more equity in education, not only in access but also in quality and learning outcomes.

These requirements are placing increasing demands on systems to track individual children as they progress through the education system. Systems should enable the disaggregation of data to allow for analysis of complex socioeconomic factors affecting a child's progress through the education system, or exclusion from it.

In 2019 SDG4 progress was reviewed in Asia Pacific at the Asia Pacific Forum on Sustainable Development, co-organized by UNESCAP, UNESCO with support from UNICEF and UIS. An SDG4 profile was produced for the region, and the following paragraph was drafted on the lack of availability of quality data in the region to be able to report on a greater number of indicators:

SDGs have put strong emphasis on the need for quality data for evidence-based policymaking, planning and timely monitoring and evaluation at national, regional and global levels. However, producing quality data from different sources such as administrative and household survey data is challenging. Only 44 per cent of the 11 global indicators were available in the region[52]. Comparable indicators that measure both quantity and quality of education remained elusive; only a few countries were able to report on student learning outcomes. Moreover, disaggregated data required for monitoring equity in education are even more scarce, especially for disadvantaged groups such as people with disabilities. More work is also needed in order to assess difficult to measure characteristics such as language and migrant status. Household surveys (e.g. Multiple Indicator Cluster Survey [MICS] and Demographic Health Survey [DHS]) can provide better disaggregated data but use of such alternative data sources is still limited.

In addition, out of the 6 headline messages presented at the High Level Political Forum (HLPF) in New York for the region, the 5th recommendation highlighted the importance of strengthening

[48] Examples include Chile, Belize and Uganda. UNICEF has developed a framework of early childhood development indicators derived from SDG indicators and other research to help guide and focus countries on the monitoring of early childhood development.

[49] Examples include reporting deworming and vaccination programmes to the ministry of health and reporting incidents of violence against children to authorities monitoring child protection.

[50] For example, reporting the quality and source of water supplies in schools to the ministry of water and sanitation.

[51] OECD, *Equity and Quality in Education: Supporting Disadvantaged Students and Schools* (OECD Publishing, 2012). http://dx.doi.org/10.1787/9789264130852-en, referenced on 31 March 2019.

[52] UNESCO *SDG 4 Data Digest 2017. The Quality Factor: Strengthening National Data to Monitor Sustainable Development Goal 4* (UNESCO, UIS, SDG UIS/2017/ED/SD/11, 2017).

monitoring systems which was to “Strengthen monitoring of inclusion, equity and quality by ensuring mechanisms are in place and capacity are available”[53].

To comprehensively and systematically track progress and address inequalities, high-quality and more disaggregated data based on gender/sex, ethnicity, language, income, disability status, and geographical location must be available to planners, decision makers and stakeholders. Strengthening management information systems and capacity of data users on data collection using multiple sources (e.g. administrative, household, etc.), processing, analysis, and the effective utilization of data are also crucial in ensuring evidenced-based policies. Greater investment is therefore needed in national statistical systems that are struggling to meet the demand for more and better data for the global education goals and targets. This includes increasing funding to line ministries and national statistical offices for the training, resources and support needed to collect and use data for their own education priorities. Standards and tools must also be in place to produce the internationally comparable data needed to track global progress towards SDG 4. The new agenda also calls for use of diversified data sources to review progress based on agreed framework and processes at different levels (global, regional and national).

1.4 Changes in global education and the evolution of EMIS

The recent years have seen an increased emphasis on delivering quality education to all. The past two decades have seen a growing interest in strengthening systems for the measurement of learning. International learning assessment instruments such as Trends in International Mathematics and Science Study (TIMSS), the Programme for International Student Assessment (PISA) and Progress in International Reading Literacy Study (PIRLS), have increasingly been adopted in developing countries, supplemented by the more recent Early Grade Reading Assessment (EGRA) and Early Grade Maths Assessment (EGMA), or adapted to become part of a national assessment system[54,55]. In addition, UNICEF has also developed a new learning module in its Multiple Indicator Cluster Survey (MICS6) to capture the quality of student learning. MICS6 has been conducted in countries including Mongolia[56].

Access to education is increasingly being defined as ‘access to quality education’ and education plans are including facilities for encouraging and measuring the quality of the education system. The Global Alliance to Monitor Learning[57] has been designed to improve learning outcomes by supporting national strategies for learning assessment and developing internationally comparable indicators and methodological tools to measure progress towards key targets of SDG 4. New initiatives such as the Global Alliance to Monitor Learning will place increasing pressures on EMIS to be able to report locally and internationally on learning outcomes using comparative standards. This is reflective of a broader shift in EMIS from simply monitoring inputs to measuring and monitoring outcomes such as learning outcomes.

Both international communities and local governments have driven a change towards a greater emphasis on **equity** and **equality** whereby the needs of marginal and disadvantaged groups are clearly addressed in education planning. SDG 4 emphasizes the need to “Ensure inclusive and

[53] Source: https://sustainabledevelopment.un.org/content/documents/21990SDGEducation_2030_2019_HLPF_Steering_Committee_Submission.pdf, accessed on 30 January 2020.

[54] https://www.cambridgeinternational.org/Images/271193-international-surveys-pisa-timss-pirls.pdf

[55] TIMSS 2011 (maths): timss.bc.edu/timss2011/international-results-mathematics.html; TIMSS 2011 (science): timss.bc.edu/timss2011/international-results-science.html; PIRLS 2011: timssandpirls.bc.edu/pirls2011/international-results-pirls.html; PISA 2012: www.oecd.org/pisa/keyfindings/pisa-2012-results.htm

[56] http://mics.unicef.org/tools

[57] http://gaml.uis.unesco.org/

equitable quality education and promote lifelong learning opportunities for all" and SDG 4.5 stresses the need to "ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations", which requires "all data that can be" to be disaggregated by gender, location, wealth quintile and others, such as disability status, indigenous peoples and conflict-affected. Thus, EMIS must increasingly be capable of storing data on individuals and be able to disaggregate by a wide range of socioeconomic factors.

There is a global recognition that enrolling a child in school is no longer sufficient to ensure a child completes the education cycle. Students cannot perform well academically when they are frequently absent. Intermediate or continuous assessments help inform teachers and administrators of a child's progress and can ensure learning is adjusted to a child's specific needs. This places increasing emphasis on an EMIS being able to record and report on a child's ongoing progress.

In many countries there has been a growth of private and partially funded schools. **Private schools**, and schools offering religious, schools for children with disabilities or alternative education, such as Monasteries and Madrasas, often do not fall under the direct responsibility of MoEs. Ensuring these other education institutions are properly captured in education statistical systems can therefore be challenging for many MoEs. Barriers to the capture of private institution data can include : poor communication within the system and amongst stakeholders; inadequate human and material resources; the registration of private schools not being strictly enforced or taking time; inadequate advisory personnel at the education division; transport issues; and financial constraints[58].

Funding mechanisms for education have become increasingly complex. After 2000, there was a growing trend within the international development community away from project-based support towards general sector and budget support[59]. In many cases, different government programmes may be funded by different partners, who all require detailed information in order to be able to monitor and evaluate programme effectiveness in achieving goals. This places even greater emphasis on the availability of robust and precise education and budget plans, as well as flexible modalities of monitoring funding to schools[60].

Other shifts in education which influence EMIS deployment and design include: Incorporating sub-national and school-level admin and management functions to serve the needs of devolved responsibilities linked to decentralization, and more autonomous schools; Broadening of the types of information captured linked to improved monitoring of quality standards such as Water, Sanitation, and Hygiene WASH, Menstrual Hygiene Management (MHM), adaptations and specialized staff for children with disabilities/special needs, staff characteristics such as qualifications; Expansion of, or separate EMIS, to cover other levels: pre-primary/ECD, TVET, higher education; Interoperability of EMIS with other information systems, such as civil registry to

[58] Mkandawire J.K. *The Growth of Private Secondary Schools in Malawi: Its Implications on the Registration and Quality Monitoring Systems* (University of Massachusetts Amherst, 2002).

[59] Kharas H. *Trends and Issues in Development Aid* (Brookings Institute, 2007).

[60] Many Asian countries are in the process of shifting responsibilities for the provision of basic education from the central government to subnational governments, or to the schools themselves. This process is referred to as education decentralization. EMIS can help subnational administrative authorities and schools to better allocate and monitor the distribution and effectiveness of funds under decentralization.

UNESCO *Education Micro Planning Tool Kit, Module 5, Data and Information for Decision-Making and Planning* (UNESCO Bangkok, 2012).

ensure records are unique, and to identify children not in school and Health Management Information Systems (HMIS).

These shifts place an emphasis on the development of robust systems that can inform well-structured sector plans and expenditure frameworks, and that can monitor flexible funding arrangements. The growth of private education increasingly requires governments to develop information systems that monitor both the public and private education sectors.

A UNICEF report on the evolution of EMIS defines three stages to EMIS development[61]. These are:

- Stage 1: Pre-EMIS, which is characterised by mostly paper-based submission of data to the administrative levels. EMIS is typically characterised by aggregate data and there will be few if any operational systems. Countries in this stage often have gaps in data such as lacking private schools or those delivering alternative modes of education.
- Stage 2: Digitization, which is characterised by schools submitting data directly to the national EMIS. These EMIS may have individual student and teacher data and there will be the emergence of operational systems such as Human Resource Management Information Systems (HRMIS). There may be gaps in the data such as poor recording of students with disability.
- Stage 3: Bridging horizontal and vertical information gaps. These EMIS are the most sophisticated and will include all children in the EMIS. All education facilities will be required to report data through the EMIS. Information flows will be two way with information being returned to the school to facilitate processes, resource allocation, planning and monitoring.

Countries may have characteristic elements of different stages but will generally be classifiable into one stage based on decentralisation of data management, data coverage and the quality and extent of system deployment.

1.5 EMIS in the South Asian Region

Countries in South Asia have made remarkable progress in human development. Most are now classified middle-income countries, with rapid economic growth and improving social indicators. In the last five years alone over 150 million people have climbed out of income poverty[62].

South Asia is home to about 627 million children under 18 years of age[63] - approximately 36 percent of the total population of 1.82 billion[64]. Notwithstanding the strides in achieving Universal Primary Education globally and in South Asia, the issue of out-of-school children remains huge. South Asia, there are a total of 12.4 million out-of-school children of primary school age and 16.5 million children of lower-secondary school age who do not attend school and are thus deprived of their right to education[65]**.** At the same time, millions of children are completing primary education and not able to master foundational literacy and numeracy.

South Asia's rich ecological, geographic and cultural diversity make the region unique but also explains why it is volatile and vulnerable in social, economic and environmental terms.

[61] Van Cappelle, F (2018) *The Road to EMIS: Transitioning from a paper-based system to electronic and web-based information management*

Lessons learned from the Europe and Central Asia region, UNICEF

[62] The World Bank, Databank Poverty and Equity database at: http://databank.worldbank.org/data/reports.aspx?source=poverty-and-equity-database

[63] The State of the world's Children 2016, UNICEF, https://www.unicef.org/sowc2016/

[64] United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision, DVD Edition

[65] UIS Sept 2019, Factsheet no.56

Bangladesh, India, and Pakistan are among the ten most populous countries in the world while Bhutan and Maldives are among those with the smallest population. Urbanization is also shaping South Asia's development trajectory. Nearly 130 million South Asians currently live in informal urban settlements, but with rapid and uncontrolled urbanization this may increase to 42 percent by 2035. The region faces continuing challenges from weak urban governance, poor provision of public services, lack of effective social protection systems and mounting urban poverty to the impact of climate change, natural hazards, political turmoil, gender inequality, etc.

There have been several notable developments in South Asia regarding the development and implementation of education monitoring and management systems by governments used at sub-national/local and school levels, some of them with significant support and/or funding from UNICEF. Maldives is an example of a highly developed EMIS in the region.

Maldives EMIS[66]

The Republic of Maldives launched a project in 2015 to adopt OpenEMIS as a means of strengthening EMIS in order to meet its needs to improve the quality of the services and outputs relevant to education[67]. Prior to this, the collection and utilisation of education data was very rudimentary and fragmented, relying on paper records and excel spreadsheets. The new Maldives EMIS (MEMIS) commenced implementation in 2017.

Maldives EMIS (MEMIS) tracks Individual students and includes the following equity variables, distance from school, occupation of mother and father as proxies for Socio-economic status, attendance of pre-school. It contains a module on student attendance that includes reason for absence, and a management system for students at risk of drop-out. The teacher and school modules are very comprehensive. MEMIS covers pre-primary, primary, higher primary, and secondary for public schools however data is still limited for private schools.

MEMIS includes is a module to identify and manage students at risk of dropping-out. The ministry adopted a policy regarding actions to be taken to prevent dropouts and implemented algorithms in MEMIS to provide early warming alerts concerning students at risk of dropping out. The measures taken have proven highly effective in reducing absenteeism five-fold.

MEMIS is also interoperable with other government systems such as the Computerized. National. Identity Card (CNIC) which is a civil registry including children Age 2 to 18 years of age. This CNIC list is imported to MEMIS annually and provides a complete repository of children in the country on which to base MEMIS data.

[66] Mott Macdonald. (2019, October). *Evaluation of EMIS at school and sub-national levels - Evaluability Report*.

[67] OpenEMIS, or Open Education Management Information System (EMIS), is an Education Management Information System for the education sector. Its main purpose is to collect, analyze, and report data related to the management of educational activities. Initially conceived by UNESCO, OpenEMIS serves as a response to Member States' need in the area of tools for educational strategic planning. Source: https://www.openemis.org/

2 Purpose, Objectives, Scope and Methodology of the Review

2.1 Purpose and Objectives

The purpose of this review is to understand the existing efforts in development and implementation of EMIS which improve education management, monitoring and planning at national, sub-national and school levels, and subsequently improve efficiency, quality and equity. This will help development partners such as UNICEF and governments learn from and build on existing efforts in the development and implementation of such systems.

The objectives of the review are to:

i. Determine the strengths and limitations of the systems, from which lessons can be drawn for the improvement of the system as well as other monitoring and management systems in the region.
ii. Determine the requirements and constraints of the systems for scale-up and wider use, especially at the lowest level admin and school levels, and in contexts with limited ICT infrastructure.
iii. Determine the key technical aspects required (existing and yet to be developed) for the successful implementation of the EMIS and SIMS and more broadly – extrapolating from the review findings – for other monitoring and management systems.
iv. Determine the key institutional, technological, financial and socio-cultural aspects which have positively or negatively shaped the use and impact of the two systems.
v. Review the impact of the system's use on school efficiency, by reviewing progress made in terms of teacher and student attendance, student survival rates and drop-outs, or any other relevant progress which could be attributed to the system's use
vi. Capture in the review report all these lessons learned, covering technical, institutional, financial and socio-cultural dimensions, which would enable development partners to better support the development and effective use of existing and emerging education monitoring and management systems in South Asia.
vii. Determine UNICEF's relative strengths and weaknesses in supporting Governments in the design, development and adoption and use of such systems, and thus to outline on which aspects UNICEF is well positioned to lead, and on which others UNICEF is not yet where it needs to be.

2.2 Scope of the Review

This review took place between November 2019 and January 2020. The review took place in Andhra Pradesh and focussed on the EMIS operated in the Department of School Education and its relationship to the national systems. The implementation of the EMIS at district, block, cluster office and school levels were reviewed. To undertake this review, a field mission was undertaken to Andhra Pradesh in November 2019 to review the systems. The full methodology is detailed below.

2.3 Review Questions

The review questions are presented in Annex 3 and are organized into several dimensions based on the UNICEF & UIS framework for monitoring education participation[68]. The dimensions are 'technical' and 'use and impact' and questions are presented under thematic areas in both these dimensions (refer below). Both quantitative and qualitative data collection and analysis methods were used to obtain relevant information for each review dimension, from a range of stakeholders at different levels. In addition, questions are divided into two categories: descriptive questions, and normative ones.

Descriptive questions aimed to provide information and verifiable facts about the systems being reviewed. Answering **normative questions** involves making judgments, based on application of explicit criteria for weighing evidence.

Technical

2. Relevance and comprehensiveness of indicators for monitoring access, equity and quality
3. Data quality management and mechanisms
4. Measures for safeguarding personal and confidential information
5. Types of information and levels of disaggregation
6. Efficiency of data collection and administration
7. Two-way vertical information flows from school to regional/national and in between
8. Integration with other relevant databases, within and cross-sectoral, including financial, demographics, learning assessment
9. Integration of an early warning system or mechanisms to prevent dropout
10. Level of automation

Use and impact (institutional and socio-cultural dimensions)

1. Level of school and local level implementation, ownership, and use
2. Easy to use
3. Usefulness
4. Transparency
5. Sustainability
6. Effectiveness and impact
7. UNICEF's role

2.4 Methodology

2.4.1 Overview of Methodology

The methodology used for this review was based upon a three-stage process:

Stage 1 involved conducting a review assessment of six EMIS systems. The purpose of the review assessment was to select two countries for a more in-depth review during Step 2 of which India was one selected country and AP was the selected region within India. Criteria for the

[68] UNICEF & UIS (2016). Framework for Monitoring Out of School Children and Children at Risk of Dropping Out, Geneva: UNICEF. https://www.unicef.org/eca/reports/monitoring-education-participation

review study included assessing the devolution and use of the EMIS at school level. During this phase, a number of different Frameworks for assessment of EMIS were examined at the Review stage, including DQAF[69], SABER[70] and Monitoring Education Participation - Framework for Monitoring Children and Adolescents who are Out of School or at Risk of Dropping Out[71]. Elements were selected from each methodology applicable to this study with a focus on SIMS and equity at the school level.

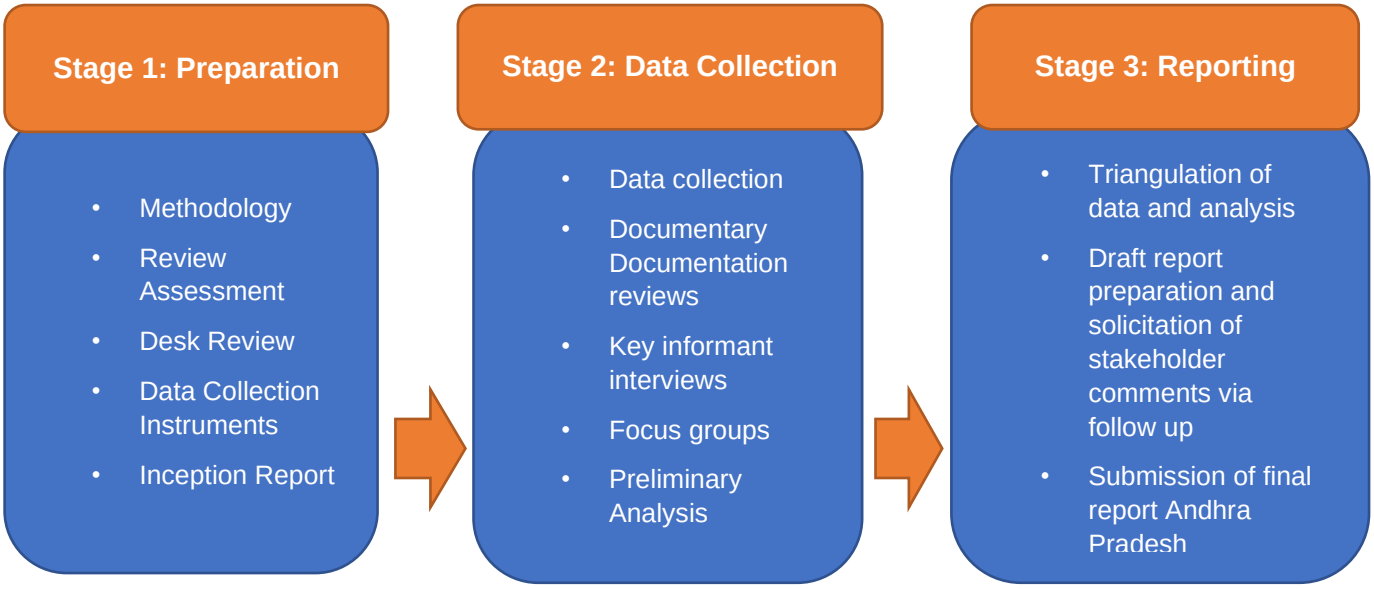
Based on findings from the completed questionnaire and the review of documentation provided by authorities and found online, a Review Framework was applied to select two EMIS to participate in the Review[72]. The UNICEF Steering Committee accepted the selection of the two EMISs which were the state of Andhra Pradesh in India and the province Khyber Pakhtunkhwa in Pakistan.

Stage 2 consisted of an in-depth study of the two selected EMIS to review the systems to help identify how well established and embedded they are, and lessons learned with potential applicability to other EMIS within the ROSA region and beyond. Stage 2 involved Country visits of International EMIS Consultants.

Stage 3 consisted of analysis and documentation of findings and generation of the final report.

The EMIS review built on the questionnaire and documentation obtained during Stage 1. Stage 2 involved stakeholders' interviews including users of EMIS data (for example in policy or research) as well as those involved directly in EMIS operations. It looked for evidence covering all areas set out in the methodology. Each of the two reviews has been carried out by a different international consultant working in close cooperation with the local UNICEF offices.

Figure 2.1: Methodology for In-depth Study



[69] UNESCO (2019) *Ed-Data Quality Assessment Framework (Ed-DQAF)*

(Ed-DQAF) to Evaluate Administrative Routime Data Systems: Manual for the Conduct of an Evaluation by a National Technical Team, http://uis.unesco.org/sites/default/files/documents/training-workshop-manual-data-quality-assessment-framework-2017-en_0.pdf, accessed on 20 January 2020

[70] Abdul-Hamid, H, SABER EMIS Framework Paper (World Bank, 2014)

[71] UNICEF and UNESCO Institute for Statistics. (2016, December). *Monitoring Education Participation : Framework for Monitoring Children and Adolescents who are Out of School or at Risk of Dropping Out*, retrieved from http://uis.unesco.org/sites/default/files/documents/monitoring-education-participation.pdf.

[72] Mott Macdonald. (2019, October). *Evaluation of EMIS at school and sub-national levels - Evaluability Report*.

Figure 2.2: Systems Approach for Better Results (SABER)-EMIS Thematic Areas of Analysis (*Source*: SABER-EMIS Framework Paper, World Bank[73])



The Review tools and methods for key informant interviews were informed by the Review questions, as well as by the World SABER-EMIS methodology and tools commonly used in EMIS evaluations and reviews[74] and UNESCO's Data Quality Assessment Framework (DQAF)[75, 76].

The SABER-EMIS approach has identified four main thematic areas as highlighted in the figure above and according to:

1. **Enabling environment:** The policies, structure, human resources, and culture surrounding an EMIS that ensure collection, processing, and dissemination of data.
2. **System soundness:** The architecture, processes, and integration capabilities of an EMIS, along with the comprehensiveness of the data collected by the system.
3. **Quality data:** The procedures that ensure the collection of reliable, accurate, and timely data for decision-making purposes.
4. **Utilization for decision making:** The extent to which the data produced by an EMIS is used by different stakeholders (principals, teachers, parents, students, and governments) across the education system.

SABER data collection tools were reviewed and questions from SABER were aligned with themes from the Review study. Specifically, the SABER data capture tool for country survey of EMIS was reviewed and, where feasible and appropriate, questions were adopted to fit under the thematic structure and questions of this Review[77]. It will be noted that the overall thematic structure of the

[73] Abdul-Hamid, H, *SABER EMIS Framework Paper*, (World Bank, 2014).

[74] The SABER-EMIS methodology utilises a structured evaluation process to provide education systems analyses, assessments, diagnosis, and opportunities for dialogue. At the global level, it improves the education systems knowledge base and uses this information to implement effective reforms. http://saber.worldbank.org/index.cfm?indx=8&pd=2&sub=4, accessed 27 March 2019.

[75] Developed to implement evaluation methodologies that assess the quality of data produced by national statistical systems using such standards and tools for assessing education data quality produced by member states. Source: UNESCO (2019) *Ed-Data Quality Assessment Framework (Ed-DQAF)*

(Ed-DQAF) to Evaluate Administrative Routime Data Systems: Manual for the Conduct of an Evaluation by a National Technical Team, http://uis.unesco.org/sites/default/files/documents/training-workshop-manual-data-quality-assessment-framework-2017-en_0.pdf, accessed on 20 January 2020

[76] This Review was not envisaged as a detailed SABER evaluation and was not designed to address all of the same issues.

[77] SABER, *Data Collection Instrument*, (World Bank Group, 2014).

SABER review is different from this Review as this Review was not intended as a thorough review of all aspects of EMIS within each country, but rather sought to address specific questions under the two policy themes identified.

2.4.2 Primary Data Sources

During Phase I a survey was sent to Andhra Pradesh Department of School Education, the results of which helped inform the methodology and approach for primary data collection. Phase I data was referenced for this report but not used extensively. Almost all data used in this report was gathered during Phase II.

The UNICEF country office in conjunction with Andhra Pradesh Department of School Education, identified key informants during the preparatory phase. Interviews were conducted over a period of two weeks. This included planning face-to-face meetings with key-stakeholders, planning visits to the EMIS and planning departments offices, organizing focus group discussion with key informants, and organizing field visit to collect information at sub-national, district and school level. A designated Department of School Education focal point handled the scheduling of meetings with all Department of School Education parties, with District Offices, and with schools.

Primary data collection focused on interviews with EMIS administrators at the different levels as well as with school directors/head teachers and teachers in selected schools. The list of informants interviewed is shown in Annex 2. A summary is presented below.

Table 2.1: Summary of Key Informant Interviews conducted in Andhra Pradesh

SN	Entity	Number Rural	Number Urban	Number Persons Participating
1	State Level Agencies and Departments within Department of School Education	11	39	39
2	Commissioner of Education Debrief Meeting	1	12	12
3	State Level Agencies and Departments external to the Department of School Education	8	28	28
4	Development Partners (UNICEF)	3	3	3
5	District level Agencies within the Department of School Education	9	0	63
6	Mandal Education Office	3	1	14
7	Cluster Resource Persons	3	1	9
8	Advantaged Secondary School	2	0	21
9	Kasturba Gandhi Balika Vidyalaya (KGBV) residential girls' secondary school	1	0	6
10	Disadvantaged Primary School	2	0	5
	Total			200

This review process required to build a sample of schools and sub-national structures for primary and secondary data collection. The international experts planned carefully before the mission and liaised to ensure that sampling method is consistent over the review processes.

The choice of national or regional structures, district education offices and schools was made in collaboration with UNICEF country offices, considering the following criteria:

- Distinction between urban and rural areas.
- Considering different level of education depending on the EMIS targeted structures.

- Accessibility.
- Disadvantaged vs Advantaged schools.

These criteria were established based the need to respond to research questions which required establishing factors relating to the successful use and implementation of SIMS at the school level in a range of operational environments including rural and urban locations and advantaged and disadvantaged schools. The small number of schools visited may introduce bias however this was an inherent limitation of the resources applied under the study. No private schools were visited which limited the study to government schools and reports on private schools supplied by the Department of School Education.

For sub-national (district, state) and school interviews, disadvantaged (poorly equipped) and advantaged institution(s) (well equipped) were visited. Districts selected for interviews included East Godavari and Prakasam District. The strategy was maintained however owing to time limitations not all stratified variations were possible. For example, urban primary schools were not visited in preference of confirming results in two rural disadvantaged primary schools.

2.4.3 Secondary Data Sources

Existing literature was reviewed concerning the education system and EMIS in the country. Secondary data sources are referenced throughout this document in the footnotes and include: Education sector plans and national education strategies, policies and laws; EMIS enabling documents such as budgets, plans, staffing arrangements, training and capacity development documents and organisational structure and roles documents; EMIS system documents such as manuals and architecture as well as direct access to the EMIS; EMIS data publications and reports highlighting quality aspects of the data and the nature of the data (specific content); documents and reports highlighting EMIS in the decision making context, particularly at the school level such as its use to monitor schools or in the development of School Improvement Plans. Local documents were placed in the context of international best practice as evidenced through research and reviews and evaluations of EMIS.

2.4.4 Qualitative and Quantitative Data Analysis Methods

Quantitative data analysis, such as analysing EMIS data for consistency and quality, was beyond the scope of this Review. Existing analytical reports, data verification and validation exercises and key informant opinions were used where such were available. Interview data was analysed for positive or negative responses and noted during narration. Judgements for inclusion of responses were made based on frequency and: a) the extent to which qualitative and/or quantitative evidence generated from different sources point to the same conclusion, and b) the quality of the individual data and/or source of evidence as determined by reliability/completeness of response and capacity of the respondent to make an assessment or offer an opinion.

Gender equity and equality analysis is applied through referenced education statistical data highlighting how the SIMS may helped highlight or address equity issues. Other forms of equity analysis, such as gender participation in interviews, was not applied as this was not a focus of any of the review questions.

2.5 Ethical considerations and inclusiveness

The Review has considered throughout issues of equity, gender equality and human rights, in line with UNICEF's Evaluation Policy (2018)[78] and the United Nations Evaluation Group Norms and

[78] UNICEF, *Revised evaluation policy of UNICEF* (UNICEF, 2018), https://www.unicef.org/about/execboard/files/UNICEF_Revised_Evaluation_Policy-2018.01.30.pdf , accessed on 15 April 2019.

Standards (2016)[79]. The consultant adhered to UNICEF's[80] Procedure for Ethical Standards in Research, Evaluation, Data Collection and Analysis[81]. Adherence to UNICEF's Procedure for Ethical Standards and Research, Evaluation and Data Collection and Analysis (2015)[82] was maintained.

There are three main tenets of research ethics that the consultant aims to uphold in the Review[83]:

1. Ensure informed consent from all respondents.
2. Ensure the sensitive treatment of vulnerable respondents, or data pertaining to such persons.
3. General data confidentiality.

Efforts were made to ensure all respondents understood exactly how the information they have provided was to be used.

A gender lens cut across all stages and components of the Review, to assess whether interventions affect one gender more than others, as per UNICEF Guidance on the Integration of Human Rights and Gender Equity in Evaluation (2014)[84]. Where possible and where data was made available, various dimensions of equity were examined to see if the interventions have differential impacts on distinct categories of beneficiaries, such as disability, wealth and location. Training materials, guidelines and policy documents, where feasible, were reviewed to determine the extent to which they promoted gender equality and inclusiveness, and the extent to which they contribute towards promoting equality.

2.6 Review Limitations

All Reviews are limited by resources. The Review was conducted over a period of three months which included 13 days of field work. These efforts were supported by inputs from the team leader and UNICEF ROSA. The time constraints limited the extent to which the consultant could undertake fieldwork and analyse results. In Andhra Pradesh, the EMIS was complex and involved many systems and processes which were all interlinked. There was an extensive arrange of portals and applications through which persons interacted with the systems. The depth of the Review, as in all reviews, is reflective of the time that was available. Time limitations were mitigated by the consultant having previously worked throughout India and thus having familiarity with the context.

[79] UNICEF, United Nations Evaluation Group, (*UNEG) Norms and Standards for Evaluation* (UNICEF, 2016), http://www.unevaluation.org/document/detail/1914 , accessed on 15 April 2019.

[80] These are often adopted in UN evaluations. Director, Division of Data, Research and Policy, 'UNICEF procedure for ethical standards in research, evaluation, data collection and analysis' Document Number: CF/PD/DRP/2015-001 (Director, Division of Data, Research and Policy, 2015).

[81] There were cases where data on children were obtained and analysed, including data of individual children. Caution was taken to treat the confidentiality and reporting of all such data in accordance with the standards.

[82] UNICEF, *UNICEF Procedure for Ethical Standards and Research, Evaluation and Data Collection and Analysis* (UNICEF, 2015), https://www.unicef.org/supply/files/ATTACHMENT_IV-UNICEF_Procedure_for_Ethical_Standards.PDF, accessed on 15 April 2019.

[83] Likewise, conventional ethical guidelines have been followed during the Review. Specific reference has been made to the United Nations Evaluation Group Norms and Standards and Ethical Guidelines (2008), as well as to UNICEF's Evaluation Policy (2016), the United Nations Evaluation Group Guidance on Integrating Human Rights and Gender Equality in Evaluation, the UN SWAP Evaluation Performance indicator, the UNICEF Procedure for Ethical Standards in Research, Evaluation and Data Collection and Analysis, and UNICEF's Evaluation Reporting Standards. Good practices not covered therein were also followed.

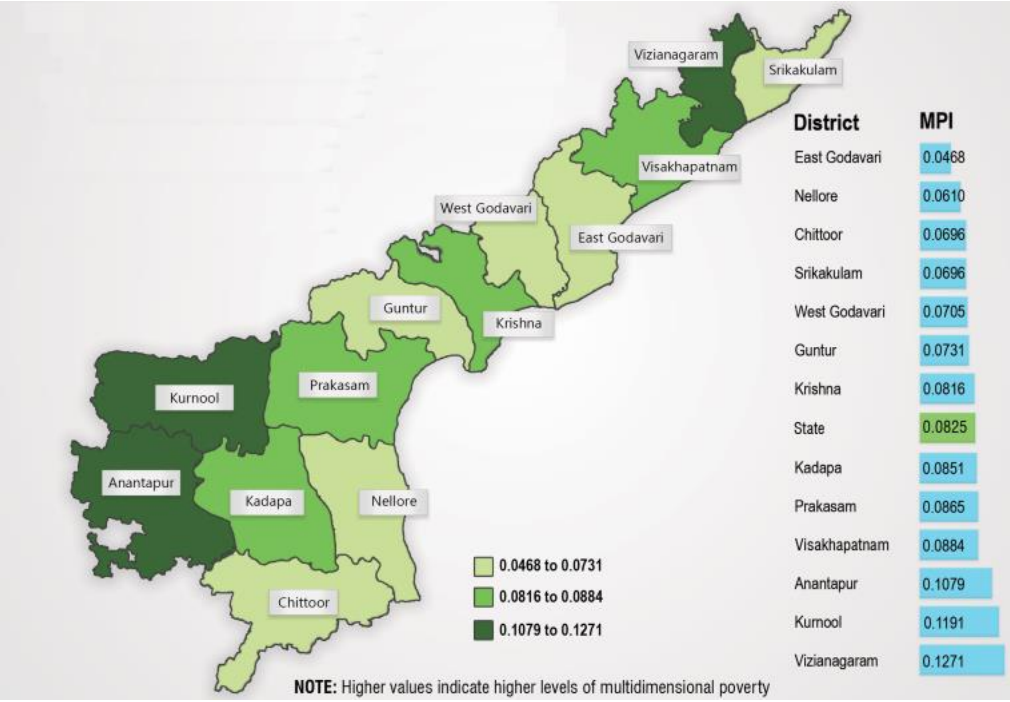
[84] UNICEF, United Nations Evaluation Group (*UNEG) Guidance on Integrating Human Rights and Gender Equality in Evaluation* (UNICEF, August 2014), http://www.unevaluation.org/document/download/2107 , accessed on 15 April 2019.

3 Main Findings

3.1 Overview of Andhra Pradesh State

Andhra Pradesh is the 10th largest state in India in population and is located on the south eastern coast of India. The area of the state is 1,60,240 Sq. Kms with a population of 4,93,86,799 as per the Census 2011 and the decadal growth rate is 9.21%. The major languages spoken in the state are Telugu and Urdu. The density of population is 308 per Sq. Km. The urban population is 29.58% and the rural population is 70.42%. The literacy rate of the State is 67.41 as per the census 2011[85]. In which the male literacy rate is 74.83 whereas the female literacy rate is 60.01. The main socio-economic statistics of the state are shown in Annex 4.

Figure 3.1: Andhra Pradesh state map showing multidimensional poverty index by district[86]



According to a multidimensional poverty study conducted in 2017[87], 21% of its population as living in multidimensional poverty[88] (refer figure above). The state has a projected total GDP of $160 billion USD (2019-2020) and a GDP per capita of $2,000 USD (2017-2018) which classifies Andhra Pradesh as lower middle income[89]. This is close to the national average for India of 2,015 USD (2018). Despite this Andhra Pradesh has a very high GDP growth per capita of 15.3% (2018-

[85] It monitors 10 indicators, such as school attendance, nutrition and safe drinking water, grouped into three dimensions: education, health and standard of living. The Alkire Foster counting approach to multidimensional measurement is employed to create each person's deprivation profiles, then use these to calculate Andhra Pradesh's MPI.

Source: DES (2018) *Statistical Abstract, Andhra Pradesh*, 2018, Directorate of Economics and Statistics, Government of Andhra Pradesh, Gollapudi, Vijayawada

[86] Source: https://ophi.org.uk/indian-state-of-andhra-pradesh-releases-its-first-multidimensional-poverty-index-report/

[87] Multidimensional Poverty Index (MPI) Report 2017

[88] OPHI (2018) *Global Multidimensional Poverty Index*, Oxford Poverty Human Development Initiative, University of Oxford

[89] Source: https://datatopics.worldbank.org/world-development-indicators/stories/the-classification-of-countries-by-income.html, , accessed on 14 January 2020

2019) which is well above the national average of 6.6%. Urbanisation has been regarded as an important component for growth realization. The percentage of urban population to the total population in the State is 29.47 percent in 2011 as compared to 24.13 percent in 2001)[90] and slightly lower than the national average of 31.16% (2011).

Administratively, Andhra Pradesh is comprised of 13 districts and 676 Mondals[91], of which Chittoor district (66 mandals), has the greatest number of mandals and Vizianagaram district (34 mandals) has the least number of mandals in the state.

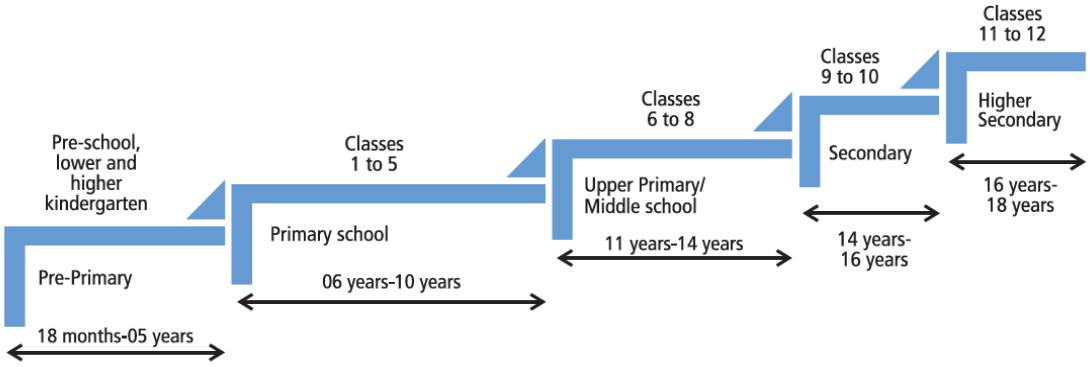
3.2 Overview of School System in Andhra Pradesh

3.2.1 Overview of the Education and System[92]

The School Education Department of Andhra Pradesh, the largest department of the state, manages and regulates schools in various districts of the state[93]. An organogram of the Department of School Education in Andhra Pradesh is presented in Annex 6. The primary and secondary school education is imparted by government, aided and private schools[94]. These schools are categorized as urban, rural and residential schools[95].

The school system is in Andhra Pradesh follows segmentation in accordance with the standard class system applied throughout India and is show in the figure below.

Figure 3.2: Segmentation of Indian Schools by level of Education[96]



The state of Andhra Pradesh has been adopting free and compulsory education to all children to the age of 14 years[97]. The majority of schools are public (72.0%) or government aided (3.7%) as indicated in the table below.

[90] GoAP (2017) *Socio Economic Survey 2016-17*, Planning Department, Government of Andhra Pradesh

[91] The administrative level below a district in Andhra Pradesh is the mandal.

[92] Source for all education statistics: UDISE 2017-18

[93] Source: https://cse.ap.gov.in/DSE/aboutUs.do, Accessed on 20 January 2020

[94] *Special Order.No. 25/Academic Inspections/2015-4*, Government of Andhra Pradesh, School Education Department, Dated:20-03-2015

[95] Nagaraju, M. T. V. (2004). *Study Habits Of Secondary School Students*. Discovery Publishing House. p. 75. ISBN 9788171418930.

[96] Source: *Indian School Education System, An Overview*, pg12, British Council, December 2014

[97] Source: Government of Andhra Pradesh, *The right of children to free and compulsory education act, 2009* (1st April, 2010)

Table 3.1: AP State Number of Schools by Administrative Management and Funding

Management	Primary		Upper Primary Schools		High Schools		High Schools	
	No	%	No	%	No	%	No	%
Government	33,654	85.2%	4,283	6,290	50.9%	44.8%	44,227	72.0%
Government Aided	1,492	3.8%	283	468	3.8%	3.0%	2,243	3.7%
Private	4,145	10.5%	4,718	5,510	44.6%	49.3%	14,373	23.4%
Total	39,519	100.0%	9,565	12,361	100.0%	100.0%	61,445	100.0%

135,259 teachers are employed in primary schools with 64,537 working in upper primary. 60,722 teachers are employed in secondary schools and in Higher secondary there are 10,031 teachers working in all the management schools. AP State has made significant progress in recent years towards improving access to education and increasing equality. Enrolment is almost universal for children of the age group 6 to 14 being above 82.5% in 2016/17 whereas National is 93.5%[98].

The table below shows Andhra Pradesh (AP) progress since the introduction of SIMS for main education indicators. It should be noted that SIMS was introduced in 2015 and with it individual child tracking was implemented. This resulted in an initial reduction in GER from 88.21% to 84.48% which was attributable to the identification of ghost children, some double counting of enrolments and other anomalies. SIMS was attributed as a tool with which to help address these issues thus resulting in a correction of data in 2015/16[99]. The increase in teacher to pupil ratio at primary and secondary levels may also be attributable to increased retention of pupils but this was not confirmed.

Table 3.2: AP State progress for selected education indicators 2015 to present[100]

SN.	Name of Indicator	2015-16	2016-17	2017-18	2018-19 (Provisional)	Improve	National Average (2016-17)
1	Gross Enrolment Rate (GER) (Primary)	84.48	82.79	85.59	87.28	Improved	95.12
2	GER (Upper Primary)	81.33	80.87	83.93	86.22	Improved	90.73
3	GER (Secondary)	75.51	76.08	79.14	82.69	Improved	79.35
4	Annual Average Drop out Rate (Primary Level)	6.27	2.15	0.00	0.00	Improved	6.35
5	Annual Average Drop out Rate (Elementary Level)	5.47	1.56	0.00	0.00	Improved	6.12
6	Annual Average Drop out Rate (Secondary)	3.81	1.30	3.52	3.94	Same	-
7	Pupil Teacher Ratio (PTR) Secondary	24	19	-	-	Improved	27
8	Gender Parity Index Primary	0.94	0.89	0.94	0.96	Improved	1.02
9	Gender Parity Index – UP	0.94	0.94	0.99	1.00	Improved	1.10
10	Gender Parity Index - Sec	0.99	1.09	1.02	1.03	Improved	1.02

[98] Latest figures available from 2016/17. Source: http://udise.schooleduinfo.in/dashboard/elementary#/

[99] Reported in interviews with Department of School Education Staffs.

[100] Source: UDISE 2019.

Under the Performance Grading Index (PGI) (2017-2018) for all states and union territories throughout India[101], Andhra Pradesh achieved well in terms of Quality of Education (154, 5th) and moderately in terms of Access to education (70, 15th), infrastructure and facilities (99, 15th) and Governance Process (211, 13th) but poorly in terms of Equity (194, 32nd).

According to the Annual Survey of Education (ASER) Education report for 2018, AP state is overall ranked 9th for basic literacy and numeracy[102] and is ranked 11th in basic reading skills and 7th in Arithmetic skills. Within the state, almost all children pass the upper secondary exam[103].

Table 3.3: Grade wise performance of Class III, V and VIII

Class III	Class V	Class VIII
% Children who can read Std II level text • AP Rank is 19 with 22.4% • National is 27.2&	% Children who can read Std II level text • AP Rank is 9 with 59.7% • National is 50.3%	% Children who can read Std II level text • AP Rank is 14 with 79.20% • National is 73%
% Children who can do subtraction • AP Rank is 8 with 38.40% • National is 28.10%	% Children who can do division • AP Rank is 7 with 39.3% • National is 27.8%.	% Children who can do division • AP Rank is 13 with 47.60% • National is 28.1%.

The Department of School Education is running under Department of Education which will implement from Classes from Class 1 to 10th. Further, the Commissionerate of Intermediate will implement from Classes 11 to 12th. The state also places a high priority on monitoring learning outcomes and contextualising teaching accordingly for individual students.

- National Achievement Survey (NAS) -2017 For Classes 3,5,8 &10
- Annual Survey of Education Report (ASER) - 2017, 2016 – Classes 3,5 & 8, 2017- Secondary Classes
- Rs and Student Learning Achievement Survey (SLAS), 2016 – Classes 2 & 3 (3Rs) Classes 4 & 8 (SLAS), 2017 - Classes 4, 6 & 9
- SSC Public Examinations 2018

In Andhra Pradesh, around 82% of schools are managed by the Department of School Education and the remaining 18% schools are managed by the Municipal and Welfare Departments. The Municipal Department manages 16 municipal corporation schools. The Welfare Department manages Tribal schools which are established to facilitate participation of tribal people in remote and urban areas.

[101] Department of School Education, Ministry of Human Resource Development (2019), *Performance Grading Index (PGI) (2017-2018) for all states and union territories*, https://mhrd.gov.in/sites/upload_files/mhrd/files/PGI_2017-18.pdf, accessed on 27 March 2020

[102] *Annual Status of Education Report (Rural) 2019*, ASER, January 15 2019, http://img.asercentre.org/docs/ASER%202018/Release%20Material/aserreport2018.pdf, Accessed on 25 January 2020.

[103] The Andhra Pradesh Board of Secondary Education (Directorate of Government Examinations) administers the Secondary School Certificate (SSC) examination. For the 2019 SSC exam, more than 600,000 students have appeared and recorded an overall pass percentage of 94.88%, a little increase from 94.48% of the previous year. In terms of district-wise pass percentage, East Godavari stood at the top with 98.19% and Nellore at the bottom with 83.19%. Schools which recorded a 100% pass percentage were 5,464, out of 11,000.

Examples of Targeted Education Programmes

The *Kasturba Gandhi Balika Vidyalaya* or *KGBV* is a residential girls' secondary school managed by the State Government of Andhra Pradesh and supported through the Ministry of Human Resource Development (MHRD). The objective of *KGBV* is to ensure that quality *education* is feasible and accessible to the girls of disadvantaged groups.

Navodya Vidyalaya Samiti was registered as a Society with the primary objective to provide good quality modern education to the talented children predominantly from the rural areas, without regard to their family's socio-economic condition. At present, it has 589 functional residential schools. Admission in Jawahar Navodaya Vidyalayas is made on the basis of selection test which is designed to ensure that talented children from rural areas are able to compete without facing any disadvantage.

3.2.2 Transformative Education Initiatives

AP state has undertaken significant transformative initiatives to modernise and improve the education system throughout the state. As indicated in the next section, the School Information Management System (SIMS) plays a vital role in the monitoring and evaluation of all initiatives.

The Department of School Education in AP has initiated a programme called "Badi Parivartana"[104] for a strategic school transformation. The vision is towards a more child centric school education with a goal to create an all-enabling ecosystem to ensure 'happy, fulfilled, resilient and responsible students who are future ready'. The programme's mission is that 'All children complete K-12 Education and gain appropriate scholastic and co-scholastic skills[105].

AP state is also implementing the Samagra Shiksha[106] which was launched in 2018-19 extending from pre-school to class 12 with the broader goal of improving school effectiveness measured in terms of equal opportunities for schooling and equitable learning outcomes, [107], [108].

AP state is also promoting a **digital education initiative** across the state which aims to establish digital classroom learning[109] for all years. During 2019 Digital Class Rooms (DCR) were established in 5000 schools, 3905 with 30% Donor support and 1095 with 100% government funding. Virtual Class Rooms (VCR)[110] were established 1874 in schools (with Connectivity)

[104] http://badiparivartana.ap.gov.in/

[105] No. 14-4/2019-IS-18, Government of India, Ministry of Human Resource Development of School Education and Literacy (IS-18 Section), Shastri Bhawan, New Delhi, 5th July 2019

[106] SamgraSamagra Shiksha subsumes the Central Sponsored Schme of Rashtriya Madhyamik Shiksha Abhinyan (RMSA), Sarva Shiksa Abhiyan (SSA) and Teacher Education (TE).

[107] *SamgraSamagra Shiksha an Integrated Scheme for School Education Manual on Financial Management and Procurement Department of School Education and Literacy*, Ministry of Human Resource Development, Government of India, 2018

[108] The main outcomes of the Scheme are envisaged as Universal Access, Equity and Quality, promoting Vocationalisation of Education and strengthening of Teacher Education Institutions (TEIs). The Scheme is designed to help improve the Transition rates across the various levels of school Education and aid in promoting universal access to Children to complete School Education. It would is also designed to broaden the benefits of Technology and widen the access to good quality education across all States and UTs and across all sections of the society. The major objectives of the programme are to (i) Provision of quality education and enhancing learning outcomes of students; (ii) Bridging Social and Gender Gaps in School Education; (iii) Ensuring equity and inclusion at all levels of school education; (iv) Ensuring minimum standards in schooling provisions; (v) Promoting vocationalisation of education (vi) Support States in implementation of Right of Children to Free and Compulsory Education (RTE) Act, 2009; (vii) Strengthening and up-gradation of State Councils for Educational Research and Training (SCERTs)/State Institutes of Education and District Institutes for Education and Training (DIET)s as a nodal agency for teacher training.

[109] A digital classroom is a classroom that is fully immersed in technology. Digital classrooms prepare students for life in college and the real world by providing them with a technology-based education. Digital classrooms also promote a reduction or elimination in the use of paper.

[110] Virtual classrooms are online environments that enable students and instructors to communicate synchronously, by means of audio, video, text chat, interactive whiteboard, application sharing, instant polling, and other such features, as though they were standing face to face in a classroom

supported by 10 District Studios and a state level studio which enable two way interaction for learning. Digital content in the form of textbooks has been made available for easy access using Quick Response (QR) codes[111]. Student performance is evaluated real time using clicker analysis[112]. Personalised adaptive learning (PAL) is being piloted throughout the state. 1943 Information Communication Technology (ICT) labs have been established each with 31 laptops and 31 tablets.

In addition, or as part of the noted programmes above, AP state is undertaking the following transformative initiatives:

1. The Nedu-Nedu programme which seeks to transform all government schools with required infrastructure and up-gradation of skills besides setting up of English laboratories in addition to providing basic amenities such as clean environment, running water, furniture, compound walls, toilets, renovation and involvement of parent committees over two years. The scheme has a budget of 1,678 million USD[113] and for the first year, 489 million USD[114] will be spent for the development of infrastructure. To date 42,655 (96%) Schools Photos & Videos have been captured to assist (using SIMS).
2. Enhance Learning Levels & education standards in schools.
3. Introduce English Medium in every Government school which has involved extensive in-service teacher training monitored using the SIMS.
4. Give top priority to Mother tongue; make learning Telugu mandatory for all students of all schools.
5. Deliver Free Textbooks and Uniforms, Shoes to every student on time. During 2019 100% Textbooks were delivered and 87% Uniforms supplied monitored using the SIMS.
6. Enhance the quality of Mid-Day-Meal programme[115].
7. Recruit adequate number of Teachers - ensure School/Class level Pupil-Teacher Ratio.
8. Ensure Skill Development which has involved vocational education for 35000 students.
9. Establish a Regulatory Commission on Pvt. schools to monitor fee structure (reducing fees), improve educational standards and enhance the private school teachers' service conditions.

3.3 Overview of EMIS in Andhra Pradesh (SIMS)

3.3.1 Overview of SIMS in Andhra Pradesh

EMIS, which is called School Information Management System (SIMS) in Andhra Pradesh, is highly developed in Andhra Pradesh. It is deployed over the internet and is thus cloud based. It is comprised of a warehouse element which reports annual data in accordance with UDISE+ standards and also detailed transactional elements[116]. Data permeate almost all aspects of

[111] QR code (abbreviated from Quick Response code) is the trademark for a type of matrix barcode (or two-dimensional barcode) first designed in 1994 for the automotive industry in Japan.

[112] Via the AP eKnowledge Exchange Portal DIKSHA: https://diksha.gov.in/explore

[113] Rs.12,000 crores

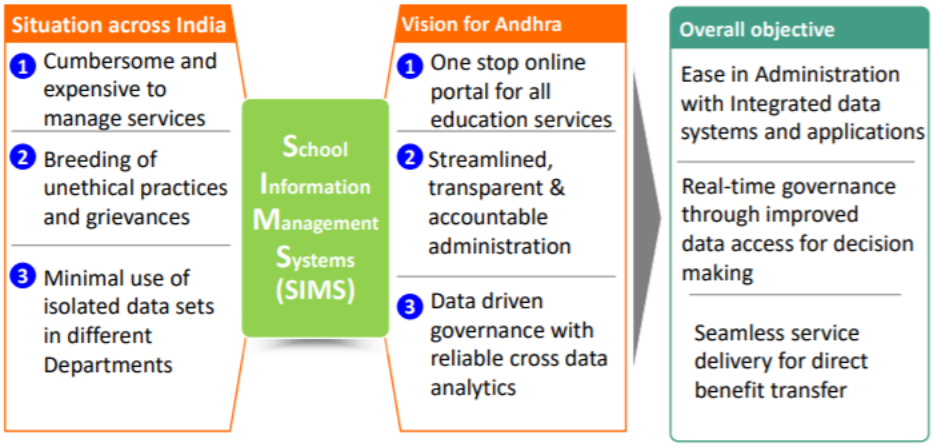
[114] Rs.3,500 crores

[115] The Mid Day Meal Scheme was launched by the Government of India to help poor pupils from rural and urban areas attend school and to resolve issues of lack of nutrition. The Mid-Day Meal programme is monitored daily and monthly via a mobile app in AP.

[116] A Transaction Processing System (TPS) is a type of information system that collects, stores, modifies and retrieves the data transactions of an enterprise. Transaction processing systems also attempt to provide predictable response times to requests, although this is not as critical as for real-time systems. Rather than allowing the user to run arbitrary programs as time-sharing, transaction processing allows only predefined, structured transactions. Each transaction is usually short duration and the processing activity for each transaction is programmed in advance. Source: Weikum G. (2002) *Transactional Information Systems: Theory, Algorithms, and the Practice of Concurrency Control and Recovery*, The Morgan Kaufmann Series in Data Management Systems, 1st Edition

education administration and monitoring. The system is highly integrated and rationalized and as a result, each data point within SIMS is collected once only[117]. Access to relevant elements of the EMIS is granted to schools via a desktop portal and via various mobile applications. These are explained in the sections below. SIMS is implemented uniformly in public and private schools as mandated by the Government of Andhra Pradesh[118].

Figure 3.3: Vision for SIMS in Andhra Pradesh[119]



The data which is captured through SIMS is used as a single source database for all purposes. The equity related data on students are rich and include 63 parameters on each child enabling comprehensive equity analysis. Process information such as the health, wellbeing and attendance of a child is monitored through SIMS and SIMS stores detailed information on the learning outcomes of each student. This has enabled AP State to pilot sophisticated child centred approaches to deliver improved pedagogical outcomes such as the use of sophisticated algorithms for identification of children at risk of dropping out and monitoring of follow-up interventions to reduce the probability of a student dropping out.

SIMS covers public and private primary, lower secondary and upper secondary schools. It excludes pre-primary schools, and other education programmes including Technical and Vocational Education and Training (TVET), Higher Education and Nonformal education.

The EMIS can be described through a number of different lenses. AP classify the system through the application portals through which is it accessible and which are understood by users[120]. The main functions or uses of the system and the thematic data groupings are evident though the classifications of SIMS through its applications. The main modules are explained in the section below.

[117] Respondents noted that this was a state-wide strategy and permeated all information systems. For example, heath data from SIMS was shared with the Health Management Information System to ensure the data could be verified and only collected once.

[118] This was not verified during the study which verified SIMS in public schools only.

[119] Source: http://www.aphrdi.ap.gov.in/documents/Trainings@APHRDI/2018/9_Sept/Best%20Practices%20PPP/best-practices-cse-2018.pdf, Accessed 27 January 2020.

[120] It should be noted that the modules do not represent the technical architecture of the system which is complex and distributed over many servers.

Figure 3.4: Simplified High Modules of SIMS



3.4 Description of the Main Modules to SIMS

3.4.1 Unified District Information System for Education (UDISE)+

Unified District Information System for Education (**UDISE**) initiated in 2012-13 integrating DISE for elementary education and SEMIS for secondary education is one of the largest Management Information Systems on School Education covering more than 1.5 million schools, 8.5 million

teachers and 250 million children. UDISE is the data standard for collection of education data for planning, monitoring and evaluation throughout India[121]. UDISE has been updated to UDISE+ which is an online portal for UDISE. The Ministry of Human Resource Development (MHRD), Government of India recognized U-DISE as an official statistics and Annual Work Plan and Budget (AWP & B) for *Samgra Shiksha* are prepared based on U-DISE data[122]. This includes comprehensive information on students' enrolment, school Infrastructure, Water and Sanitation Hygiene (WASH), Children with Special Needs (CWSN), Teachers, School programmes and other information typically required of school census and specific to the national Indian context such as information on implementation of the Right of Children to Free and Compulsory Education Act (2009) and School Management Committees (SMC).

The present UDISE+ data capture format is 54 pages long and a significant proportion of that is dedicated to collecting student and teacher data by a wide range of parameters[123]. AP state process individual teacher data through the Teacher Information System and individual student data through SIMS. AP state collect approximately 63 parameters on each student and therefore can analyse data by comparing any of these parameters. This provides far greater analytical capacity than UDISE+ data capture formats allow and has enabled AP state to implement functions such as the Vidyarthi Nestham programme Dropout Prediction (refer section below). This has also allowed AP state to ingrate UDISE+ into SIMS and automatically populating all required aggregate student and teacher tables from individual data stored in SIMS and e-Hazar. Given that this data is based on verifiable individua data, it provides far greater accuracy and analytical capacity than the UDISE+ data capture format.

In AP 61,684[124] schools are captured in UDISE+ format. This ensures comparable data for decision making and school planning and the calculation of almost all required education indicators[125].

3.4.2 Child Info

The **Child Info** component of SIMS stores Student individual information from class I to Class XII including socio-economic factors and biodata. 63 variables are stored on each child and are listed in Annex 5. It is a large database which has data on six development sectors including: Personal Information; Academic Information; Health Information; Family Information; Benefits Received; Disability Information. Many items of information have robust verification processes. For example, there are 22 categories of disability reported in SIMS and disability must be verified by certificates issued by a registered medical practitioner recognised by the health department. ChildInfo stores historical data on each child which enables longitudinal analysis of data. The database presently has data on 7 million students throughout the state and in all types of education institutions including public and private. 99.89% of students in the database have an

[121] It was originally developed with the support of the World Bank form 1994-2000 and has been supported through different initiatives and programmes since 2000.

[122] MoHRD (2018) *Education Statistics at a Glance, Government of India, Ministry of Human Resource Development* (MoHRD), Department of School Education and Literacy, Statistics Division, New Delhi, 2018

https://mhrd.gov.in/sites/upload_files/mhrd/files/statistics-new/ESAG-2018.pdf

[123] http://udiseplus.gov.in/informationDetails.action?fileId=2

[124] Source: UDISE 2019

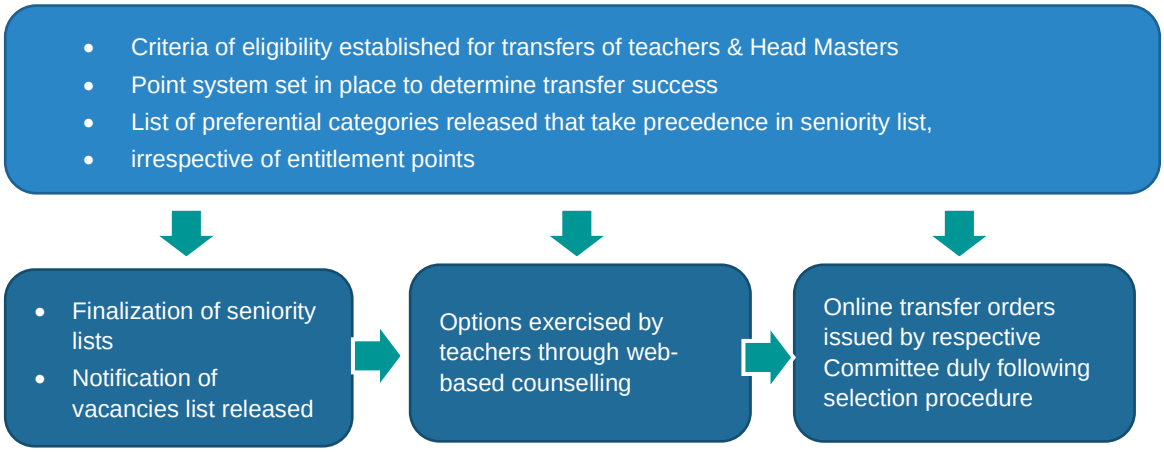
[125] In accordance with OECD standards and SDG standards: Source: https://www.oecd.org/education/school/keyindicatorsoneducation.htm

Aadhaar number (UIDAI)[126] starting at age 5, which is referred to as Aadhaar Seeding. During 2019-20 AP would like to complete this to 100%[127].

3.4.3 Teacher Information System (TIS)

The Teacher Information System (TIS) contains detailed information on 184,000 government teachers employed throughout AP state. The main objective for developing the TIS is to ensure correct and reliable data on teachers in each district to facilitate appropriate training, up to date seniority lists, timely promotions, transfers and most other matters relating to teacher administration, wellbeing and capacity development. This system also helps ensure correct assessment of number of subject teacher requirement and deployment. AP State notes that it is important to ensure that the teachers data is updated correctly, diligently and validated at respective levels. To facilitate this, teachers have access to update their details subject to a digital approval process involving head teachers, cluster education officers and Mandal education officers via a mobile application[128]. The TIS has eight general categories of information on each staff member which include: Personal details; Spouse details (If married); Educational details; Appointment details; Departmental Tests details; Promotion details; Transfer details; Salary steps; Salary entitlements; Leave entitlements; Health Card details; a history of awards and disciplinary action and other relevant information[129].

Figure 3.5: Online Teacher Transfers & Web Counselling[130]



Some of the functions and benefits of the system include:

- Transparent and speedy process in issuing of No Objection Certificates (NOC)[131] and Medical Claims.

[126] The Aadhaar is a 12-digit unique identity number that can be obtained voluntarily by residents or passport holders of India, based on their biometric and demographic data. The data is collected by the Unique Identification Authority of India (UIDAI), a statutory authority established in January 2009 by the government of India, under the jurisdiction of the Ministry of Electronics and Information Technology, following the provisions of the Aadhaar (Targeted Delivery of Financial and other Subsidies, benefits and services) Act, 2016. Aadhaar is the world's largest biometric ID system. Source: https://uidai.gov.in/about-uidai.html

[127] No. 14-4/2019-IS-18, Government of India, Ministry of Human Resource Development of School Education and Literacy (IS-18 Section), Shastri Bhawan, New Delhi, 5th July 2019

[128] Staff can access and comment on their file by logging in using their treasury ID and password sent to their mobile number.

[129] More detailed information is available at: https://www.ateacher.in/2019/05/how-to-update-ap-teachers-information.html, accessed on 20 January 2020.

[130] Source: http://www.aphrdi.ap.gov.in/documents/Trainings@APHRDI/2018/9_Sept/Best%20Practices%20PPP/best-practices-cse-2018.pdf, accessed on 27 January 2020.

[131] An application for Issue of No Objection Certificate is required for special requests such as transport requests.

- Online Teacher Transfers and Rationalisation (refer figure above). Teacher transfer facilitation through online application, processing of interview schedules and transfer orders online. Transfer requests are automatically prioritised according to a point system based on factors such as length of service, locality, marriage status, efficiency (based on last year of student performance on teacher performance on department examinations). The Department of School Education report that there has been a 10% increase in satisfaction resulting from a more transparent and faster system[132].
- Class Subject Section Teacher Mapping with Students.
- Teacher Grievance System enabling teachers to lodge grievances. Officers at the administrative must respond within a set time period.
- TIS data is used to generate Payroll and Payroll projection. The teacher information shared with the Comprehensive Financial Monitoring system (CFMS). Confirmation of salary payment is then updated in TIS. This helps ensure salary payments are accurate and reflect any changes in the salary status of the recipient.

3.4.4 Teacher Training Support System (TTSS)

The objective of the Teacher Training Support System (TTSS) is to enable end-to-end effective and efficient planning, execution and monitoring all in-service trainings and workshops in the state conducted by various stakeholders under the coordination of the Department of School Education State Council of Educational Research and Training (SCERT). The module allows for the creation and execution of trainings. It is linked to both e-Hazar and TIS and uses this information to automatically calculate budgets and honorariums and support allowances based on the distance of the teacher's home address from the training location. The system is also used in conjunction with DCR and VCR. The TTSS is used to identify training requirements and plan training courses. Teachers may also request training via the system. The learning outcome of the teachers is recorded in TTSS and the attendance via eHazar.

[132] Validated through interviews at school and mandal level.

3.4.5 E-Hazar

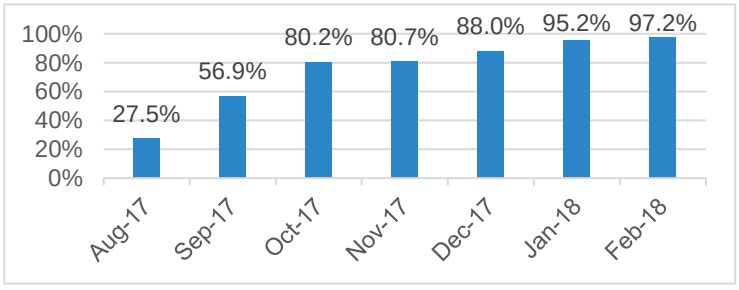
Figure 3.6: Biometric Scanner in a Rural Primary School



E-Hazar is an Aadhaar-Enabled Biometric Attendance System (AEBAS) used to capture Daily Attendance of Teachers at School points. E-Hazar was introduced in September 2017. The system Report is able to report real time the numbers and percentages of teachers who have submitted their Biometric Attendance at Login Time (In-Time) and How many Teachers have given their Bio Metric e-Hazar at Logout Time (Out-Time). The system is linked to the Teacher Training Support System, the Teacher Selection System (DSC) and the Secondary School Certificate (SSC) Examination System. Through the system, over 187000 public teachers record Attendance Twice daily. Teachers can also apply leave using the E-Hazar mobile application. This has helped accelerate leave requests and enable management to respond quickly with replacement teachers. Biometric scanners have been procured for all schools and are also placed in Department of School Education offices. Biometric scans work via fingerprint scanning and send Global Positioning System (GPS) coordinates to confirm the location of the staff member. The biometric scanners also have the android operating system installed and can be used to access the mobile apps in the event the head teacher does not have an adequate phone. At 11 am daily a reminder alert message is sent to teachers and to the management authority for staff who did not mark/Apply Leave or other reason.

Teacher attendance can be monitored real time through the CM Dashboard[133].

Figure 3.7: Teacher Attendance since Introduction of E-Hazar[134]



E-Hazar is also used to register students for the G12 examination to ensure each child is properly identified. There are plans to use e-Hazar for student attendance, but one device would be required for each 100 students which may be cost prohibitive.

[133] https://ehazar.ap.gov.in/ATTENDANCE1/teacherWholeAttendanceCatAndMgtWiseReport.do, accessed on 20 January 2020

[134] Source: http://www.aphrdi.ap.gov.in/documents/Trainings@APHRDI/2018/9_Sept/Best%20Practices%20PPP/best-practices-cse-2018.pdf, accessed on 27 January 2020.

3.4.6 School Transformation Monitoring System (STMS)

School Transformation Monitoring System (STMS) is accessible to schools as a mobile application for the purpose of monitoring and tracking the transformation of schools in the state of Andhra Pradesh and supports the Nedu-Nedu programme[135]. This application records detailed information on the status of infrastructure in schools. STMS utilises GeoFencing technology[136], which helps validate digital videos and pictures of infrastructure which are submitted and accessible to the public and planners. The application records the status of fans, lights, wiring, switchboards, toilets, water, furniture, black boards, computer laboratories, libraries, laboratories, playgrounds and includes pictures of how many children are present. 44,512 government schools and their infrastructure status with pictures have been captured[137]. All data is available on the website www.stms.ap.gov.in.

3.4.7 Student Assessment System (SAS)

The overall objective of the Student Assessment System (SAS) is to better understand the competency gaps in students and target interventions to address the gaps. SAS **tr**acks 3,325,304[138] child's learning needs throughout and records detailed information on the formative (1 annually) and summative assessments (3 annually) for each subject conducted throughout the year for every grade. Students Assessments (SA2) are captured[139]. The data captured by SAS is used to inform advice to teachers concerning remedial teaching for individual students and it is used as one set of variables in the dropout predictive algorithm used by Vidyarthi Nestham (refer section below).

Teacher register marks in the system and feedback is provided through dashboards to teachers[140], usually at the Mandal office at monthly meetings. The performance of schools is based on the student results however the performance of teachers is not as this would create a false learning environment. The student report card generated from SIMS is also based on this and other data. Results for each subject are categorised and stored under 6 competencies which are subject specific[141]. The teacher then posts the marks for these areas and addresses each students' shortcomings individually. Results are also analysed to help inform teacher training programmes on a district level. During 2018/19, 25600 teachers received in-service training as a result of the system.

[135] This includes all Government schools, Government Junior Colleges, Mandal Resource Centers and District Institutes of Education and Training.

[136] A geo-fence is a virtual perimeter for a real-world geographic area. A geo-fence could be dynamically generated, as in a radius around a point location, or a geo-fence can be a predefined set of boundaries such as school zones or neighborhood boundaries.

[137] Of those, 42,655 (96%) schools had videos & Photos captured through the Mobile Application in 10 days form 01.08.2019.

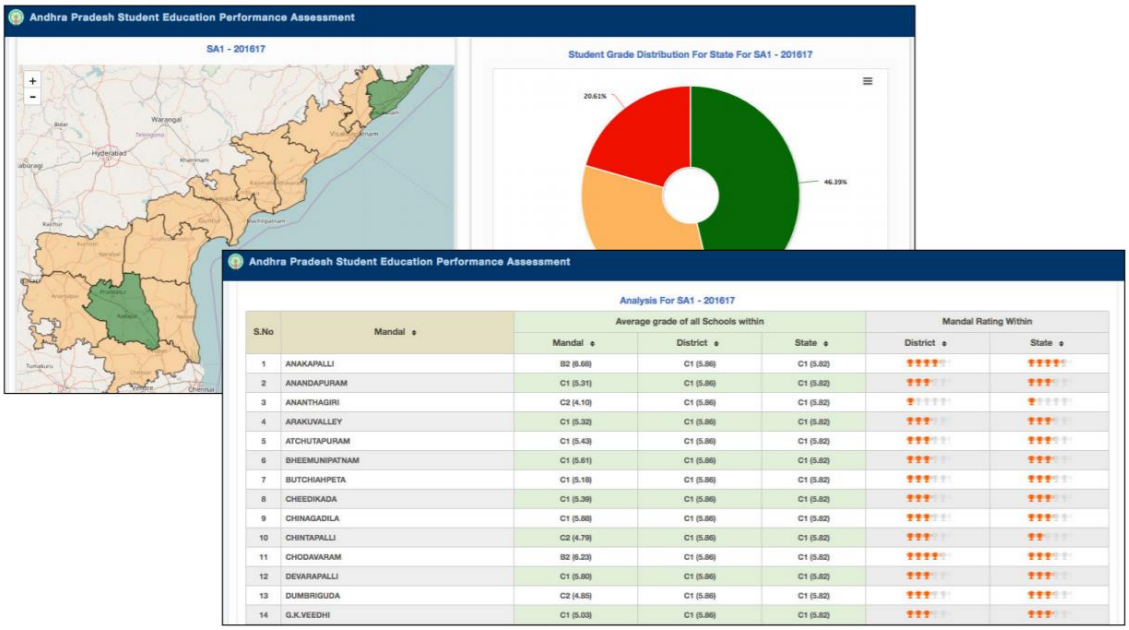
[138] As of July 2019

[139] The District Common Examination Board (DCEB) issues the questions to examinations and prints and distributes to all schools based on student enrolment numbers in SIMS.

[140] The dashboard is presently not very informative but the Department of School Education noted that they were working on the dashboard to ensure it can help inform individual student learning.

[141] For example, for mathematics the 6 categories of competency are: Problem solving, logical thinking, communication, connections, representation, descriptive

Figure 3.8: Example of Secondary Education Performance displayed through the CM Dashboard



SAS is also being integrated with VCRs[142] and used for clicker-based assessment to assess competency attained learning. Data analytics using psychometric analysis via 3rd party are applied to inform teachers of individual student learning needs[143]. Currently this initiative is only operating on a small scale of approximately 80,000 students but the information is being applied to development of in-service training programmes and textbook development.

3.4.8 Mapping School Record Keeping to SIMS

Schools maintain hardcopy books for school-based analysis and review and discussion with the Parents committee (PC). The cluster resource person will often inspect books to ensure they conform with information stored in SIMS. Almost all information stored in hardcopy at the school is available in SIMS. The relationship between SIMS and school record keeping is detailed in Annex 10.

3.5 Interoperability with other Government Systems and Links to Household Survey

The Govt. of Andhra Pradesh undertakes a household census called Praja Sadhikara of all individuals residing in Andhra Pradesh State once every two to three years. An Aadhaar Number, which is unique to each individual was assigned and is used as the reference for all data in the survey and in the state systems. The household survey data is stored in Civil Supplies database[144] under management of the Department of Civil Supplies (see figure below).

The data in the civil supplies database is used to populate the governments Real Time Governance System (RTGS) and is used to populate the SIMS. SIMS tracks in and out of school children. SIMS updates data on all children and staff under its management on a regular basis and so is used by the government as the basis for updated data in the RTGS. It is also the main

[142] Of which 1874 of 4000 had already been established as of November 2020.

[143] Typically 60 questions will be applied over a limited duration.

[144] 40 government departments have access to the data from the Civil Supplies Database.

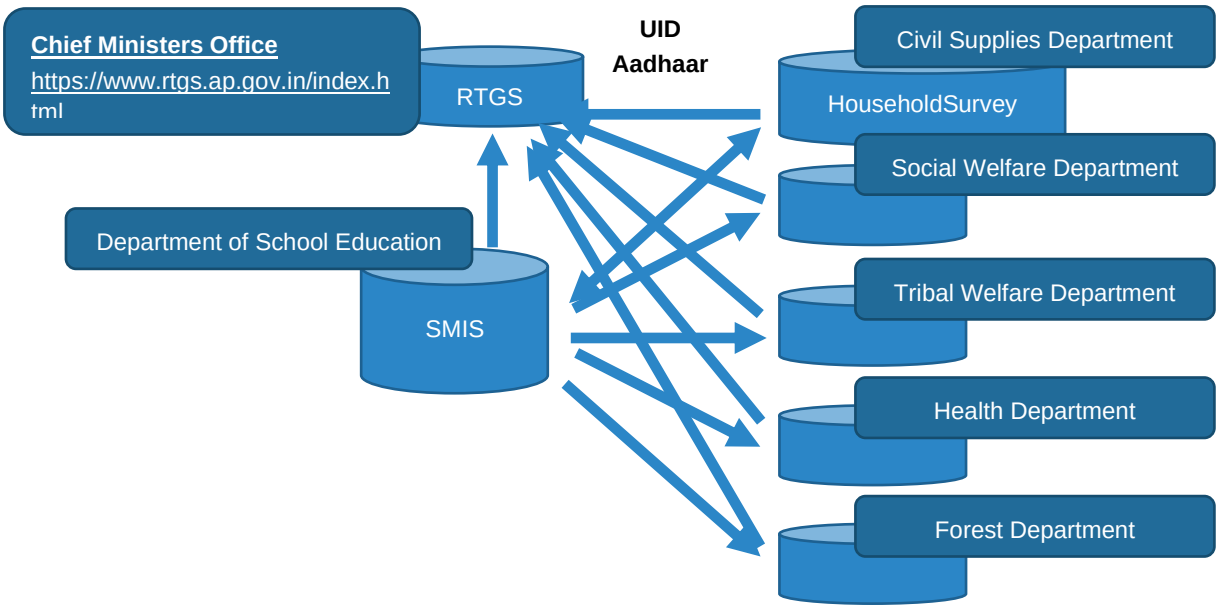
source of data for other departments requiring updated information on education staff and children throughout AP state.

Children who are out of school and may not have an Aadhaar number are identified using annual community drives (refer section below) and so are gradually included in the SIMS to ensure all children are tracked.

The updated status on children and their families is used by other departments such as the social welfare department and the health department. Examples include:

- Precise allocation of rice to schools is made by the Civil Supplies Department based on SIMS data as part of the Mid-Day Meals (MDM) programme and distribution is confirmed through the MDM mobile application.
- Rs. 15000 pro-poor support allocated to mothers of children confirmed as attending school. Data to confirm the allocation is derived from SIMS concerning enrolment, attendance and socioeconomic status of the family. Data is derived from the Civil Supplies Database and other databases for eligibility criteria such as: Not having a 4-wheel drive; Income tax assessment; Household consumption of power >200 units; Not being a Government Employee; Not being Land holders of > 20 acres.

Figure 3.9: Interoperability with other Government Systems



3.6 Use of Mobile Applications

AP state has utilised mobile applications to enable head teachers and teachers to engage with the systems on a daily basis. The use of mobile applications enables ready purpose driven targeted access to SIMS data and functionality. The applications ensure that all stakeholders in the education system have access to the system for purposes specific to each stakeholder. The table below lists the mobile applications available to staff and the purpose of each.

Table 3.4: Mobile Applications for SIMS and Purpose of each

App Name	Purpose
eHazar	Recording attendance of staff and students[145] using a biometric device(s). Thumbprint scan for teachers and IR reading for students although students are being scanned in limited areas.
APSTel	An e-Leave System that enables staff to log requests for leave and seek approval. Automatic alerts are sent to the CRP and HM. In most cases paper application is still required for significant leave. Enables monitoring of teachers who are under leave, OD and training.
Textbook distribution	Tracks the receipt of textbooks and enables schools to request textbooks. This application is used for distribution of TextBooks to the students with Aadhaar Authentication. Based on this APP the indent will be generated automatically. By tracking the data of Textbooks up to the school level has saved more than 27 crores (9 million USD) last year.
GIS Mapping	Enables access to Basic information of the school displayed on a map.

[145] Students are only recorded in some schools

App Name	Purpose
School Transfer Management System (STMS)	Allows schools to upload videos, photographs and tag to points in the school such as the four boundaries or asset locations.
School Complex Meeting App	The Clusters will conduct a meeting with other schools, and they log attendance numbers (members of each school, PC, HM, Teachers) used for performance indicators.
DIKSHA	Developed by NCERT, e-content is hosted here which can be accessed by any remote teacher and student
Bathikostar App	Distribution of Bicycles for grades 8/9 Girls (187,318 students) using Aadhaar Authentication so they can more easily come to school regularly and face fewer difficulties.
MDM attendance app	The Mid Day Meals attendance application used also for monitoring daily attendance in schools by Mandal Education Office (MEO) and District Education Office (DEO). Basing on the enrolment the bills will generated automatically and payment to end user will be made directly without any delay. This app is used by the head of the institutions only and not by all teachers.
School Inspector (Monitoring) App	This application is not linked to SIMS. It includes 10 parameters for the inspector to rate the school on.
Teacher Training Support System (TTSS)	This application is useful during the conducting of special duties such as examinations, workshops, training. This is recorded as separate from leave.
Assessment Management System	This application enables schools to upload student examination results for individual students and manages formative and summative Continuous Comprehensive Review (CCE) for students.
Asset Management System	This system increases visibility by capturing & analysing the accurate data of Inventory management. This system is still under development and will keep a track of the office equipment more efficiently through bulk purchasing and correctly allocating supplies.
Vidyarthi Nestham	Under Vidyarthi Nestham initiative, system randomly allotted 1-5 students of Class 5 per teacher in each Govt Primary School and predicted dropouts of Class 6 – Class 9 per teacher in certain Govt Upper Primary and Govt High Schools (refer below)
Mana Badiki podam	Monitors the Out of School children in the state. This Application was developed to know the cause of the Dropout candidates and identification of never enrolled students in the state (refer section 3.11).
EAPEAX	Teachers use a module application called Andhra Pradesh E-Knowledge Exchange (EAPEAX) which is linked to SIMS. Through this application they can discuss subject specific contents and share information such as e-content, lesson plans and learning materials. The Department of School Education can monitor and evaluate the material they are sharing and better understand teacher training requirements and support needs.

3.7 History of EMIS Development in Andhra Pradesh and main drives of Transformation

Andhra Pradesh initiated a programme of Digital Reforms in 2014 encapsulated in its Information Technology Policy 2014-2020, Electronics Policy 2014-2020 and Innovation and Start-up Policy 2014-2020. The digital reforms Importance to introduce Real-Time Governance by bridging gaps, seamless service delivery to each beneficiary and stakeholder and streamlined, transparent &

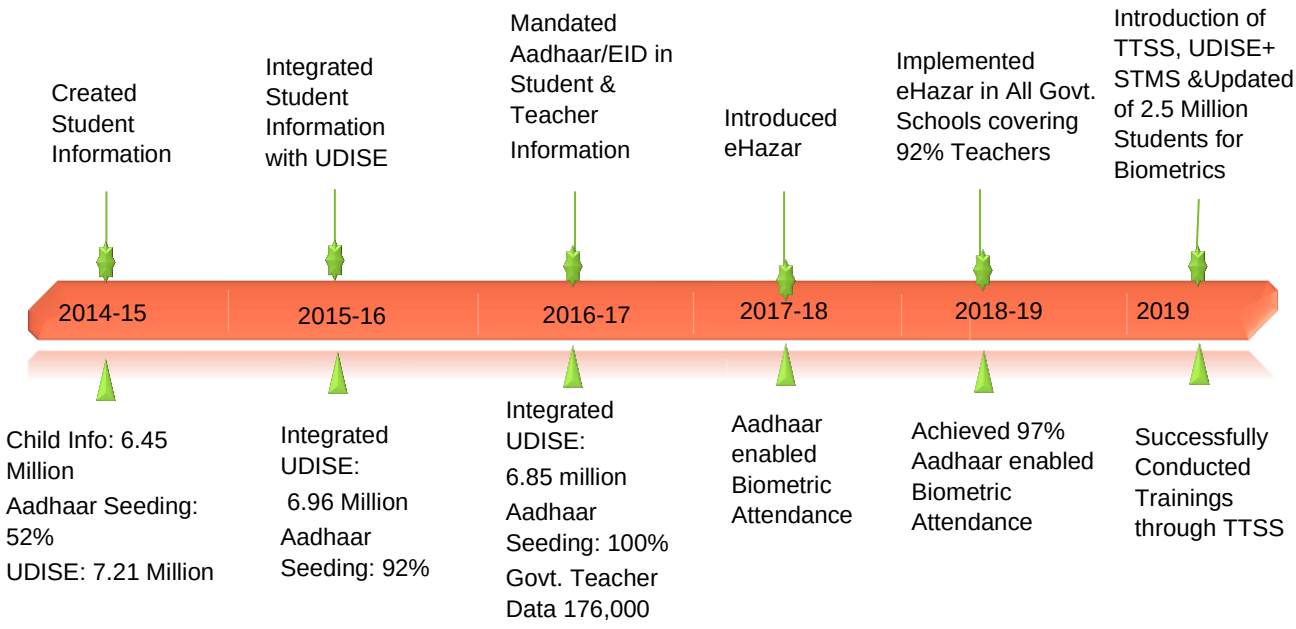
accountable administration[146]. The SIMS was also designed to accommodate reforms education to ensure a child focused education model.

The general timeline of SIMS development in Andhra Pradesh between 2014 and 2019 is shown in the diagram below.

There are several key transformational drivers. These include:

- A clear state level vision of information systems as important facilitators to effective delivery of government services.
- A drive from top level managers throughout the government of AP State such as the Chief Minister and the Commissioner of Education.
- A culture and education system which has embraced information technology[147] and its use in governance as facilitated through public/private partnerships.

Figure 3.10: Timeline of SIMS development in Andhra Pradesh 2014 to 2019



Staff noted that there was initial resistance to the monitoring of teacher attendance from teacher unions but that this was temporary. Upon implementation of the TIS and TTSS transparency increased. Teachers interviewed reported increased satisfaction resulting from the implementation of eHazar, TIS and TTSS.

[146] Initiated under Chief Minister Nara Chandrababu Naidu. Source: http://www.apiic.in/wp-content/uploads/2015/07/AP-IT-Policy-2014-2020.pdf, accessed on 28 January 2020

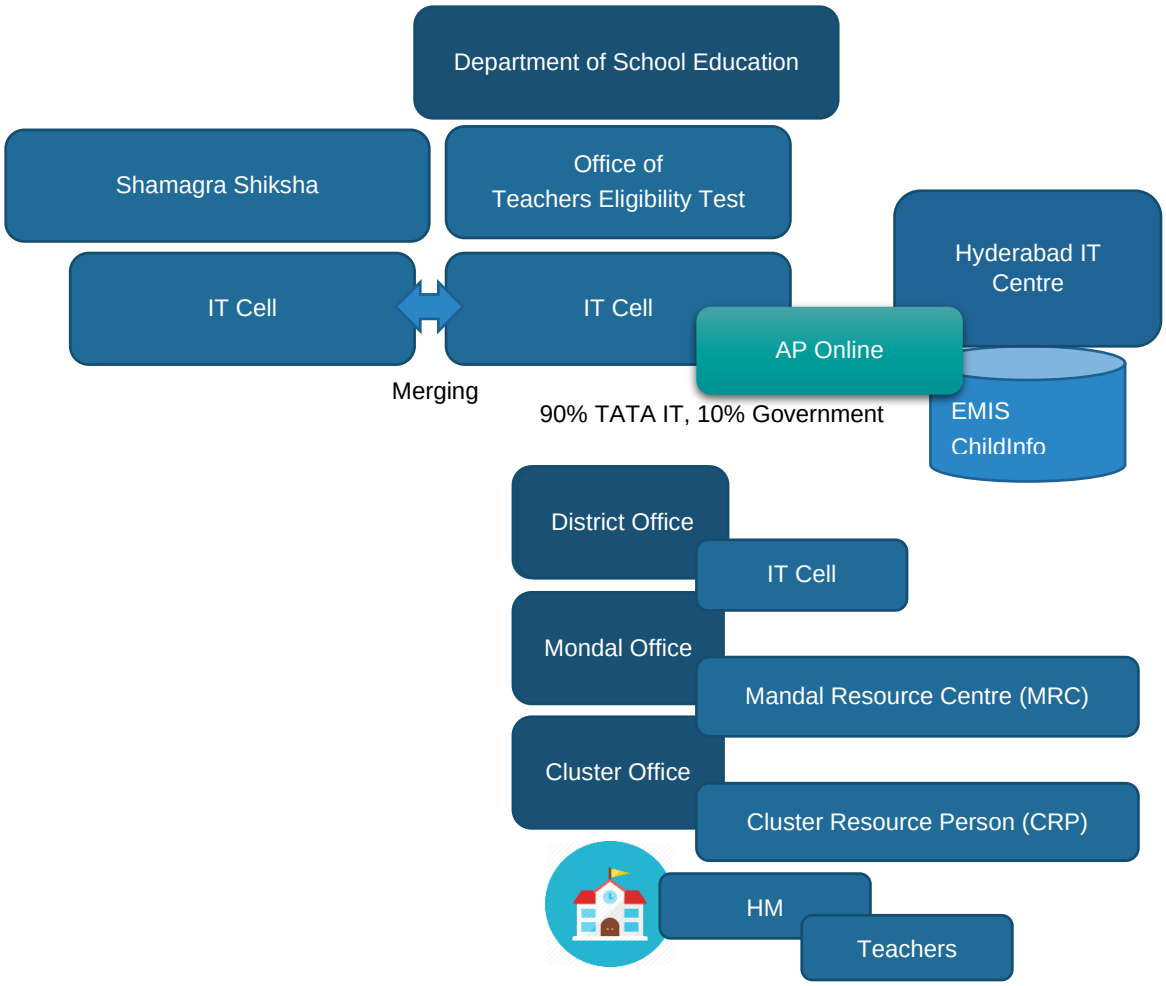
[147] Ramesh Subramanian (2006) *India and Information Technology: A Historical & Critical Perspective*, Journal of Global Information Technology Management, 9:4, 28-46, DOI: 10.1080/1097198X.2006.10856431

3.8 Organizational and Institutional Arrangements and Capacity

3.8.1 Organisational and Institutional Arrangements

The SIMS is developed and operated by the School Education Department Information Technology IT Cell which is located under the Office of Teachers Eligibility Test (OTET)[148]. SIMS is maintained and developed under a service agreement with a private company called APTOnline[149] based on a Memorandum of Understanding (MoU) signed in 2014.

Figure 3.11: Simplified organisational structure for deployment of SIMS



IT cells also exist in districts for the purpose of supporting the district offices for SIMS requirements and for supporting Mandal Resources Centres (MRC) within their region. The Samagra Shiksha also maintain an IT cell for SIMS however this is a legacy of the past and the

[148] It was established under the Office of Teachers Eligibility Tests because historically this office had developed an earlier version of a teacher management system and already had some information technology capacity.

[149] APTOnline are a private company that is 90% owned by TATA Information Technology and 10% owned by the government of AP State. APTONLINE Established in 2002 as a joint venture of Tata Consultancy Services Limited and State Government. Provides "Government to Citizen" (G2C) and "Business to Citizen" (B2C) services in the states of Andhra Pradesh and Telangana, India. Provides IT, ITES, eGovernance and Digital services to both the state governments.

IT cell will be merged with the Department of School Education main IT cell at national and district level.

Staff in all offices can login to SIMS securely and directly using desktop computers. All logins provide access to functions relevant to each user and restrict data access accordingly.

Each school has a personal login to SIMS. The Principal is responsible for logging into SIMS at the school level however teachers will interact through applications such as eHazar and TTS. Only well-equipped schools with internet in which the principal has capacity to use SIMS log in directly through the desktop version. Most schools do not have this capacity although the IT Cell reported that most High Schools and Private schools log in and enter data directly. For schools lacking capacity to directly login, the Cluster Resource Person (CRP) interacts with the system on behalf of the school at the ICT unit of the Mandal office. Principals and teachers in all schools interact with the system via a wide range of mobile applications which are described in section 3.6. This provides a rapid and easy method for all staff to submit or obtain targeted information as required.

3.8.2 Human Resources

Centrally, eight (8) staff of the OTET are assigned to work exclusively on SIMS. APT Online have approximately 30 staff assigned to development and operation of SIMS. 26 staff are based in Hyderabad and undertake development, hosting and server maintenance. Four staff are based in Visakhapatnam in the OTET IT Cell and include a database analyst, a project manager, a business analyst and a developer.

Each of the 13 district IT Cells has a planning coordinator, a statistical officer and 4 data entry operators. Each of the 670 MRC has an MIS coordinator and a data entry officer. A single CRP caters to approximately 15 to 20 schools and is responsible for SIMS for those schools.

The SIMS is pervasive in every aspect of management and administration and a constant mentoring process is undertaken at each level of government to ensure the system is fully utilised throughout AP. Capacity development is undertaken through regular cascade training which is built into job functions. District IT cells give support to staff at the district level and to MRC under their jurisdiction. District IT cells spent a day of each month mentoring MRC. CRP will spend at least a day of each month at the MRC managing data entry for the schools under their charge. Each CRP will also spend time each month building the capacity of schools to engage with SIMS and SIMS mobile applications.

3.8.3 Connectivity and Infrastructure capacity

The SIMS is hosted in self-hosted mode only with 14 servers comprising of 9 Application Servers, 3 Database Servers and 2 backup servers located in Hyderabad Despite the large server capacity, the loads placed on the servers are very high and there is a need further to increase sever capacity. The Government of AP State is intending to shift a new data centre located in Amaravati[150] for management under the state IT Department which may help reduce costs.

Broadband Internet is provided to all government offices and most schools[151]. All administration offices were well equipped with computers, printers, photocopiers and other required hardware. The urban secondary schools visited had 3-4 computers for administrative purposes. Primary schools generally lacked hardware and interacted with the system via the biometric devices which

[150] As of 2019 Amaravati is the new state capital of AP.

[151] State Limited Company (SLC) extended broadband across the state to all areas and villages during 2015/16 in a phased implementation. This was free in initial stages but is now Rs. 150 per household per month. In some areas the coverage is weak due to terrain. When the coverage fails in any area the teacher uses their own mobile phones using a private network.

included a tablet interface, and via mobile phones. Each biometric device has a 4G chip with a monthly bandwidth of 500 MB supplied by the AP state Information Technology and Communication Department (ITEC).

39.25% of schools have one or more computer for administrative purposes and 8.65% for pedagogical purposes. 95% of schools have eHazar biometric readers. 24.62% of schools have reliable internet connectivity and 95.23% have reliable network coverage for 3G and 4G. 98.92% of schools have adequate electricity[152].

3.9 Financing and Budget

The government has not undertaken a cost analysis of SIMS. This review compiled information for the years 2015 to 2019 which is presented in Annex 11. Unverified estimated summary costs for the system sent from the Department of Finance are shown in the table below. The total estimated cost of the system is 6,402,020 USD over 5 years between 2015 and 2019 and a recurrent cost of 1,418,767 USD. The recurrent cost will likely increase significantly if biometric devices are procured for every 100 students under the expanded e-Hazar scheme in which schools would be required to have a device for every 100 pupils.

Table 3.5: Estimated cost of SIMS 2015 to 2019[153]

Budget Item	Estimated Annual		Estimated Total	
	Rs	USD	Rs	USD
AP Online Service Agreement	50,000,000	140,000	250,000,000	701,000
Procurement of Servers and costs of deployment				
Broadband to 5683 schools	20,458,800	286,835	81,835,200	1,147,343
71928 Tablets rented for SIMS for schools (e-hazar)	35,280,000	494,564	105,840,000	1,483,895
70000 3G for tablets for SIMS for schools (e-hazar)	35,280,000	494,564	105,840,000	1,483,895
Computer Repair/Procurement districts and Mandal (748)			112,200,000	1,572,849
Communication and advocacy associated with SIMS (2)	200,000	2,804	800,000	11,215
Training Teachers for SIMS (2)			130,000	1823
Training Administrators at Mondl, District level for SIMS (13)	None		None	

[152] Source: UDISE+ 2019

[153] Conversion between Indian Rupees and USD using google, 28th January 2020.

Budget Item	Estimated Annual		Estimated Total	
	Rs	USD	Rs	USD
Total		1,418,767		6,402,020

It should be noted that the above costs do not include staff salaries of the IT cell at state, district or Mandal level, costs of mentoring, or time teachers and principals spend engaging with the system. However, these costs are very difficult to quantify. The Department of School Education reported that mentoring was built into existing job roles and is part of the regular meeting process required between different levels to review progress. They noted this had not incurred additional cost. All stakeholders noted that the time required for administrative purposes had been reduced by SIMS[154] and they believed the time spent managing data and processing transactions had reduced since introduction of SIMS. The most notable cost not included above would be staffing costs for the IT cells however the Department of School Education noted that the IT cells had evolved out of earlier cells required to support UDISE and thus no additional salaries had been incurred.

3.10 SIMS Data Use and Reporting Access

3.10.1 Overview of SIMS Data Use and Reporting in AP State

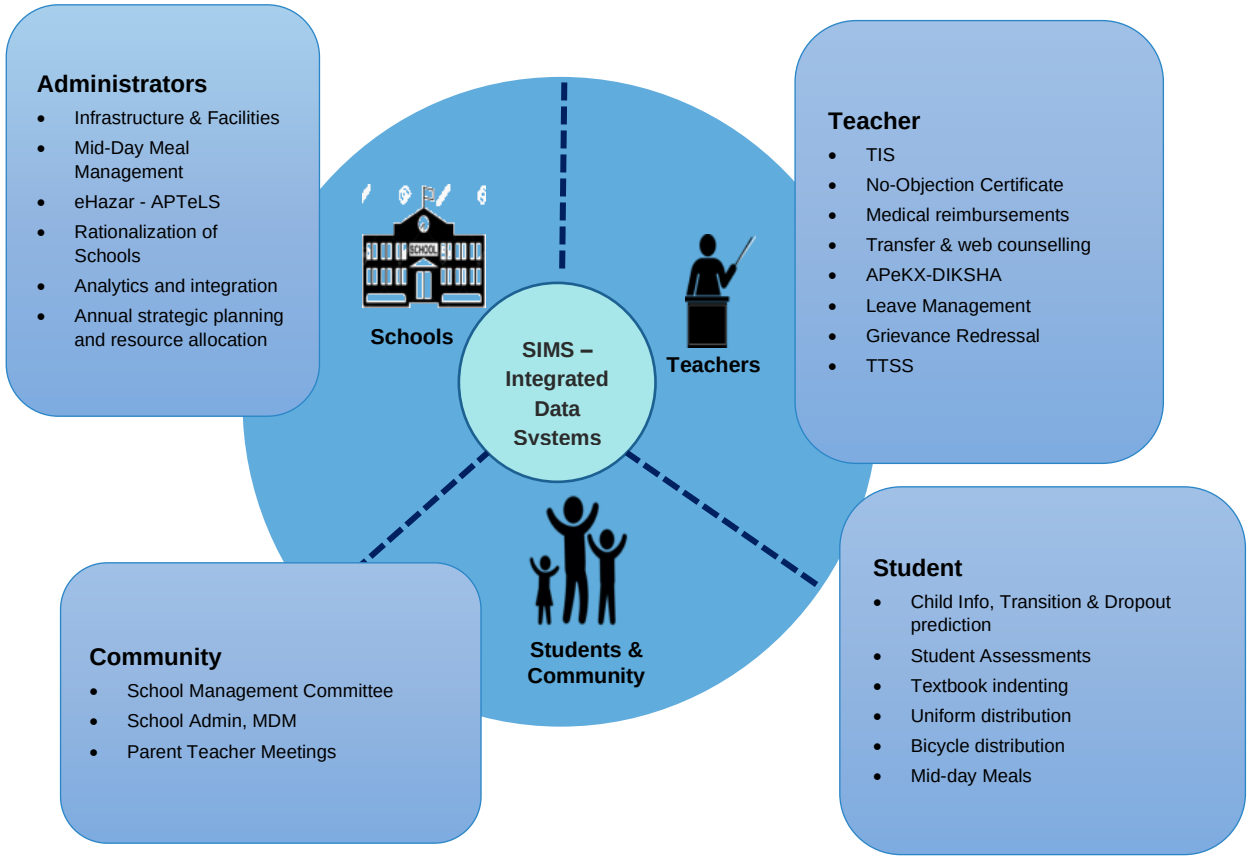
SIMS is a mature system, with broad scope and coverage. It is beyond the scope of this analysis to detail every aspect of its use. SIMS permeates every aspect of the Department of School Education functions on an operational and strategic basis.

Dissemination of data and indicators of the performance of education in AP are accessible through public on-line databases which can be viewed at state, district, and school levels, and are the source for an annual statistical abstract providing a point in time snapshot of the system. Publicly assessible school profiles are used by schools in preparation of the Annual Work Plan and Budget for Samagra Shiksha, the Integrated Scheme for School Education. AP employ a highly data-driven budgeting process, which includes monitoring of release of approved budgets to schools and use of the budgeted funds.

AP state classifies aspects of the system according to broad stakeholder category as shown in the figure below.

[154] Such as leave and transfer requests, requests for resources and other transactions.

Figure 3.12: Main operational and planning uses of SIMS



3.10.2 Portals of Access to SIMS and SIMS data

AP state, in conjunction with the Government of India, makes a substantial amount of data available to the public to the school level. The following is a list of the main portals providing access to data dependent on purpose and stakeholder[155].

Table 3.6: Portals to Access SIMS and SIMS Reports

SN	Portal	Description
1	https://schooledu.ap.gov.in/DSENEW/	Main portal through to modules such as the TIS
2	https://schooledu.ap.gov.in/DSE/totalReports.do	Access to most operational and some planning reports including: School Information; Teachers

[155] The list is not exhaustive. There are additional portals not included in the table.

SN	Portal	Description
		Information; Student Information; Medication Reimbursement; Continuous and Comprehensive Education (CCE); No objection certificates; eHazar System; Mid-day Meals system; Textbook Status; UDISE Status; Samgra Shiksha Sectoral Officers Reports.
3	https://ehazar.ap.gov.in/ATTENDANCE1/teacherWhole\AttendanceCatAndMgtWiseReport.do	Teacher biometric attendance
4	https://apdsc.apcfss.in/	Teacher recruitment
5	https://ehazar.ap.gov.in/ATTENDANCE1/login.do?mode=viewStatistics&filename=eHazar.pdf	Teacher Biometric Attendance Manual
6	https://udise.ap.gov.in/DSE_CI/userManuals.do	student information
7	http://udiseplus.gov.in/home	Reports for UDISE nation-wide including AP State. The portal includes analysis for main education indicators as spatial, numerical and graphical analysis.
8	www.stms.ap.gov.in	School Transformation Nedu-Nedu Initiative and viewing of the status of infrastructure in schools including via photographs and video.
9	http://udise.schooleduinfo.in/	This portal was developed at the national level and provides data visualization on the status of more than 100 education indicators up to block level and Mandal level in Andhra Pradesh.
10	http://schoolreportcards.in/SRC-New/	School report cards (refer Annex 7).
11	https://core.ap.gov.in/CMDashBoard/Index.aspx	Refer below

There is a very large amount of data available through a diverse array of portals. Some portals are maintained by the Ministry of Human Resource Development (MHRD) at the national level, such as those concerned with UDISE. The UDISE websites are applicable to the whole of India and persons can query data to state, district, block and sometimes school level. The latest data for the MHRD websites is 2016/17 which is 2 years old. The remainder are the creation of AP State Department of School Education and draw on data specific to SIMS such as eHazar and data is usually available to the current day.

The diversity and presentation of the websites makes it difficult for someone unversed in the websites to navigate and find the correct analysis or data applicable to their purpose. There is scope to consolidate the websites and improve navigation to help educationalists and the public locate relevant data and analysis.

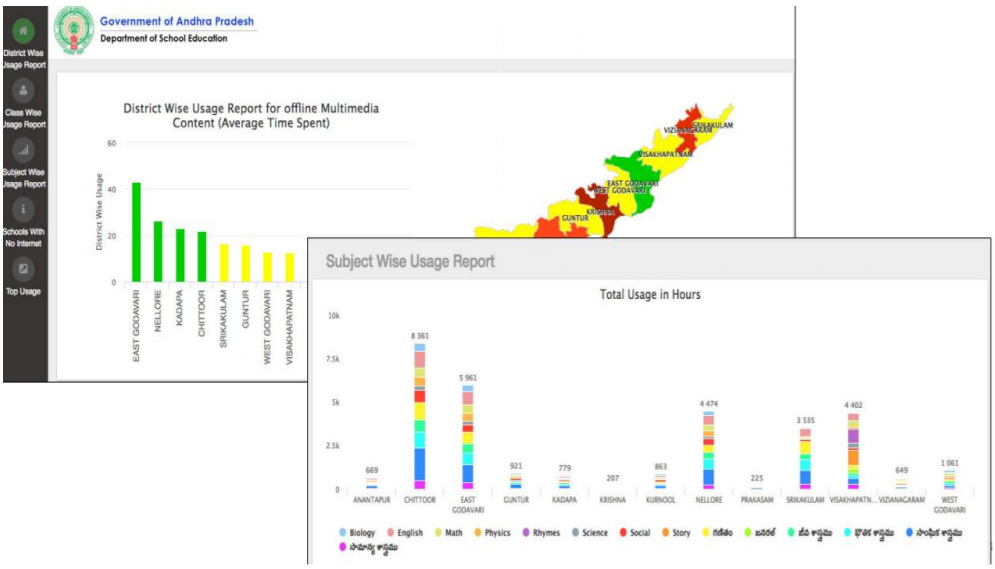
3.10.3 Integration of Analytics on CM CORE Dashboard

AP state has implemented a Real Time Governance System (RTGS). Information for the RTGS is accessible via the Core Dashboard (CM Office Real-time Executive) Dashboard. The Core Dashboard is an initiative of Government of Andhra Pradesh to : visually display department's information which need to achieve one or more objectives; consolidated and arrange data in a single portal so that the information can be monitored effectively by administrators at a glance. The portal consolidates and integrates information from 33 State Government Departments in the

Core Dashboard. Various key statistics of concerned departments are published in the CORE Dashboard.

Key Performance Indicator (KPI) reports available for education are listed in Annex 9 showing also the frequency at which data is updated. The reports include real time monitoring such as Mid-Day Meal attendance (MDM) and teacher attendance (e-Hazar). Graphical analysis is applied where appropriate and colour coding is used to highlight achievements and issues. Data and indicators can be drilled down to district, Mandal and school level depending on the data. Some main categories of information for SIMS include: Assessment Analytics; Digital Classrooms Usage Analytics; Sarva Shiksha Abhiyan; School Infrastructure Facilities Dashboard; APEKX Analytics; e-Hazar (Teacher Attendance).

Figure 3.13: Example of Digital Classroom Usage Report displayed through the Core Dashboard



3.11 Tracking OOSC in Andhra Pradesh State

A comprehensive study on Out of School Child (OOSC) has not been undertaken in AP State so a comprehensive analysis of the strategies and policies relating to OOSC was not available for this review. Nonetheless, AP State were able to articulate some of the policies and strategies being employed to address the issue of OOSC and detailed the ways in which SIMS is being used as a tool to help address OOSC.

AP State has instituted an annual drive conducted by teachers, head teachers and habitation representatives to identify children who are OOSC in the catchment area of each school. OOSC are recorded in a mobile application called Mana Badiki podam which commences tracking of these children in SIMS. The CRP and HM from the school will then be required to approach the child and family and understand why they are not attending school and attempt to address the issue. This approach is being improved under Vidyarthi Nestham (refer section 3.12 below)

AP State has a number of equivalency and special programmes, such as *Kasturba Gandhi Balika Vidyalaya* (*KGBV*), in which children may be enrolled depending on their socio-economic

circumstances. OOSC are placed into Child Info and assisted to obtain an Aadhaar number. OOSC are monitored at each level of the education system[156].

Participation rates such as Gross Enrolment Rate (GER) and Net Enrolment Rate (NER) are calculated based on SIMS data concerning individual children. The Department of School Education has mapped all SIMS data to the household survey data called Praja Sadhikara. When this was undertaken the state had recorded approximately 889,000 Out of School Children (OOSC) and the Department of School Education now reports that the number of OOSC approximately 89,000 OOSC. The remainder were largely determined to be dead, migrated or were older or younger than their age classification recorded in Badiki Podam. Others have been assisted through the state's efforts to reduce OOSC. It is unclear whether the tracking of children has contributed towards the reduction of OOSC but it has helped identify and track OOSC. 380,556 OOSC were enrolled in school between 2014/15 and 2020/21.

SIMS has also been used to help address barriers likely faced by OOSC or at risk of being OOSC. As noted in section 3.5 this includes using SIMS data and data from the Civil Supplies Database to enable targeted support to poor families with children attending school. SIMS is also used to track children in programmes designed to assist OOSC and other disadvantaged children such as the *Kasturba Gandhi Balika Vidyalaya* (*KGBV*) residential girls' secondary school programme which targets disadvantaged and orphaned girls. Children who are eligible for inclusion in the programme are identified based on criteria, such as being an orphan, and are tagged in SIMS for inclusion in KGBV. Once allocated to a KGBV school the children are then monitored for retention, health and achievement through SIMS.

Whilst retention is accurately monitored through SIMS, it should be noted that it is a combination of policies and programmes that have resulted in dropout reductions. Under the Sarva Shiksha Abhiyan Programme some of the interventions include (1) Implementation of activity based and child centric teaching learning process by building the capacities of teachers (2) Supply of children literature to schools (3) Involvement of community in school activities (4) Release of various types of grants to schools (5) Implementation of specific programmes for the education of focused groups like girls, SC/STs, minorities and urban deprived (6) Establishment of KGBVs for the education of girls belonging to disadvantaged groups (7) Supply of free textbooks, uniforms and providing Mid-day meal to the children. Collectively these have been attributed by the Department of School Education to increasing retention of children in elementary school from 74.18% (Gender Parity Index (GPI) 0.99) in 2013/14 to 88.53% (GPI 0.97) in 2017/18[157], [158].

3.12 Example of Best Practice, Vidyarthi Nestham programme Dropout Prediction and Child Mentoring

Andhra Pradesh School Education department has implemented a number of reforms supported by SIMS which aim to reduce the number of school dropouts, especially during the critical transitory stages from Primary School to Upper Primary School and from there to High School. This is referred to as Vidyarthi Nestham[159] and is designed to ensure students likely to dropout out are academically mentored.

AP state, with support of Microsoft, has been piloting a dropout prediction model to reduce dropouts in 10,000 government schools in AP State. The dropout model uses sophisticated

[156] Education officers interviewed were able to report numbers of children OOSC within their region by referring to SIMS.

[157][157] Although GPI is slightly lower in 2017/18, it should be noted that retention of both genders has increased significantly since 2013/14.

[158] Andhra Pradesh Department of School Education (2019) *Samgra Shiksha plan 2019-2020,*

[159] Loosely translated as 'able to see and converse with nestor for eloquence and wisdom with the student.'

statistical analysis based on SIMS data to determine the likelihood that a child will drop out of school[160]. The accuracy of the model progressed to 75% in 2017-18 and then to 92% in 2018-19[161]. The predictive method has been in pilot for 2 years and will be rolled out gradually in the future. 64 parameters are used to predict dropout likelihood. The general weighting of parameter clusters is shown in the table below.

Table 3.7: Dropout Influencing Factors (weighting)

SN	Dropout Influencing Factor	% Influence
1	Learning Outcomes	57%
2	School Infrastructure	31%
3	Transition	7%
4	Age Inappropriateness	4%
5	Social Category	1%

For schools not part of the pilot, children at risk of dropping out are identified based on attendance and learning outcome both through SIMS and at the school level. Students at risk of dropping out are randomly allotted between one to five students of Class 5 to every teacher in every government primary school and predicted dropouts of Class 6 to Class 9 to every teacher in selected government upper primary and government high schools[162].

Vidyarthi Nesthams monitors teachers to closely begin academic mentoring and monitoring of their allotted students. They have to gather contact numbers of the parents of their assigned students, fill a report every fortnight with qualitative student and family factors observed that may eventually lead to student discontinuing in that school and record them on Mobile Application created for the purpose[163].

The model is also able to generate information to inform district specific interventions. For example, in Nellore, Kurnool and Guntur districts dropouts have been associated with poor infrastructure and poor teacher strength. Therefore, these districts should increase the number of classrooms; Improve the Toilet and Urinal infrastructure; Ensure continuous electricity in the school; provide infrastructure for Children with Disabilities; increase provision of Science teachers(Physics and Biology) and English teachers; provide training to the highly experienced teachers so that they are in touch with the latest teaching methodologies and also to stay in touch with the latest/updated syllabus content.

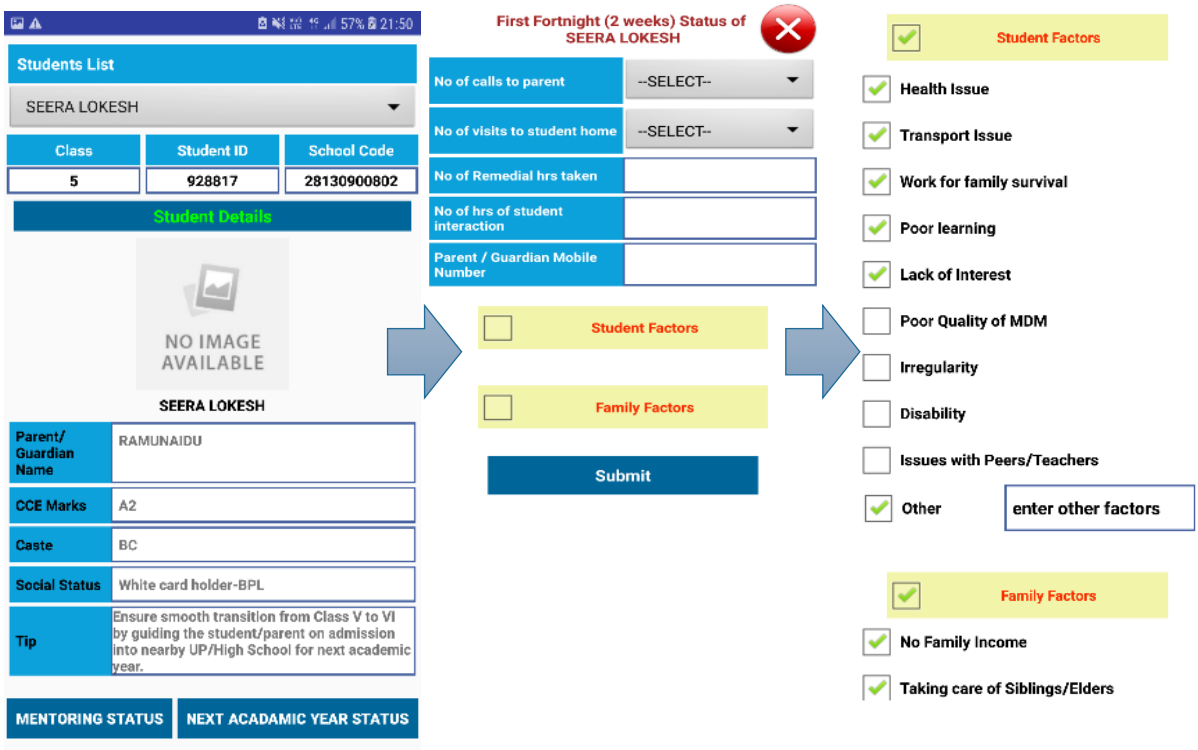
[160] Clustering techniques such as Entropy Weighted KMeans Models are applied to identify similar group of students and schools based on various features. Clustering is undertaken separately for students and schools, hence we obtain different clusters are obtained for schools and different set of clusters for students. Student clusters are identified based on their Socio-economic features and based on their academic performance. School clusters are identified based on the Girl-Boy student ratios, student strength and the infrastructure. A Boosted Decision Tree Model (Decision Forest and Extreme Gradient Boosting) is applied on the above data set to train the model on 2016-17 Student data and the resultant model is used for predicting the student dropouts for future years. The model has been refined each year based on outcome results and uses Azure Machine Learning (ML) and R libraries to improve its accuracy. Source: https://indiaai.in/case-study/ai-is-being-used-to-identify-potential-school-dropout-rate-in-andhra-pradesh, accessed on 20 January 2020.

[161] Figures were reported by the Department of School Education who established the numbers after comparing actual dropout against predicated likelihood of dropout.

[162] No negative or unintended consequences were identified in this process however this doesn't rule out the possibility.

[163] This App is made available on Google Play Store with the name Vidyarthi Nestham. https://play.google.com/store/apps/details?id=com.apdp.aponline.apdp, accessed on 20 January 2020

Figure 3.14: Responding to a potential student dropout using Vidyarthi Nesthams



3.13 Use in Sector Analysis and Planning

Data from SIMS is used in developing and monitoring strategic plans such as the Samgra Shiksha plan for 2019-2020[164] which is the main plan for education development in each state. The plan makes extensive use of EMIS data both tabularly and graphically to district level. Disparities in access, participation, achievement and the quality of service delivery are highlighted using data derived from SIMS. These inform the changes to policies, programming and resource allocation for the coming year. The analysis comprehensive at 661 pages and covers all aspects of delivery of education services throughout the state. The plan focuses on government and government aided schools but makes provision for statistics from private schools when assessing the requirements of the public sector.

As noted elsewhere, SIMS data is used to justify school plans which are aggregated and prioritised at Mandal, District and State level as mandated under Samgra Shiksha by the Ministry of Human Resource Development at the national level. Plans are monitored using SIMS data and progress towards objectives and targets discussed at monthly meetings.

3.14 Summary of Some of the Main Achievements of SIMS[165]

The following gives a brief summary of some of the main outcomes of SIMS to date:

[164] Andhra Pradesh Department of School Education (2019) *Samgra Shiksha plan 2019-2020,*

[165] Figures and statistics are derived from the Department of School Education Andhra Pradesh which is the only source of comprehensive education data in Andhra Pradesh. Therefore the figures quoted in this section are not triangulated and the consultant cannot verify their accuracy.

- **Dropout Prevention:** The Vidyarthi Nestham programme features a sophisticated dropout prediction model using 64 parameters, with 92% accuracy (refer below) and follow up assignment of teachers. The system is still in pilot and the impact on reducing dropouts has not yet been established. SIMS also facilitates a wide range of programmes and policies aimed at increasing retention by tracking individual students, their attendance and learning outcomes.
- **Reducing Teacher Absenteeism:** Using the E-Haazar biometric attendance system. Teacher attendance has increased from 27.5% at introduction of the system in August 2017 to 97.2% in February 2018.
- **Identification and targeting of OOSC:** The Praja Sadhikara Household Survey combined with the use of SIMS and Badiki Podam has helped reduce recorded OOSC numbers of children from 889,000 in 2016 to approximately 89,000 in 2019 through correction of data and drives to ensure children are enrolled in school. 380,556 OOSC were enrolled in school between 2014/15 and 2020/21.
- **Elimination of Ghost Schools:** Introduction of SIMS led to identification and elimination of ghost schools. AP State reported that the elimination of ghost enrolment lead to the saving of 27.44 Crores Rs. for textbook printing and 105.42 Crores Rs for provision of mid-day meals. Elimination of ghost schools also lead to consolidation of schools enabling the closing of 1480 Schools between 2014-15 and 2015-16[166].
- **Servicing unserved communities:** GIS mapping of schools has been used to determine locations of new schools. GIS Coordinates of Schools and geotagging of school boundaries were captured in 2014-15 and updated in 2019-20. When a new government school is proposed, the location of all schools within a radius (1 KM – Primary, 3 KM- Upper Primary, 5 KM – High School) is determined. The DoE is in the process of ensuring all habitation boundaries and populations are identified and properly located on the maps help further identify the location of new schools.
- **Exchange with Other Government databases:** SIMS data is shared with other government agencies. For example, SIMS collects data on certain medications given in schools, and this is shared with the MoH.
- **Improved evidence-based decision making:** Needs as identified in SIMS data are the basis for budget decisions at a national level, right down to the school level to inform the planning and budgeting process form school to state level has resulted in evidence-based budgeting decisions.
- **School/Community Use of Data:** A program has been started to provide resource persons to engage with communities on data awareness.
- **Cost savings through targeted programmes:** Child Info has enabled the saving of an estimated 38.5 Million USD in greater targeted textbook provision, large savings in Mid-Day Meal provision, targeted provision of uniforms, bicycles for girl Children and other required resources.
- **Greater teacher satisfaction** through transparent transfer, attendance, in-service training and payroll systems (TIS, TTSS and eHazar).
- **Advocacy for reforms programmes** such as Nedu-Nedu through online sysetms promoting the condition of facilities in schools (STMS)
- **Targeted student learning interventions** through assessment and learning systems such as SAS.

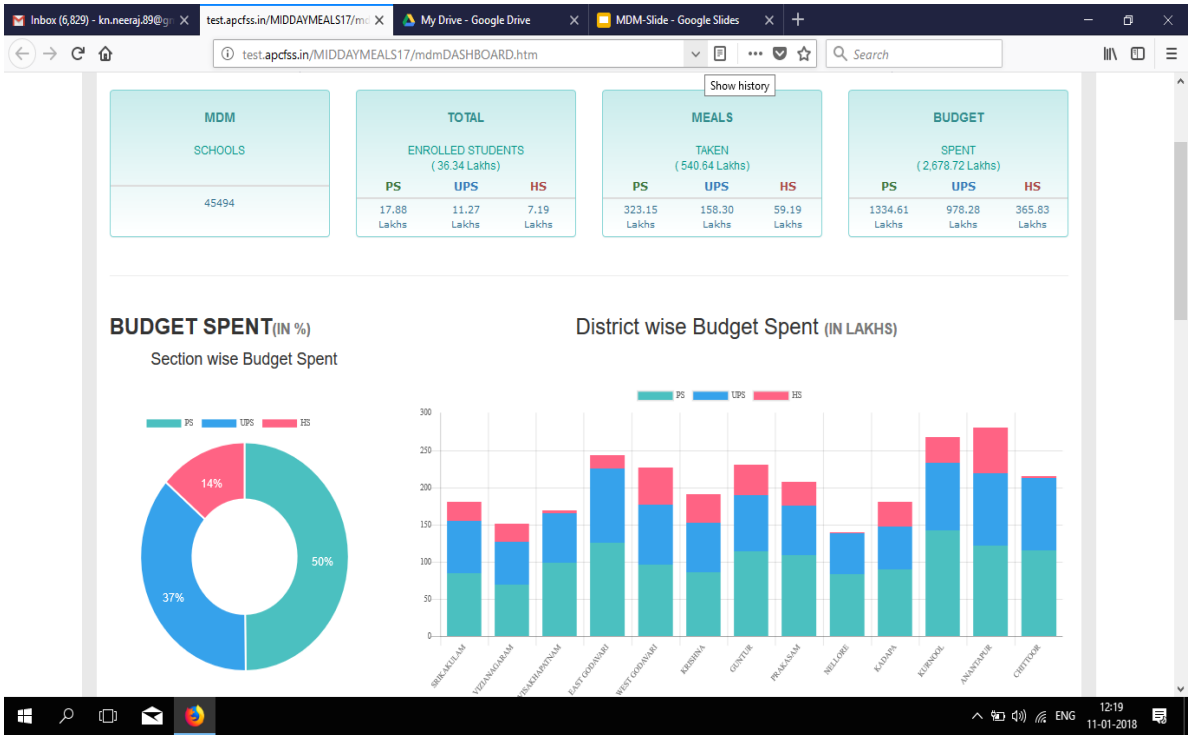
[166] Reducing the total number of schools from 61915 to 60435.

- **Facilitating programmes for disadvantaged pupils** such as in the identification and allocation of disadvantaged girls as part of the *Kasturba Gandhi Balika Vidyalaya* (*KGBV*) residential girls' secondary school programme.

Table 3.8: Mid-Day Meals Advantages of Implementation through SIMS[167]

METRIC	EARLIER…	NOW…
Bill payment time	2 to 3 Months (avg.)	15 Days (Avg.)
Numbers	Inflated/wrong numbers of attendance and enrolment	Meals Taken/Attendance linked to Enrolment Database (SIMS) and eventually to Biometric
Person Hours Saved	80% of DEO/MEOs official Hours spent on MDM bill clearance	Saved 100s of hours put by DEO/MEO every month which will be utilised for MDM monitoring purposes
Bill payment status	Cook, Helpers, HM did not have any idea about the status of MDM bills	Complete transparency in bill status and amount through NIC app and SMS to stake holder at each stage

Figure 3.15: MDM Budget Analysis Screen



[167] Source: Department of School Education Presentation on SIMS

4 (1.0) Responses to Review Technical Questions

4.1 (1.01) Relevance and comprehensiveness of indicators for monitoring access, equity and quality

AP State monitor almost all education indicators for the sub-sectors of primary, lower secondary and upper secondary schools. Standard education indicators, non-standard operational indicators, such as for teacher attendance monitoring, and other data are openly published on the internet using graphical and numerical analysis to highlight disparities (refer section 3.10.2). SIMS does not yet report on other sub-sectors including Early Childhood Education (ECE), Higher Education, TVET and Non-Formal Education[168].

Both public and private schools are mandated to use SIMS in AP State so the data available is identical for both[169]. Indicators published through Department of School Education websites do not highlight disparities between public and private schools however analytical planning documents such as the Samgra Shiksha plan for 2019-2020[170] disaggregate some data by public and private schools. However, most indicators are published for either the public sector, for use in public sector planning, or reference the private sector when assessing the requirements of the public sector provision of schooling.

Indicators relating to pupils are calculated from individual student data containing 63 fields related to each pupil as well as monthly attendance and learning outcomes for each subject for formative and summative assessments for each year and attendance at school. Indicators can therefore be disaggregated by any attributes recorded for pupils.

There are several recognised parity analysis which cannot be undertaken on the data[171]. AP state does not have conflict and so does not record conflict affected children. Wealth is not classified according to quintile but rather according to poor classifications used in AP State.

Macro level equity analysis of indicators is possible through UDISE and through RTGS however the information is not presented in easy to digest formats and equity issues are not highlighted visibly. Equity analysis is undertaken extensively though the main analytical publication, the Samgra Shiksha plan for 2019-2020[172]. Equity analysis helps inform policies and programmes designed to target disadvantaged groups such as the *Kasturba Gandhi Balika Vidyalaya* (*KGBV*) residential girls' secondary school programme. Equity analysis usually includes by gender, wealth, disability, special needs, quality of service provision and location (urban and rural). Other forms of equity analysis are less common.

The ministry also adopts a highly child centred approach whereby every child is identified in SIMS, tracked and assisted to ensure they have the greatest likelihood of being retained and graduating each education cycle. This is not equity focussed but likely helps identify and monitor issues relating to individual children at the school level.

[168] Graphical and numerical publication can be found

[169] Reported by the Department of School Education but not verified as part of this review.

[170] Andhra Pradesh Department of School Education (2019) *Samgra Shiksha plan 2019-2020,*

[171] In accordance with SDG Indicator 4.5.1: Parity indices (female/male, rural/urban, bottom/top wealth quintile and others such as disability status, indigenous peoples and conflict-affected, as data become available) for all education indicators on this list that can be disaggregated.

[172] Andhra Pradesh Department of School Education (2019) *Samgra Shiksha plan 2019-2020,*

Indicators and other data analysis are all automatically calculated by the system. Dashboards highlight issues such as poor teacher or student attendance, poor student results of other issues. Data forms a central component of almost every administrative, monitoring or planning activity undertaken by the Department of School Education. Indicators are published to the lowest disaggregate-able level. For secure access this will be to the individual child or teacher however on public websites indicators are published to school level.

Indicators are used to prepare Annual Work Plan and Budget for Samagra Shiksha and copy of Annual Work Plan for state, districts and Mandals. Indicators are also used to confirm school development plans and requests resources for schools. Indicators are also used to monitor the various programmes implemented by the Department of School Education. The information in the system is sufficient to track all targets including operational and day to day targets such as student and teacher attendance. However, most schools do not have direct access to the desktop version of SIMS and can only interact via mobile applications. Therefore, most schools still rely on paper-based record keeping and manual analysis to prepare annual workplans and monitor student progress. Cluster Resource Persons (CRP) use SIMS through Mandal Resource Centres (MRC) and monitor schools through a combination of SIMS reporting, mobile applications and hardcopy documents kept at the school.

4.2 (1.02) Data quality management and mechanisms

As described in section 3.8.1, each school has a personal login to SIMS however only well-equipped schools with internet and local capacity interact with the system directly through desktop login. Most schools use the Cluster Resource Person (CRP) who interacts with the system on behalf of the school at the ICT unit of the Mandal office. In the current scenario the High Schools and Private schools will enter data directly from School Level. Primary and Upper primary schools having the environment will enter directly. All schools interact with the system via a wide range of mobile applications which are described in section 4.6. This provides a rapid and easy method for all staff to submit or obtain targeted information as required.

Extensive data validation processes are in place. All data is based on individual records of people with confirmation of individual status. Teachers are confirmed through their employment and through biometric scanners which require thumb scan and log the spatial GPS coordinates. Every individual including all students and staff are confirmed through their unique Aadhaar number and details are correlated with other databases such as the Civil Supplies household Survey[173]. If a student does not have an Aadhaar number, they are assigned one as part of the process of enrolment. Every individual has a picture and a comprehensive data record in SIMS. The system also contains a mature level of validation checks to prevent incorrect entry of data such as comparisons over time and threshold checks.

Data is verified at each level of government. The CRP validates information with hardcopy records at the school level during site visits which are undertaken several times a month. Inspectors verify information against the SIMS data upon inspection. Parents committees (PC), which is comprised of parents and the HM of the school, must confirm the school development plan which is based on UDISE data, monitor all expenditure for the school, validate the UDISE school report card and are required to approve most school development activities such as monitoring infrastructure development activities, reviewing teacher attendance and Mid-Day Meal (MDM) reports. Cluster meetings involving the PC and CRP review performance indicators for the school covering a range of topics. However, most PC do not have direct access to SIMS data and must request any reports through the Headmaster (HM). Data on infrastructure is validated

[173] Praja Sadhikara

by a site engineer prior to disbursement of funds and the STMS provides a transparent platform for viewing geotagged pictures of assets requiring maintenance or replacement.

The SIMS contains alerts for missing data and prompts the user for any pending requests or activities through a Dropbox function. For example, if a child transfers to another school, the head teacher of the school will place his/her record in the Dropbox and unenroll the child from the school. When the child enrols at the other school the HM will see the record of the child in Dropbox and will be required, if possible, to give permission to the child to enter the school.

Few information systems are completely error free however SIMS is built around numerous robust verification processes to help ensure that data is robust, and errors are minimal. The data on individuals is detailed and correlated with other government systems. The implementation of SIMS mobile applications such as MDM and e-Hazar have resulted in large cost savings by helping to enforce and monitor accurate allocation of resources. As more information is obtained directly using validated digital means such as in VCR, the data would be expected to become even more robust and detailed.

4.3 (1.03) Measures for safeguarding personal and confidential information

Access to SIMS is granted through two platforms, the desktop login and the mobile applications which require staff confirmation via their registered phone number, employment ID and a password. User access is mapped against job roles and responsibilities to determine classifications of users by position and region being district, Mandal, Cluster and School. All users log in under a user classification and only gain access to functions and data for which they have job responsibility. For example, a HM can only access and modify data for students in their school and a CRP can only view and modify data for schools within their jurisdiction. Some functions within SIMS require multiple electronic confirmation checks under secure login such as validating MDM expenditures and student transfers. Each user in the process will keep alerts in their Dropbox until a request addressed.

The system has industry level protection for the database. Robust security protocols have been implemented including physical and virtual security of the database[174].

Whilst the system is robust electronically, there have been suspected data breaches in which citizen's personal data may have been exposed and which have been widely reported[175]. On 24 August 2017, a nine-judge bench of the Supreme Court ruled that the right to privacy is a fundamental right guaranteed by the Indian Constitution and citizens have referred to this when questioning the vast amount of data that the government of AP stores and uses on individuals[176]. The Department of School Education also lacks a clear policy on how individual data should be used for purposes such as research and other analysis. Schools post individual student results on notice boards within schools. One HM remarked that this process was demoralising for underperforming students and had negative consequences. In one school visited, the HM had given his password to all parents of the school so they could review their child's attendance and progress. This well-intentioned gesture inadvertently resulted in all parents having access to all children's records and to change data. This highlights the lack of robust processes concerning data security. Given the large quantity of detailed data AP has on each individual it is important to develop robust legislation and policies surrounding the use and protection of individual data.

[174] Using firewalls, secure severs and adequate database security.

[175] Source: https://timesofindia.indiatimes.com/city/hyderabad/data-breach-in-andhra-pradesh-again-4-5-crore-citizens-details-exposed/articleshow/64653524.cms, accessed on 28 January 2020

[176] Source: https://caravanmagazine.in/policy/right-to-privacy-data-protection-bill-policies, Accessed on 28 January 2020.

4.4 (1.04) Types of information and levels of disaggregation

As noted in the response to question (1.01)[177] data on individuals is comprehensive[178] and processes surrounding data verification are also robust such as those concerned with identifying a child's disability. As noted also there are several recognised parity analysis which cannot be undertaken on the data[179] but which are not relevant to the context of AP State.

As noted above, equity analysis is undertaken as part of sector analysis and planning[180]. It usually includes by gender, wealth, disability, special needs, quality of service provision and location (urban and rural). Other forms of equity analysis are less common but are possible based on the extensive data on each child stored in SIMS.

AP State is also able to use individual child data to help identify and address the needs of individual children.

- Each school, CRP and Mandal being responsible for ensuring all children out of school are identified through annual drives and encouraged to attend school. SIMS facilitates this by identifying and tracking OOSC[181].
- Each child is retained in school and assisted to achieve regardless of socio-economic status. SIMS assists in this by helping to identify children likely to dropout and tracking mentoring of children identified[182].
- Targeted pro-poor support for children to attend schools using SIMS data and data derived from other government systems such as the Civil Supplies Database[183].
- Child centred monitoring of attendance and learning outcomes via modules such as the Student Assessment System (SAS) and Virtual Class Rooms (VCR)[184].

SIMS has capacity to facilitate programmes but must work in synergy with the correct policy, capacity development and funding arrangements. For example, disadvantaged orphaned girls are identified and flagged in SIMS. These girls are then facilitated into *Kasturba Gandhi Balika Vidyalaya* (*KGBV*) residential girls' secondary schools and then tracked using SIMS to ensure they are retained and succeed. The programmes resources are scaled according to the proportion of un-serviced disadvantaged girls.

All teaching staff whether government or non-government are recorded in the system. Data on each staff member is comprehensive including Personal details; Spouse details (If married); Educational details; Appointment details; Departmental Tests details; Promotion details; Transfer details; and Health Card details[185]. Data on teachers is correlated against student achievement to guide in-service training programmes and feedback to teachers. Teacher attendance is also monitored using e-Hazar. The data is comprehensive and used to identify and act on issues

[177] (1.01) Relevance and comprehensiveness of indicators for monitoring access, equity and quality

[178] Indicators relating to pupils are calculated from individual student data containing 63 fields related to each pupil as well as learning outcomes for each subject for formative and summative assessments for each year and attendance at school.

[179] In accordance with SDG Indicator 4.5.1: Parity indices (female/male, rural/urban, bottom/top wealth quintile and others such as disability status, indigenous peoples and conflict-affected, as data become available) for all education indicators on this list that can be disaggregated.

[180] As encapsulated in the Samgra Shiksha plan for 2019-2020

[181] First recorded through the Mana Badiki podam mobile application and then through SIMS.

[182] Using Vidyarthi Nestham Dropout Prediction and Child Mentoring. Note that dropout prediction is being piloted in 10,000 schools as of November 2019.

[183] Containing the individual household survey data called Praja Sadhikara.

[184] Virtual classrooms are online environments that enable students and instructors to communicate synchronously, by means of audio, video, text chat, interactive whiteboard, application sharing, instant polling, and other such features, as though they were standing face to face in a classroom

[185] More detailed information is available at: https://www.ateacher.in/2019/05/how-to-update-ap-teachers-information.html, accessed on 20 January 2020.

relating to teacher performance and attendance. The data is used to allocate teachers, manage teachers and to identify and monitor teacher capacity development. The use of e-Hazar also allows Mandals to react immediately to unexpected teacher absence such as in the case of emergency leave or sickness.

Data collected on schools is comprehensive as shown in the UDISE+ data capture form[186]. In addition to this comprehensive level of data, there is a dedicated and integrated platform for recording geotagged images and videos of schools as part of the school transformation programme Nedu-Nedu[187]. Other applications sever specific targeted purposes such as the mobile applications for textbook distribution, Mid-day Meals (MDM), Bicycle distribution to girls[188] and the piloted Asset Management System. Comprehensive financial information is also collected through the Comprehensive Financial Monitoring system (CFMS). Data is used in the generation and monitoring of school development plans.

Trend analysis over time is undertaken at routine intervals and data comparisons over time form an integral part of almost all reporting. Most routine monitoring uses snapshots such as teacher attendance monitoring.

4.5 (1.05) Efficiency of data collection and administration

Staff at all levels noted that the system had greatly decreased the time and effort required for tasks. All HM interviewed noted that tasks, such as transferring students or procuring textbooks, use to require large amounts of paperwork and took a long time to process. They noted that the use of mobile applications and SIMS has made all tasks much easier as the student data was already in SIMS and applications referenced this data and processed requests automatically.

The use alerts such as the Dropbox function, which lists pending requests and tasks for each user, also helped to ensure that requests were processed rapidly. All staff were monitored through the system for response times to pending tasks and data submissions as part of Key Performance Indicators (KPI) used during assessment.

All HM and teachers interviewed also expressed satisfaction with the speed and transparency of the TIS and e-Hazar. These made tasks such as application for leave easy, fast and transparent and enabled the Mandals to quickly address resource shortfalls. Teacher transfers were transparent and based on a point allocation system and queue which everyone could understand and view. Staff could comment on their own staff record, lodge issues or grievances and receive accurate calculation of support allowances in a timely manner. Staff training was easy to request Staff did not note any shortcomings with the system or any reduced contact time with students.

The Department of School Education had realigned job roles to accommodate SIMS and had implemented innovations such as mobile applications to ensure engagement in the system was fast and easy. CRP managed large data volumes for some schools which lacked capacity[189] through desktop login to engage directly in the system. MRC gave support to CRP for data management. A dedicated and well-equipped IT Cell was active at State, District and Mandal level to provide cascaded support to the use of SIMS.

There is usually scope to improve information systems to increase efficiency. In the case of SIMS, there were limited ways in which teachers could engage with SIMS without the assistance of the HM. Parents cannot engage directly with the system to review their child's progress. There is

[186] http://udiseplus.gov.in/informationDetails.action?fileId=2

[187] Via the School Transformation Monitoring System (STMS)

[188] The Bathikostar mobile application

[189] In terms of internet, computers or skills.

scope to consider direct parent access to SIMS. PC, who are now paramount to school development planning and monitoring the school, must request data from the HM or know how to view it online. There is scope to improve PC access to SIMS and improve feedback mechanisms to PC. Making the annual school development plan fully electronic and tracking it online may also help clarify the relationship between SIMS data and school development planning.

4.6 (1.06) Two-way vertical information flows from school to regional/national and in between

SIMS has been institutionalised into the monitoring and planning functions of each office within the Department of School Education. The adoption of SIMS at all levels of government and its pervasive influence on many operational and planning functions has led to a large ownership from the school to the national level. Staff engaged with the system daily and it was central to many operational purposes. Teachers and HM interacted with the SIMS on a daily basis for operational and transactional purposes through mobile applications such as MDM and e-Hazar. These applications provided ongoing feedback to staff at the school level related to application specific purposes such as leave applications or transfer requests (refer section 3.6).

Annual school development plans are based on SIMS data displayed in the school report card (refer Annex 7). However, schools visited developed their School Development Plans based on data contained in hardcopy books (refer annex 10) and the hardcopy UDISE+ form they complete for submission of school data. They calculated required indicators manually.

At the Mandal level, the school development plan is compared against UDISE+ data via the school report card by the CRP and Mandal Education Officer. Mandal level plans are developed based on school development plans and are also verified at district level against UDISE+ data in a similar process. This is repeated to State level. The process is highly data driven.

However, the school report card largely reports data back to the HM / PC which is already known in the form of raw data and a few selected indicators (refer annex 7). There is large scope to improve the quality of the report card to better highlight issues relevant to the school, highlight important trends and note progress towards regional and state targets and goals.

CRP and PC conduct monthly meetings at which school performance data is discussed. This includes monitoring the progress of the implementation of initiatives in the school development plan, discussing issues of student performance and attendance[190] and teacher performance and attendance. Specific purpose driven meetings are also conducted such as annual meetings concerning OOSC who are identified in the school catchment. These meetings also rely on SIMS to track OOSC and efforts made to enrol children in school. CRP noted that meetings are informed by a combination of examination of school hardcopy records and reports generated from SIMS. The extent to which CRP relied on one or the other was dependent on their knowledge and skill in using SIMS.

Student learning outcomes are a component of school assessment but not teacher assessment. The Department of School Education noted that they had previously included student performance as a criterion in teacher assessment but removed it owing to the unintended negative consequences of doing so[191]. District level capacity development programmes for teachers are also informed by student performance data available through SIMS.

[190] Monitored through either the MDM application or school hardcopy record books

[191] Such as teachers facilitating students to obtain good marks so as to improve their own profile.

AP State is in the process of increasing targeted feedback to teachers such as via guidance concerning student performance or notification of students likely to dropout. The Vidyarthi Nestham programme, which combines dropout prediction[192] with monitored interventions designed to reduce the chance of a child dropping out, reflects the emphasis AP state places on ensuring processes of intervention are an integral part of data systems. Teachers and HM not only receive information on students likely to dropout based on predictive algorithms applied to SIMS data but must also follow a set of processes to minimise the chance of the child dropping out. The teacher must report further information on each child using the Vidyarthi Nestham mobile application and report the status of interventions. It was not conclusively established whether this intervention has been successful in reducing dropout as the pilot is only now concluding.

The Virtual Class Rooms (VCR)[193] initiative, active in 1874 schools[194], is being used to pilot Personalised adaptive learning (PAL) throughout the state using automated evaluation of student performance based on clicker analysis[195]. Feedback on learning areas on which to focus will be sent to teachers and students.

Given the achievements of the past 5 years it would be likely that SIMS will continue to become more pervasive over time and increasingly be used as a central platform for influencing and guiding decisions at all levels of government.

4.7 (1.07) Integration with other relevant databases, within and cross-sectoral, including financial, demographics, learning assessment

AP State has implemented a broad-based digital reform strategy, commencing in 2014[196], which emphasises interoperable real time governance systems, detailed information on all individuals in the state, and rationalisation of data so that each data point is collected once. The objective of the real time governance is seamless service delivery to each beneficiary and stakeholder and streamlined, transparent & accountable administration. The implementation of SIMS is a component of this broader government strategy. SIMS forms the basis of updated information concerning children at school and OOSC. SIMS references the states household survey data called Praja Sadhikara stored in the Civil Supplies database. The Praj Sadhikara data is updated in the Real Time Governance System (RTGS) along with 39 other government departments. This contains detailed information on all individuals residing in Andhra Pradesh State and is used to populate SIMS data on children, their parents and their socio-economic status (refer section 3.5).

Each individual person in AP State is referenced with a unique Aadhaar Number through government databases. The Real Time Governance System (RTGS) shares SIMS data with other databases such as the Health Management Information System (HEMIS). Children who are out of school and may not have an Aadhaar number are identified using annual community drives (refer section below) and so are gradually included in the SIMS to ensure all children are tracked. The extensive data on each individual is updated constantly through service delivery

[192] Currently being piloted in 10,000 schools. The review did not assess any schools in which the algorithm was being piloted.

[193] Virtual classrooms are online environments that enable students and instructors to communicate synchronously, by means of audio, video, text chat, interactive whiteboard, application sharing, instant polling, and other such features, as though they were standing face to face in a classroom

[194] Reported in November 2019.

[195] Via the AP eKnowledge Exchange Portal DIKSHA: https://diksha.gov.in/explore

[196] Encapsulated in its Information Technology Policy 2014-2020, Electronics Policy 2014-2020 and Innovation and Start-up Policy 2014-2020

points such as schools and health clinics and can be used for precise targeting of support under each sector such as the pro-poor support to mothers of children confirmed as attending school[197].

Financial data is stored separately in the AP State's Comprehensive Financial Monitoring system (CFMS) which is common to all departments. Robust data standards such as the use of unique codes for all entities and use of Application Programming Interfaces (API) ensure that relevant data is shared between systems.

SIMS itself is comprehensive and includes modules for teacher management, learning assessment, facilities etc. (refer section 3.4). The database, which is distributed over 9 and application database servers, enables referencing of any data as required for reporting of functional purposes.

AP States approach enables monitoring of each citizen to ensure they are participating in essential services. Within the education sector, the high level of data interoperability ensures that correlations can be easily derived as required, such as assessing the performance of schools or the training needs of teachers based on student assessment results.

4.8 (1.08) Integration of an early warning system or mechanisms to prevent dropout

Dropout prevention and inclusion of OOSC are major initiatives in AP State and like most initiatives, are facilitated and monitored through SIMS. SIMS monitors both teacher absenteeism and student absenteeism. Teacher absenteeism is monitored through the e-Hazar application which records attendance of all staff twice daily, at the start and end of the workday. Alerts are given to the managing authority in event of an unauthorised or unregistered absenteeism.

Student absenteeism is monitored through two methods:

a. The MDM mobile application which records numbers of children attending daily by gender and grade. This is used to confirm daily the MDM allocation to the school, which itself is calculated based on SIMS and data derived from the Civil Supplies Database.
b. A Monthly attendance figure for each child is recorded into SIMS and reasons for absenteeism noted using the Student Assessment mobile application.

The MDM attendance data is correlated with the monthly individual child data and discrepancies noted.

Absenteeism is dealt with through several mechanisms. The Mandal Education Officer will note incidences of high absenteeism in schools and individuals using SIMS and discuss these with the CRP. The CRP will also monitor schools for incidences of repeat absenteeism and discuss action with the HM and the HM will do likewise with teachers. In most cases, the CRP and HM refer to hardcopy records to identify cases of high absenteeism although reports in SIMS highlight the same. The HM and Teacher must then follow a process of intervention which includes meeting with the child's parents, identifying reasons for absenteeism and special mentoring for the child[198].

Andhra Pradesh are piloting the use of SIMS to facilitate this process through the Vidyarthi Nestham programme (refer section 3.12). Vidyarthi Nestham, in conjunction with Microsoft, is piloting the use of predictive algorithms to help identify children most likely to dropout based on data stored in SIMS including: learning outcomes (57%); infrastructure (31%); transition (7%);

[197] Rs. 15000 pro-poor support is allocated to mothers of children confirmed as attending school. Data to confirm the allocation is derived from SIMS concerning enrolment, attendance and socioeconomic status of the family. Data is derived from the Civil Supplies Database and other databases for eligibility criteria such as: Not having a 4-wheel drive; Income tax assessment; Household consumption of power >200 units; Not being a Government Employee; Not being Land holders of > 20 acres.

[198] This information was triangulated through interviews at school level.

age inappropriateness (4%); social category (1%). Numbers in brackets represent the present weightings applied to each set of variables. The system is active in 10,000 schools and has a 92% accuracy. A teacher is notified of students who are identified as likely to dropout and is assigned up to 5 students for monitoring. The teacher must then complete a report every fortnight with qualitative student and family factors observed that may eventually lead to student discontinuing in that school and record them on Mobile Application created for the purpose[199].

AP State has instituted an annual drive conducted by teachers, head teachers and habitation representatives to identify children who are OOSC in the catchment area of each school. OOSC are recorded in a mobile application called Mana Badiki podam which commences tracking of these children in SIMS. AP State has a number of equivalency and special programmes, such as *Kasturba Gandhi Balika Vidyalaya* (*KGBV*), in which children may be enrolled depending on their socio-economic circumstances. OOSC are placed into Child Info and assisted to obtain an Aadhaar number. OOSC are monitored at each level of the education system[200].

4.9 (1.09) Level of automation

SIMS and the RTGS have very high levels of automation. There are three types of automation evident in SIMS:

- **Operational.** This level of automation is evident through the transactional applications such as the Bathikostar application for the allocation of bicycles to girls, the textbook distribution application, e-Hazar the attendance monitoring application or APSTel the staff leave application. These applications have automated time-consuming paper-based processes to enable rapid and accurate execution of tasks. The Dropbox, which highlights pending tasks for each user, is also an example of operational automation.
- **Analytical:** SIMS has automated analytical analysis of SIMS data. Automated analysis has been done extensively for specific purposes such as monitoring teacher attendance, accurate MDM budget disbursement or Textbook distribution. These are often displayed using graphical means such as dashboards with graphs or coloured text to indicate whether acceptable thresholds have been exceeded. Analytical automation is also widely employed through the websites granting extensive public access to SIMS data. These are shown in section 3.10.2 and include the UDISE+ website which displays UDISE data using graphs, tables and I. Graphical
- **Targeted Service and Content delivery:** SIMS is piloting the use of complex automated analytical algorithms such as the dropout predictive algorithms under the Vidyarthi Nestham or the targeted learning algorithms under the VCR programme. These enable targeted service delivery as in the case of Vidyarthi Nestham in which children will be identified and targeted for assistance based on identification through complex algorithms analysing many variables. In the case of VCR, Personalised Adaptive Learning (PAL) algorithms enabled automated content delivery in the form of automated delivery of content based on learning needs.

As noted above there is scope to improve automated analysis such as improving the school report cards and digitising the school development plans in SIMS. However, the accomplishments to date have been significant.

[199] Schools using this application were not reviewed in this study. This App is made available on Google Play Store with the name Vidyarthi Nestham. https://play.google.com/store/apps/details?id=com.apdp.aponline.apdp, accessed on 20 January 2020

[200] Education officers interviewed were able to report numbers of children OOSC within their region by referring to SIMS.

5 (2.0) Response to Review Questions on Use and impact (institutional and socio-cultural dimensions)

5.1 (2.01) Level of school and local level implementation, ownership, and use

At the school level there are presently several categories of access. These are:

- **Non-Teaching staff and Teachers** who interact through mobile applications being mainly eHazar and APTel concerned with teacher leave and teacher attendance and Teacher Training Support System (TTSS) for teacher training requests and renumeration.
- **HM of schools without adequate infrastructure or connectivity to use a desktop** computer for administration purposes. These users interact with SIMS through a wider range of applications including MDM, Mana Badiki podam for OOSC, Bathikostar App for bicycle provision, Textbook distribution for textbooks and the assessment Application for student attendance and marks. In several schools the HM involved teachers in the use of these applications. In schools of this type visited the Cluster Resource Person (CRP) managed the remainder of the schools data at the Mandal Resource Centre (MRC) and the HM would often accompany the CRP for this task.
- **HM and Teachers in larger schools**, which were typically secondary schools, would interact with all mobile applications as well as the full SIMS portal available through desktop login. This would enable schools to directly mange all data through SIMS and directly utilise features such dropbox which queued alerts. These schools also generated school reports through SIMS such as student report cards and the school report card (refer Annex 7).

CRP accessed SIMS at the MRC and managed school data and generated required reports. CRP and PC conduct monthly meetings at which school performance data is discussed and school plans monitored (refer section 3.11). PC did not have direct access to SIMS but could request data through the HM or CRP.

Public access to SIMS was only available through government portals (refer to section 3.10.2). Data displayed in the portals is extensive but not easily consumed by the general public. There is scope to improve access to SIMS data for the public. Some countries publish school report cards which can be easily understood by the public and can be used to encourage public contribution or participation in local school development[201].

Parents do not have access to SIMS and there is scope to include access for parents to view their child's progress and receive alerts concerning issues such as absenteeism.

5.2 (2.02) Easy to Use

Users who engaged with the system understood how to use the system within the context of their job role and responsibilities and reported no difficulties or issues in using the system or applications. A significant factor towards the institutionalisation of the systems has been the development of a culture of continuous training and mentoring at all levels of the education system.

[201] The Illinios State School Report card provides a good example of a report card based on EMIS data suitable for public consumption. Source: https://ilhonorroll.niu.edu/, accessed on 29 January 2020

As noted in section 3.8.1, there are different categories of user at the school level. Most teachers and HM only understood how to use the mobile applications they were required to access. The mobile applications were designed to operate easily, with speed and with minimum data entry. The desktop login to SIMS was understood and accessible to HM and some teachers in larger schools having adequate connectivity and hardware, however HM in smaller schools relied on CRP to access the SIMS. Some CRP relied on the MRC staff to access SIMS and manage school data under their remit. At the district and national level users were well versed in the use of mobile applications and the desktop version.

During introduction of SIMS there were several large-scale training exercises. Since introduction of SIMS all staff reported receiving one day a month mentoring and training on SIMS through a cascade model. For example, CRP are required to have a monthly review meeting and training with the MIS coordinator and data entry operator at the Mandal office. MRC staff are reviewed and mentored for one day a month by the DEO IT Cell staff. Timely data submission and response to dropbox alerts are monitored through the SIMS and if there are any issues apparent then a special meeting may be called to address the matter. When significant new functionality is added to SIMS or a new mobile application is introduced, all Mondal MRC staff are trained by DEO IT cells who in turn should train CRP who should train and mentor HM in the use of the application or function.

A robust mechanism of support helped ensure the system has been developed based on user feedback and helped ensure users obtained rapid feedback to issues. A mobile application permits feedback concerning issues or problems encountered with any aspect of SIMS. All feedback is categorised, logged and processed by the developers. The SIMS office has stablished a hotline that users may contact concerning any immediate or urgent issues. Staff may also engage in a forum for sharing best practice and experience with other users or to lodge and receive responses on questions concerning the SIMS.

The system of continuous training and mentoring has proven sustainable and cost effective and has helped to institutionalise SIMS in most aspects of administration, management and monitoring of the education system. This model may be more sustainable than developments which rely on large training activities which are dependent on funding release annually.

5.3 (2.03) Usefulness

The community and parents are represented through the Parents Committee (PC). The PC can request access to SIMS reports and data and are responsible for reviewing school record keeping, approving all aspects of the school development plan, approving receipt and disbursement of finances and undertaking monitoring of the school on a monthly basis. The PC do not have direct access to SIMS but do review the UDISE+ school report card as part of developing and monitoring the school development plan. The PC are involved in development of the school plan. The guidelines for development of the plan specify the requirements for justification using SIMS data in generation of the plan but this information is not fully presented on the UDISE school report card. The plan is confirmed using UDISE data at the Mandal, District and State levels. This mechanism, and the transparency that underpin it, were reported as having encouraged community investment in education[202].

Parents do not have direct access to SIMS and do not interact with the system. The main use of SIMS is presently restricted to operational, administrative, monitoring and planning purposes to

[202] Schools visited gave examples of community investment which they believed was based on a transparent system of management in which the PC are central to approval of all school finances, plans and other activities.

facilitate and ensure accountable and transparent administration of the education system between the HM, CRP, Mandals, Districts and the State Department of School Education.

The Real Time Governance System (RTGS) and UDISE portals ensured data was published to school level but neither portal is easily accessible or understood by school level stakeholders such as teachers, PC or parents. However, AP state continue to make efforts to ensure the public is better informed. For example, during June each year the grade 10 public examination results are published for all schools on the ministry website and in local newspapers. There is also a component of SIMS which deals with grievance submissions from parents concerning schools. All submissions must be addressed in a timely manner by the Mandal Education Officer.

SIMS has increased the accountability of the education system throughout AP State but there is scope to increase delivery of information in easily understood formats to actors at the school level. The use of CRP to liaise with HM using hardcopy reports generated from SIMS has enabled the benefits of monitoring using SIMS data to reach schools which have poor capacity to interact directly through the desktop version of SIMS. The school report card could be improved to ensure it is easily accessible and understood by PC and is more applicable to development and monitoring of the school development plan. There is a need to gradually increase direct engagement in the desktop version of SIMS as schools develop sufficient infrastructure. There is also scope to enable parents to have direct access to view their child's academic progress and achievements.

5.4 (2.04) Transparency

A vast amount of information is made available to the public as noted under section 5.3 (2.03, transparency) however the information is not in an easily accessible or understood format. AP state has empowered the PC to oversee all aspects of school operational and management. It is primarily through this mechanism that SIMS data is made accessible to the public and used to influence management and development of the schools. PC are responsible for approving all financial allocations and disbursements to schools and monitoring all aspects of the school in conjunction with the HM. The PC reports to the Habitation Committee as the school development plan must feed into the annual Habitation Plan[203].

The public also has access to SIMS data through the RTGS and UDISE Portals to school level however the information is not in an easily digestible or understood format. All education indicators pertaining to the general education sector are made accessible to the public through these sites as well as school report cards. Performance of schools is published in newspapers and on the ministry website.

5.5 (2.05) Sustainability

Measuring the sustainability of information systems is a complex undertaking and a full analysis is beyond the scope of this review. Fiskel[204] (2003) notes multiple factors relating to sustainability of information systems some of which can be discussed in the context of SIMS.

- **Cost effectiveness:** SIMS is estimated to cost 1,418,767 USD annually and 6,402,020 USD in total between 2015 and 2019 (refer section 3.9). The Department of School Education conservatively estimates that SIMS has led to cost reductions of 38.5 Million USD through

[203] The habitation plan is the plan for the entire habitation catchment of which the school is one component. The plan includes details of the population, activities in the village, school age children, inclusive needs. A school catchment area may contain more than one Habitation area. Therefore, it may participate in more than one habitation plan. Other centres such as health and child welfare centres also contribute to the plan.

[204] Fiksel, J. *Designing resilient, sustainable systems. Environmental science & technology*, 37(23), 2003, 5330–5339.

targeted resource allocation. This does not take into account the massive gains from improved teacher attendance or reduced HM time on administration functions.

- **Technical capacity to operate and develop:** The Department of School Education has created a partnership with a semi-private organisation TATA IT who manage development and deployment of the application. This has allowed both entities to focus on their core skills and has resulted in a professionally developed and deployed system.
- **Technical capacity to Use:** Staff at all level demonstrated a high capacity to engage with the system. The institutionalised mentoring process and realignment of functions to ensure proper support to SIMS helped ensure that staff maintained capacity to use SIMS.
- **User Satisfaction and contentment:** Staff at all levels noted a high level of satisfaction with SIMS and lauded its transparency and efficiency.
- **Behaviour modification:** The systems have resulted in significant behavioural changes such as greater attendance of teachers in schools and more transparent and fair processes such as staff transfers.
- **Productivity increase:** The SIMS has resulted in significant productivity increases in such areas as targeting students likely to dropout and targeting student learning needs.
- **Social transparency:** SIMS has resulted in greater social transparency through the open publication of data such as teacher attendance through government portals. These have been combined with reforms such as strengthening the role of PC in management of the school.
- **Reduction of effort:** Staff noted the reduction to paperwork since in the introduction of SIMS and did not consider the SIMS to be a burden.
- **Ecological constraints:** The SIMS imposed no large ecological constraints and had greatly reduced paper-based transactions.

The brief analysis suggests that SIMS is highly sustainable and has been fully adopted by the staff at all levels of government. SIMS has been designed with consideration to ensuring that processes managed electronically are simplified, made more transparent and require less effort. Resource constraints at the school level are managed by readjustment of the organisational structure to ensure an intermediate support between schools and Mandal offices, being the CRP, as well as ensuring staff can engage in important functions via mobile applications.

Given the constraints inherently faced in a lower income environment, such as poor electricity and infrastructure, it is difficult to envision how the systems could be more effectively deployed. As schools gradually develop improved infrastructure, they will be able to take advantage of some of the features that require greater resources such as the VCR initiative.

5.6 (2.06) Effectiveness and impact

SIMS has had a large impact on the effectiveness and operation of the education system in AP state. HM and teaching staff expressed satisfaction at the reduced paperwork and time it took to process tasks such as leave applications, student transfers, requests for textbooks and other functions. They noted that the system had improved fairness and transparency siting examples such as more transparent resource allocation to the schools and transparent promotion and transfer requests processed in a faster time. Some of the main achievements of SIMS are noted in section 3.13. and are summarised below.

Accurate data on individual children in and out of school, combined with annual enrolment drives using applications such as Badiki Podam, have helped reduce recorded OOSC numbers of children from 889,000 in 2016 to approximately 89,000 in 2019 through correction of data and drives to ensure children are enrolled in school. 380,556 OOSC were enrolled in school between 2014/15 and 2020/21.

The robust data on individual children and teachers has enabled targeted provision of resources. The Department of School Education estimates that child Info has saved approximately 38.5 Million USD[205] through targeted provision of textbooks, uniforms and bicycles for girl Children and accurate allocation of Mid-Day Meals. Applications such as Nedu-Nedu, which publishes photographs concerning the condition of facilities in schools, helped encourage efficiency, transparency and awareness[206].

Perhaps the largest impact on efficiency has been the greater level of monitoring and accountability evident at each level of the education system. E-Hazar has been attributed with increasing teacher attendance from 27.5% in August 2017 to 97.2% in February 2018[207]. There is also evidence to suggest that SIMS has improved teacher and HM satisfaction by ensuring fairer, more transparent processes of decision making such as in the case of transfer requests[208].

Individual children are monitored for participation, attendance and learning outcomes through SIMS. Children are targeted for participation in special programmes based on their profile within SIMS. For example, disadvantaged girls are identified in SIMS and targeted for assistance through the *Balika Vidyalaya* (*KGBV*) residential girls' secondary school programme. The Bathikostar programme provides bicycles for girls attending secondary school who are tracked through SIMS.

SIMS has provided far more detailed and robust data for planners and decision makers at all levels of government and has enabled the EMIS to track children in and out of school and monitor their progress within the general education cycle.

It is too early to assess the impact on quality in terms of student learning outcomes but AP state monitors learning outcomes through SIMS and is working to improve monitoring through initiatives such as the Virtual Classroom Initiative (VCR) in which Personalised Adaptive Learning (PAL) is being piloted.

5.7 (2.07) Role for UNICEF

The UNICEF country office has provided technical advice to the National Institute of Educational Planning and Administration (NIEPA) to improve the UDISE portal to enable graphical, longitudinal and numerical display of education indicators[209],[210], [211]. During 2018 and 2019, UNICEF provided support directly to Andhra Pradesh to:

- Promote further methods of equity analysis and encouraging use of SIMS data in monitoring and planning using international best practice.
- Assist with longer term sector planning and longitudinal analysis of data.
- Improve presentation of SIMS data to stakeholders at each level.
- Improve methods of engaging parents and teachers in SIMS data and systems
- Promote information sharing at all levels of government.

[205] Reported by the Department of School Education.

[206] Via the School Transformation Monitoring System (STMS) application and portal

[207] Figures reported by the Department of School Education.

[208] As reported by all staff interviewed at the school level.

[209] UNICEF (2017) *UNICEF Annual Report, Government of India, 2017*. Source: https://www.unicef.org/about/annualreport/files/India_2017_COAR.pdf

[210] http://dashboard.udiseplus.gov.in/

[211] UDISE+ was previously managed under NIEPA as UDISE before being transferred to the Ministry of Human Resource Development (MHRD), Department of School Education.

- Train district and Mandal level MIS Coordinators in analysis and mining of data including the use of SIMS data to monitor Samagra Shiksha and SDG4[212].

Andhra Pradesh state is highly progressive in many areas of EMIS / SMIS development and is in the processs of piloting innovative techniques with a child centred approach to administration, planning, monitoring and evaluation. Therefore, UNICEF support and interventions should be designed with this consideration. Recommendations for UNICEF support and interventions are detailed in section 6.3 (recommendations). These recommendations are based upon UNICEF's broad knowledge and engagement nationally and internationally in the areas of strategic planning, policy and monitoring of education systems.

In summary they include:

- Undertaking a study on the impact of SIMS on pedagogical outcomes such as reductions in OOSC and improvements in learning outcomes.
- Undertaking an analysis to identify bottlenecks and gaps by social group, gender, management of schools and other parameters to determine factors of exclusion which could be applied to planning and monitoring of the education system within AP state.
- Promoting the use of SIMS in strategic planning and the use of SIMS and demonstrating the use of SIMS to highlight disparities in participation in and achievement towards education at the state, district and mandal levels.
- Designing and promoting methods of increasing HM, teacher, parent and community engagement in SIMS based on international best practice.

External to AP State:

- Facilitating the sharing of best practice between AP and other states of India
- Promoting the best practice from AP internationally.

[212] A staff position in the MRC

6 Conclusions, Recommendations and lessons learned

6.1 Conclusions

AP state has undertaken significant transformative initiatives to modernise and improve the education system throughout the state and ensure greater equality and quality throughout. The School Information Management System (SIMS), developed by Andhra Pradesh, plays a vital role in the monitoring and evaluation of all initiatives.

EMIS and SMIS are one system in Andhra Pradesh termed SIMS. AP State SIMS has many characteristics of a stage 3 EMIS, being the most advanced classification of EMIS (refer section 1.4 Changes in global education and the evolution of EMIS)[213]. SIMS is a highly developed transactional and management system which records detailed daily information on staff, students, facilities and resources supplied to schools. SIMS permeates almost every aspect of education administration, planning and monitoring in Andhra Pradesh. The system is highly integrated and rationalized and as a result, each data point is collected once only. Access to relevant elements of the EMIS is granted to schools via a desktop portal and a range of purpose specific mobile applications.

SIMS covers public and private primary, lower secondary and upper secondary schools. It excludes pre-primary schools, and other education programmes including Technical and Vocational Education and Training (TVET), Higher Education and Nonformal education. There are plans to include the TVET sector as part of SIMS.

Both public and private schools are mandated to use SIMS in AP State so the data available is identical for both. Indicators published through Department of School Education websites do not highlight disparities between public and private schools however analytical planning documents such as the Samgra Shiksha plan for 2019-2020 disaggregate some data by public and private schools. However, most indicators are published for either the public sector, for use in public sector planning, or reference the private sector when assessing the requirements of the public sector provision of schooling.

The data which is captured through SIMS is used as a single source database for all purposes. The equity related data on students are rich and include 63 parameters on each child. In addition, process information such as the health, wellbeing and attendance of a child is monitored through SIMS and SIMS stores detailed information on the learning outcomes of each student. This level of data gives significant capacity for comprehensive equity analysis. This has enabled AP State to pilot sophisticated child centred approaches to deliver improved pedagogical outcomes such as the use of sophisticated algorithms for identification of children at risk of dropping out and monitoring of follow-up interventions to reduce the probability of a student dropping out.

SIMS has been developed and operated by the School Education Department Information Technology IT Cell which is located under the Office of Teachers Eligibility Test (OTET). SIMS is maintained and developed under a service agreement with a private company called APTOnline based on a Memorandum of Understanding (MoU) signed in 2014. This has proven cost effective with the annual service agreement being only 140,000 USD including hosting arrangements and a total cost to date of 701,000 USD. This also enables both parties to focus on their areas of

[213] Cappelle, F.V. (2018) *The Road to EMIS: Transitioning from a paper-based system to electronic and web-based information management; Lessons learned from the Europe and Central Asia region*, UNICEF

specialisation and as a result SIMS has been developed using international best practice for deployment of enterprise level solutions[214].

SIMS is accessible to school level however many schools lack adequate facilities to access SIMS directly. To accommodate this the Department of School Education has institutionalised a cascaded structure of operation and support to enable ongoing capacity development to all staff and to ensure that all schools can manage data for SIMS. IT cells have been formed at state, district and Mandal levels. A Cluster Resource Person (CRP) manages approximately 12 schools and assists those schools to manage their data in SIMS. At least one day a month is allocated to mentoring staff at all levels of education to school level. When a new application is introduced staff allocate time required for mentoring and training in the new functions. Thus, the need for large scale training has been eliminated ensuring that SIMS had greatly reduced operational costs when compared to EMIS deployments which encourage large recurrent training exercises in order to ensure sustainability.

SIMS also employs mobile applications to engage teachers and headmasters in schools. This review mapped 16 applications used for varying specific purposes at school level. Examples include: APSTel, an e-Leave System that enables staff to log requests for leave and seek approval and which sends automatic alerts to the CRP and HM responsible; A Textbook distribution application that tracks the receipt of textbooks and enables schools to request textbooks; and Mid-day Meal attendance application which is used for monitoring daily attendance in schools by Mandal Education Office (MEO) and District Education Office (DEO) and to verify the allocation of rice to schools through the Department of Civil Supplies. The Department of School Education ensured schools had a monthly allowance for mobile connectivity and thus mobile applications were easily accessible to staff in schools having poor infrastructure and which lacked capacity to engage the desktop version of SIMS.

The combination of factors above has ensured that SIMS is a cost-effective deployment. The Department of School Education supplied figures which indicated that annual operational costs for SIMS were 1,418,767 USD and the total cost between 2015 and 2019 was 6,402,020 USD.

SIMS has had a large impact on the effectiveness and operation of the education system in AP state. HM and teaching staff expressed satisfaction at the reduced paperwork and time it took to process tasks such as leave applications, student transfers, requests for textbooks and other functions. They noted that the system had improved fairness and transparency citing examples such as more transparent resource allocation to the schools and transparent promotion and transfer requests processed in a faster time.

The robust data on individual children and teachers has enabled targeted provision of resources. The Department of School Education estimates that child Info has saved approximately 38.5 Million USD[215] through targeted provision of textbooks, uniforms and bicycles for girl Children and accurate allocation of Mid-Day Meals. Applications such as Nedu-Nedu, which publishes photographs concerning the condition of facilities in schools, helped encourage efficiency, transparency and awareness[216].

Perhaps the largest impact on efficiency has been the greater level of monitoring and accountability evident at each level of the education system. E-Hazar has been attributed with

[214] Enterprise applications are about the display, manipulation, and storage of large amounts of often complex data and the support or automation of business processes with that data. Source: Martin Fowler, Patterns of Enterprise Application Architecture (2002). Addison Wesley

[215] Reported by the Department of School Education.

[216] Via the School Transformation Monitoring System (STMS) application and portal

contributing to increased teacher attendance from 27.5% in August 2017 to 97.2% in February 2018 as reported by the Department of School Education[217]. There is also evidence to suggest that SIMS has improved teacher and HM satisfaction by ensuring fairer, more transparent processes of decision making such as in the case of transfer requests[218].

SIMS has helped address the issue of Out of School Children (OOSC). Accurate data on individual children in and out of school available through SIMS, combined with annual enrolment drives using applications such as Badiki Podam, have helped reduce recorded OOSC throughout the state. SIMS has also been instrumental in identifying children falsely recorded as OOSC. Together these initiatives have helped reduce the number of OOSC from 889,000 in 2016 to approximately 89,000 in 2019. 380,556 OOSC were enrolled in school between 2014/15 and 2020/21. AP State are also piloting innovative methods of utilising the large amount of data stored on each individual child to address the issue of dropout. The Vidyarthi Nestham programme, which combines dropout prediction with monitored interventions designed to reduce the chance of a child dropping out, reflects the emphasis AP state places on ensuring data systems are an integral part of practical and tangible processes to achieve desired results. Teachers and HM not only receive information on students likely to dropout based on predictive algorithms applied to SIMS data but must also follow a set of processes to minimise the chance of the child dropping out. The teacher must report further information on each child using the Vidyarthi Nestham mobile application and report the status of interventions.

Whilst retention is accurately monitored through SIMS, it should be noted that it is a combination of policies and programmes that have resulted in dropout reductions. Under the Sarva Shiksha Abhiyan Programme some of the interventions include (1) Implementation of activity based and child centric teaching learning process by building the capacities of teachers (2) Supply of children literature to schools (3) Involvement of community in school activities (4) Release of various types of grants to schools (5) Implementation of specific programmes for the education of focused groups like girls, SC/STs, minorities and urban deprived (6) Establishment of KGBVs for the education of girls belonging to disadvantaged groups (7) Supply of free textbooks, uniforms and providing Mid-day meal to the children. Collectively these have been attributed by the Department of School Education to increasing retention of children in elementary school from 74.18% (Gender Parity Index (GPI) 0.99) in 2013/14 to 88.53% (GPI 0.97) in 2017/18[219], [220].

SIMS has provided detailed and robust data for planners and decision makers at all levels of government. The data is used for the creation and monitoring of school development plans and plans and expenditure are monitored by Parent Committees (PC). PC receive SIMS data and reports through the HM and Cluster Resource Person (CRP) but do not have direct access to data. SIMS data is published through a wide range of government portals and all education indicators are accessible for graphical and tabular data. However, almost all information is targeted at education planners and administrators and is not easily accessible or understood by the public. AP state continues to make efforts to ensure the public is better informed such as through the open publishing of grade 10 examination results for schools in news media.

Macro level equity analysis of indicators is possible through UDISE and through RTGS however the information is not presented in easy to digest formats and equity issues are not highlighted visibly. Equity analysis is undertaken extensively though the main analytical publication, the Samgra Shiksha plan for 2019-2020. Equity analysis helps inform policies and programmes designed to target disadvantaged groups such as the Kasturba Gandhi Balika Vidyalaya (KGBV)

[217] Other activities and policies also contributed such as increased renumeration for teachers and improved performance monitoring.

[218] As reported by all staff interviewed at the school level.

[219] Although GPI is slightly lower in 2017/18, it should be noted that retention of both genders has increased significantly since 2013/14.

[220] Andhra Pradesh Department of School Education (2019) *Samgra Shiksha plan 2019-2020,*

residential girls' secondary school programme. Equity analysis usually includes by gender, wealth, disability, special needs, quality of service provision and location (urban and rural). Other forms of equity analysis are less common.

Education Data is available on a diverse range of websites maintained at the national level through the Ministry of Human Resource Development (MoHRD) and at the state level through the Department of School Education and the State government of Andhra Pradesh. There is scope to consolidate these websites and streamline presentation to enable educationalists and the pubic to more easily navigate the websites and locate relevant data. Data is now always up to date, particularly through the MoHRD websites where the latest data is 2016/17 for many published indicators.

Significant factors which contributed towards SIMS implementation included:

- Strong top down leadership both within the Department of School Education and through the Chief Ministers Office of Andhra Pradesh
- A state level vision which guided development of the states' information systems and emphasised rationalised and interoperable department level systems containing detailed information at the individual level.
- Strong public private partnerships towards development and operation of the systems enabling both parties to focus on their core strengths.
- A detailed Department level development and operational plan for SIMS available at the commencement of development.
- Consideration to a cascaded model of support that emphasises continuous on the job mentoring and training in the systems.
- Readjustment of most ministry administrative, monitoring and planning functions to mandate use of the SIMS and SIMS data.
- Continuous communication throughout development with staff at all levels of the education system including teachers and HM in schools.

Having robust and interoperable government systems has resulted in an abundance of information on each individual and therefore raises issues of privacy and the rights of the individual. For instance, there is the need to safeguard fundamental rights such as those of minorities and the privacy of individuals. As more of such data becomes available, the risk of such data being misused also increases, with people being susceptible to being harmed in both material and non-material ways[221]. It is essential that AP State continues building a regulatory framework to safeguard sensitive digital information about individuals.

It is too early to assess the impact on quality in terms of student learning outcomes but AP state monitors learning outcomes through SIMS and is working to improve monitoring through initiatives such as the Virtual Classroom Initiative (VCR) in which Personalised Adaptive Learning (PAL) is being piloted.

The review concludes that SIMS is highly sustainable and has been fully adopted by the staff at all levels of government. SIMS has been designed with consideration to ensuring that processes managed electronically are simplified, made more transparent and require less effort. Resource constraints at the school level are managed by readjustment of the organisational structure to

[221] UN (2014). *Report on data gaps A world that counts: mobilising the data revolution for sustainable development*, The United Nations Secretary-General's Independent Expert Advisory Group on a Data Revolution for Sustainable Development, http://www.undatarevolution.org/wp-content/uploads/2014/11/A-World-That-Counts.pdf, accessed on 20 January 2020

ensure that CRP provide intermediate support between schools and Mandal offices, and ensuring staff can engage SIMS for important functions via mobile applications.

Given the constraints inherently faced in a lower income environment, such as poor electricity and infrastructure, it is difficult to envision how the systems could be more effectively deployed. As schools gradually develop improved infrastructure, they will be able to take advantage of some of the features that require greater resources such as the VCR initiative.

There are areas where SIMS can be improved and further developed and some of these are known to the Department of School Education. These include improved methods of engaging teachers and HM in disadvantaged schools, access to Parent Committees (PC) and enhancing the analysis of SIMS data to highlight disparities in education access, participation and achievement at the Mandal, District and State levels. These are described further under the recommendations below.

6.2 Lessons Learned for Application to Other Environments in South Asia:

SIMS is an example of an EMIS which has been developed with a clear plan towards deployment, integration and interoperability with other state level government systems and engagement with actors at the school level. It has been designed to complement state, district, mandal and school level planning and makes more efficient and effective many operations undertaken throughout the Department of School Education to the school level. As such there are lessons which can be learnt from its development and deployment.

- **The commitment, direction and engagement of the highest levels of management are essential to reforming EMIS**. This is particularly important in South Asia in Collectivism is valued over Individualism[222] and where power distance may be high[223] . A clear vision for the EMIS and its place in the regions governance systems must defined and encapsulated in policy and planning documents and monitored closely by senior management. Top down commitment can be attributed to ensuring innovations such as eHazar, which tracks the daily attendance of all staff through biometric scanners, could be implemented, despite facing initial resistance from unions and staff.
- **The use of public and private partnerships in the development and operation of the EMIS can help enable more professional, rapid and successful deployment of EMIS to school level**. AP State demonstrates that successful public and private partnerships can enable both parties to focus on their strengthens and thereby ensure a professional and rapid development of EMIS / SIMS. It enabled the Department of School Education to avoid the need to develop strong IT skills within the Department which usually involves a long duration and impacts the quality and speed of EMIS / SIMS development[224]. However, there can be downsides to such partnerships and, whilst not evident in AP State, they can include : lack of capacity development within the Department of School Education for management of EMIS; lack of ownership; over dependence on a single supplier.
- **SIMS highlights the importance of development EMIS to accommodate job functions, roles and responsibilities at all levels of government and to adjust job roles and functions as new possibilities emerge through deployment of information systems.** This is particularly important when deploying school level systems in environments where capacity to engage directly with the systems to school level may be limited. AP State have developed

[222] Peng, M. W. 2007. *Globalizing the Asia Pacific Journal of Management*. Asia Pacific Journal of Management, 24(1): 1–7

[223] Power Distance is the extent of inequality in a society: I defined it as the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally. Source: Lee, S.-H., & Oh, K. 2007. *Corruption in Asia: Pervasiveness and arbitrariness*. Asia Pacific Journal of Management, 24(1): 97–114.

[224] Professional Information Technology staff required for enterprise development require an Information Technology degree and 3 to 10 years experience in the development and rollout of enterprise systems.

an effective and cost-effective support mechanism by ensuring IT cells at each level of government and then adjusting the Cluster Resource Persons (CRPs) to help support schools in the use of SIMS which fall under their management. Consideration to the cascaded model has emphasised continuous on the job mentoring and training over costly and possibly ineffective large-scale training exercises. Likewise, it is essential that job functions are adjusted to ensure mandated use of the SIMS and its applications for specific administrative, planning and monitoring functions. This should be supported through policy and legislation. Processes should also be readjusted to make use of SIMS such as in the case of Vidyarthi Nestham which used a mobile application to monitor interventions designed to prevent individual children from dropping out of school.

- **The use of targeted mobile applications can help engage actors at the school level despite having low capacity to engage fully with a SIMS**. This was demonstrated effectively by SIMS which utilises 16 mobile applications to ensure teachers and HM engage with SIMS on a daily basis for specific purposes. The applications were characterised by ease of use and targeted purpose. Schools were provided adequate connectivity monthly via dedicated biometric scanners distributed to schools.
- **SIMS should be developed based on individual pupil and teacher data.** Data systems based on individuals inherently provide more accurate and detailed data than those based on aggregate data. Most of the functions and uses for SIMS at school level in AP state were made possible through the capture of detailed data on individual children. AP state captured 63 fields on each child as well as data on attendance and learning outcomes which was made accessible to other government departments through the Real Time Governance System (RTGS). This level of data enabled child centric targeted interventions to be facilitated through SIMS such as Vidyarthi Nestham which used sophisticated algorithms to identify children most likely to drop out. This level of data also allows accurate allocation of resources through well designed SIMS such as provision of textbooks, bicycles and pro-poor allowances for individual children and their families.
- **The extensive data that SIMS stored on each individual child emphasised the need to have a robust regulatory framework to safeguard sensitive digital information concerning individuals.** The framework needs to specify how information on individuals is to be captured, stored, used and disseminated to groups both within government and externally.

6.3 Recommendations

6.3.1 Recommendations for Andhra Pradesh State for Further Development of SIMS

AP state has a clear direction and path for its SIMS which emphasised use in many school administrative, planning and monitoring functions. It is an advanced system, and as such recommendations to improve it are few, beyond what is already known within AP State.

- **Improved analysis and visual representation of SIMS data on individual children and teachers to identify and target disparities for strategic planning.** With 63 parameters stored on each child as well as attendance and learning outcome data there is a very large capacity to use data to highlight disparities at the mandal, district and state level and readjust programmes to suit. This is undertaken to some extent through programmes such as *Balika Vidyalaya* (*KGBV*) residential girls' secondary school programme which targets disadvantaged girls for assistance but there is scope to improve strategic analysis. Developing Mandal, District and State level capacity to identify disparities in data would help identify targeted programmes which may assist further.

- **Integration of SIMS with other forms of education including non-formal and Technical and Vocational Education and Training (TVET).** This will help form a more wholistic picture of the education system and the progress of each individual child in all forms of education. AP State are driving towards this vision and this recommendation is known and understood.
- **Continued focus on improved access to SIMS for teachers and HM in schools which lack adequate capacity to interact with the system directly.** The enhancement of mobile applications to feedback information on the status of the school and alerts for actions required by the school will help engage HM and teachers further in the system.
- **The extensive data that SIMS stored on each individual child emphasises the need to have robust regulatory frameworks to safeguard sensitive digital information concerning individuals.** The framework needs to specify how information on individuals is to be captured, stored, used and disseminated to groups both within government and externally.
- **Digitisation of school development plans and improvement of the school report card** for easier reference and automated progression towards school development and regional objectives. The current school report card largely reproduces the information submitted by the school in raw format with a small number of indicators calculated. There is scope to improve the school report card to show longitudinal data and to highlight priorities for development or action. The school report card could be better aligned with the school development plan and the plan digitised into SIMS to enable better automated reporting against the plan using SIMS data.
- **Parental and student access would enable parents to track their child's attendance and progress** to help engage parents to a greater extent in their child's education. Mobile phone use is pervasive throughout Andhra Pradesh. Engagement of parents through a mobile application could help address issues of truancy and underperformance and improve engagement of parents in their child's education.
- **Improved methods of communicating school and regional progress and development with the broader community.** Public access to SIMS was only available through government portals (refer to section 3.10.2). Data displayed through the portals is extensive but not easily consumed by the general public. There is scope to improve access to SIMS data for the public. Some countries publish school report cards which can be easily understood by the public and can be used to encourage public contribution or participation in local school development[225].
- **In such a data driven approach to monitoring, planning and resource allocation, robust methods of data verification are essential.** AP State has robust methods surrounding child and teacher data but there is capacity to increase verification processes for school facilities and resources such as pedagogical materials. In environments where positive data leads to rewards and without strong verification processes there is also a risk that school HM and teachers may manipulate data to promote a positive impression.

6.3.2 Recommendations for the UNICEF Country and International Offices

The following recommendations pertain to UNICEF country and international offices and are based on UNICEF's strengths in supporting Governments in the design, development and adoption and use of EMIS / SIMS:

- **Assist Andhra Pradesh and the Government of India to better promote and share SIMS with other states of India**. Documenting the different aspects of SIMS and determining what may be shared for public access would potentially assist other states of India, who may lack

[225] The Illinios State School Report card provides a good example of a report card based on EMIS data suitable for public consumption. Source: https://ilhonorroll.niu.edu/, accessed on 29 January 2020

resources, to better develop their EMIS. The Government of India may be able to adopt elements of SIMS as national standards which would also help guide other states to better develop their state EMIS and create evaluation standards for determining which states in India require assistance towards development of EMIS. This would also be advantageous to other states in India and to other countries to better understand the cost benefits to achieving SIMS similar to Andhra Pradesh.

- **Promoting the experience of Andhra Pradesh SIMS at national and international forums.** Andhra Pradesh presents the case of a SIMS devolved to school level in a lower middle-income environment. The approach to development and deployment can offer examples of best practice from which other countries of similar economic and social development may benefit. UNICEF can play a lead role in disseminating and promoting the findings from this Review. which can assist other countries to mobilize resources and support to more comprehensively develop EMIS which directly reach schools, and which have a child centred approach. UNICEF can do this through regional forums and through country office programmes.
- **Assisting Andhra Pradesh to undertake analysis of SIMS data and promote its use in strategic planning.** UNICEF can assist the Department of School Education to identify bottlenecks and gaps by social group, gender, management of schools and other parameters to determine factors of exclusion which could be applied to planning and monitoring of the education system within AP state. UNICEF can also continue to promote the use of SIMS in strategic planning and train education officers at the Mandal, District and State levels to more effectively use SIMS data to highlight disparities in the delivery and access to education services. UNICEF can also help build the capacity of AP state to use data in longitudinal analysis to help inform longer term sector analysis and planning (3-5 years).
- **Assist the MoHRD and AP State to improve the communication of data with the public and other stakeholders.** UNICEF can work with the government of India at the national and state level to continue to improve the presentation and timeliness of data and its accessibility and understandability.
- **Assist AP State to improve the monitoring and planning of Child Friendly schools using SIMS.** UNICEF has developed a framework for rights-based, child-friendly educational systems and schools that are characterized as "inclusive, healthy and protective for all children, effective with children, and involved with families and communities - and children" which can be applied to the monitoring of schools and in improving school development planning.

6.3.3 Recommendations concerning further work which may result from this Review

1. **Study the transition from aggregate EMIS to EMIS which track individual children and which function effectively to school level as SIMS**. It would be beneficial to further study the transition from simple EMIS to more decentralised EMIS which are integrated into a wide range of government processes and functions and accessible by a greater number of stakeholders. In Andhra Pradesh this process was documented to some extent and broad transitional factors were identified as part of this review. A detailed study into the transition process could help confirm the factors which contributed to a successful transition and identify further factors that could ensure success. Such a study should focus on the different aspects of transition, such as capacity and development requirements for schools and subnational offices and the impact of leadership, policy and legislation on transition. The study should also help identify key drivers for transition, such as government commitment, opportunities to leverage technology, resources and resource mobilization. It should also help identify the

challenges and barriers and identify strategies for overcoming those that are typically encountered[226].

2. **Study the specific design features, processes and functions supported through SIMS which are most useful in impacting pedagogical outcomes and school development.** SIMS has the possibility to facilitate positive interventions for the individual student. However, identifying the design features, processes and functions that are more likely to provide the greatest impact would help other countries deploy SIMS in a low to middle income environment. In particular Andhra Pradesh demonstrates the effective use of mobile technology and mobile applications in deploying SIMS to actors at the school level. A study into this topic could help countries to better deploy SIMS to positively engage actors at the school level. The study should also include a review of the capacity of teachers and head teachers to utilize individual data and other aspects of SIMS to provide a more holistic picture of the wellbeing of each individual (child) and to help improve service delivery support between sectors.

6.3.4 Recommendations relating to the Review methodology

The recommendations set out below relate specifically to the methodology of this review and are applicable to UNICEF or other international and national development partners[227] interested in supporting EMIS development in general or with a specific focus on enabling national systems for Student Tracking.

1. **Ensure adequate time and resources for a full review:** EMIS are becoming increasingly complex and now include consideration for School based systems, Student Tracking, Human Resource Development, Financial Management and greater interoperability with other government systems. EMIS is increasingly encompassing all subsectors of education which themselves are becoming more complex with flexible modes of delivery and an increased emphasis on monitoring the progress and learning outcomes of students. EMIS are increasingly facilitating and driving a greater proportion of education administrative, management, planning and monitoring functions. A comprehensive review can help form a wholistic picture of how such EMIS have been developed and function to serve all areas of the education system, but such systems also require substantial resources to review and evaluate effectively.
2. **The approach to this review complemented methodologies such as SABER and DQAF and enabled focus on the perspectives of actors at the school level.** The review questions developed for this review helped focus it on uses of EMIS data at school and local levels and helped identify factors in the EMIS leading to improve school access, equity and quality. Further developing this methodology may prove a useful complement to enhance existing methodologies such as DQAF and SABER.

[226] This recommendation also aligns with that made by: UNICEF (2019) *Review of EMIS that Track Individual Student Data Consolidated Report*, 15 October 2019, Shoobridge J.A.

[227] International development partners include agencies (such as UNICEF, the UNESCO Institute for Statistics (UIS), UNESCO, Department of Foreign Affairs and Trade (Australian Government) (DFAT), and the World Bank) supporting EMIS development at the global level. National development partners may include NGOs, commercial partners and others active at the national level supporting EMIS development within countries.

Appendices

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B. Meetings Conducted

Table 6.1: Meetings conducted

Meeting	Venue
11th November 2019, Monday	Venue
Meeting with the Commissioner, Department of School Education, Government of Andhra Pradesh. Meeting with EMIS and Planning team, Department of School Education.	O/o CSE O/o CSE
Meeting with EMIS and Planning team, Department of School Education (Continue….) Meeting with the Finance Section of Department of School Education	O/o CSE O/o CSE
12 November 2019, Tuesday	
Meeting with senior officials of the Department of School Education looking after various programmes /schemes Meeting with SCERT officials	O/o CSE O/o CSE
Meeting with senior officials of Samagra Shiksha Abhiyan looking after various programme components Meeting with Planning team of Samagra Shiksha	SSA SSA
13 November 2019, Wednesday	
Meeting with senior officials of Textbook board, A.P. open school society, Department of Higher Education, Technical Education, Board of Intermediate examination	SSA
Meeting with senior officials of the Department of Tribal affairs, Social welfare, Health, Women and Child Development and Finance	SSA
14 November 2019, Thursday	
Meeting with District Education Officer (DEO) and District Project Officer (DPO)	O/o the DEO
Meeting with District Education Team	O/o the DEO
Meeting with selected Mandal Education Officer (MEO) (5-6)	O/o the DEO
Meeting with district level EMIS and Planning team	O/o the DEO
15 November2019, Friday	
Visit to schools and meeting with Headmasters	Proposed Schools
Meeting with selected School Complex in-charges (5-6)	Selected MRC/ or any place
Meeting with District Collector	O/o the DC
Debriefing meeting with DEO, DPO and EMIS team Return to Vijayawada	O/o the DEO
Departure for Vijayawada	
17 November2019, Sunday	
Departure to Prakasam	
18November2019, Monday	
Visit to schools and meeting with Headmasters	Proposed Schools

Meeting	Venue
Meeting with the selected School Complex in-charges and MEOs	Selected MRC/ or any place
Meeting with the DEO and DPO	O/o the DEO
Meeting with the District Education Team	O/o the DEO
19 November2019, Tuesday	
Meeting with the district EMIS and Planning team	O/o the DEO
Meeting with the District Collector	O/o the DC
Departure for Vijayawada	
20November 2019, Wednesday	
In-depth discussion with state level EMIS and planning team, Department of School Education, Samagra Shiksha Meeting with the Principal Secretary, Department of School Education	O/o the CSE
21November 2019, Thursday	
Debriefing meeting the Commissioner, Department of School Education and other Senior Govt. Officials from Education department and Samagra Shiksha	O/o the CSE/SSA
Departure for New Delhi	

C. Review Dimensions and Questions

Table 6.2: Technical Review Questions

Review dimension	Review questions
1. Relevance and comprehensiveness of indicators for monitoring access, equity and quality	Descriptive questions: • Which indicators are routinely generated and monitored, and do they enable monitoring of the status and progress in terms of access, progression (e.g., survival and transition rates) and learning? If not: what are the gaps? • Are the indictors generated by the system disaggregated by gender, location, ethnicity or other aspects which would allow for an analysis focusing on equity? • If learning outcomes are not integrated within the system, what other measures of education quality are available within the system? • Are those indicators automatically calculated within the system and if so at what level (school, lower level admin or national)? • Are the values of the indicators publicly accessible through a web-platform, and at what level (school level, lower level admin or national)? What are the data access restrictions?
	Normative questions: • Are the data collected and the automated indicator calculations within the system sufficient to provide the information necessary to track progress on agreed targets at the different levels? (At national/provincial level, or district level: looking at the results framework of existing education sector plans or equivalent, does the system enable monitoring of all results? At school level: is the information provided by the system sufficient to facilitate school management practices and to monitor progress on agreed improvement plans?)
2. Data quality management and mechanisms	Descriptive questions: • Who collects the information (e.g. school admin, teachers), and how is it entered? (e.g. paper-based, mobile, web-based, PC)? • Which measures are in place to *prevent* data errors, e.g. data validation during data entry, partially pre-filled data collection instruments, help desk, documentation. • Which measures are in place to *resolve* data errors, for example, cross-checks of the same data from different

Review dimension	Review questions
	sources, detecting/fixing out of range or unusual data values, and how and at which level is this being done?
	Normative questions: • Is the system in use error free? If not: is the level of error remaining in the system acceptable and what are the risks/consequences of those errors, on planning, decision making, resource allocation etc? •
3. Measures for safeguarding personal and confidential information	Descriptive questions: • Does the system define different levels of access and editing rights according to user type/role? Which ones? • Which security and data protection measures are in place to ensure that confidential information (e.g., individual student records, financial information), are only accessible to those with the rights to access them?
	• Normative questions: • In the present condition, how safe/vulnerable is the system, and what would be recommended additional security measures to be adopted, in order to protect individual student data, or school financial information?
4. Types of information and levels of disaggregation	Descriptive questions: • For the key indicators, which levels of disaggregation are available, e.g., by gender, age, ethnicity, religion, residence location, socio-economic status, parents' profession and status (e.g., both parents, single parent, guardian), etc.? Which of these are routinely generated? • Which information is collected regarding teachers and non-teaching staff characteristics? • Which other information is collected, e.g. school-level information (school infrastructure, school improvement plans, school materials, financial information, etc.) • For which indicators are trends over time available / generated?
	• Normative questions: • Is the level of disaggregation of the different indicators available from the system sufficient to perform the necessary targeting of children according to existing plans (i.e target specific interventions or resources for a disadvantaged group,

Review dimension	Review questions
	like poor rural girls, or children with disabilities, or children from a disadvantaged ethnic group)? • Is the level of information collected about teachers sufficient to be able to comprehensively review teacher management practices and detect potential issues, such as ghost teachers, teacher absenteeism or performance, gender imbalance in teacher placement, disparities in teacher qualification between regions etc?
5. Efficiency of data collection and administration	<u>Descriptive questions</u>: • In which areas has the system *increased* and in which areas has it *reduced* the time spent on management and administration tasks by staff at different levels (e.g., school, education department, Ministry of Education)? For teachers, did it increase or reduce teachers' contact time with students? • In areas where it has increased the time required – both for existing tasks and for new tasks – do users feel this is justified in terms of the purpose and impact of these tasks? Why or why not?
	• Normative questions: • According to users, how could the system be improved to increase efficiency?
6. Two-way vertical information flows from school to regional/national and in between	<u>Descriptive questions</u>: • Which processed information (e.g. indicators, trends, analysis) is communicated or otherwise accessible at local and school levels? • At what level (e.g. school, subnational) and in which format (e.g. dashboard, school profile / report card) is the information communicated?
	• Normative questions: • How relevant is the information to the needs of users? What are the information gaps? (including based on user perspectives on information they would like to have) • Has the adoption of the system led to an increased or reduced ownership of information at school and sub-national level for planning and decision making?
7. Integration with other relevant databases, within and cross-sectoral, including financial, demographics,	<u>Descriptive questions</u>: • Which separate systems/databases have been completely integrated into one system (i.e. an EMIS), or are planned to be integrated?

Review dimension	Review questions
learning assessment	• Are there any links/integrations between *separate* systems, e.g. between the EMIS and civil registry; which ones and how has this been achieved (e.g., through an API, or manually) and for which purpose? • Does school level information (i.e., through a school level information management system or SMIS), feed into the EMIS, and to which extent? Is this for all schools or only certain types of schools (e.g. public schools, pilot schools, schools with required ICT infrastructure)?
	• Normative questions: • Which other existing data systems should be linked with the system being evaluated, in order to enable monitoring of progress on all aspects of the education sector plan (or blueprint of national education priorities)?
8. Integration of an early warning system or mechanisms to prevent dropout	<u>Descriptive questions</u>: • At the school level, is there a system for digitally registering/monitoring absenteeism? Does it distinguish between excused and unexcused absenteeism? • If yes, how is it being used – is it used to detect and prevent dropout? Does it include other indicators besides absenteeism to monitor risk of dropout? Does the system allow recording of teacher's absenteeism? • Is there a case management or referral system, e.g. automated requests for action sent to the principal, or education department, or other, according to specific referral rules like days of absenteeism?
	• Normative questions: • In the case there is no early warning system imbedded within the system, given the current technical architecture of the system, how complex and costly would it be to develop one? • In the case there is one, has it led to a follow-up of the at-risk children through concrete actions like contacting parents, or counselling for example?
9. Level of automation	• Normative questions: • To which extent are processes automated, e.g. for generating specific indicators, summaries/tables, reports, dashboards, visualizations, GIS mapping, etc.

Table 6.3: Use and impact (institutional and socio-cultural dimensions) Review Questions

	Review questions
1. Level of school and local level implementation, ownership, and use	Descriptive questions: • At which levels and by which types of staff is the system being used, i.e. school admin staff, principals, teachers, and education officers/staff at various sub-national administrative levels? • Is the system being accessed by parents, by PC member? How? • If the system is mobile-compatible, which components can be used via mobile?
	• Normative questions: • How and to which extent is it being used at the different levels? If it is not used, or used in limited ways, why? • To which extent does lack of access to Internet/computers/mobile phones (e.g., for school staff, district education staff, parents) limit access and usage?
2. Easy to use	• Descriptive questions: • Based on feedback from users familiar with work processes prior to introduction of the new system, how difficult was it to adapt to the new system? Which areas / processes are, or were, the most difficult? • How much and which types of training was provided if any, for which staff, and was it sufficient?
	• Normative questions: • According to users, how could the system be improved in terms of ease of use? • According to users, which kinds of training/capacity development would be preferred (e.g., face to face workshops, documentation/user guides, webinar/tutorial videos, helpdesk).
3. Usefulness	• Descriptive questions: • Does the system communicate information through schools (or otherwise) to the community/parents? How useful is this information? How is it communicated?
	• Normative questions: • Does the system meet all identified needs in terms of management and monitoring at school (i.e does the system provide all the necessary information needed for school level management) and different administrative levels? Why or why not?

	Review questions
	• Is the information or data presented in an easy to understand format for decision makers at the school and sub-national level, and which features would improve the utility of the system and encourage greater use?
4. Transparency	• Which indicators/information are made available to the public? To schools? To parents?
5. Sustainability	• Descriptive questions: • What are the recurring costs for maintenance and use? What percentage of the education budget does that represent? • Which capacity is required from staff to maintain and further develop the system?
	• Normative questions: • How could sustainability be improved, e.g. in terms of automating routine processes rather than depending on staff to have the time and capacity to do this? • How much of a burden does the adoption of the system represent at school level, because of IT investments and HR needs (teachers/admin staff need enough IT skills to use the system)?
6. Effectiveness and impact	• Normative questions: • How effective is the system in terms of improving and facilitating monitoring and management processes? (compared to how it was before) • How is it being used and what was its impact in improving access, equity, quality? (e.g. through the approaches outlined in the BACKGROUND section - purported concrete achievements of monitoring and management systems). → For access: can we link system-use to reduction of the numbers of OOSC, drop-outs, or progress in terms of intake, transition, survival rates? → For equity: can we see an impact of system adoption on a reduction of the gap between the most disadvantaged student population groups and the rest of the population, in terms of access, participation, learning? Is there better targeting of specific interventions for disadvantaged populations, potential cost-savings etc, since the system is in use? → For quality: can we see an impact in terms of learning outcomes of students? Can we see an impact in terms of infrastructure development for schools (perhaps better targeting of the

	Review questions
	education development budget)? Can we see an impact in terms of teacher absenteeism?
7. UNICEF's role	• Descriptive questions: • What role did UNICEF's Country Office or Field Office team play in the design, development, adoption and use of the system being evaluated? • How does UNICEF's team plan to get involved in strengthening of improving those systems in the future
	• Normative questions: • What is UNICEF's comparative advantage in the field of management and monitoring systems for decision making as school and sub-national levels, and which aspect of those systems 'development and usage is UNICEF best positioned to support governments with?

D. Main Statistics for the state of Andhra Pradesh

Table 6.4: Main Statistics for the state of Andhra Pradesh[228]

1	Area in Sq. Kms	1,60,240
2	No. of Districts	13
3	No. of Revenue Divisions	49
4	Municipal Corporations	13
5	Metro Cities	0
6	Municipalities	101
7	No. of Mandals	680
8	No. of Revenue Villages	21264
9	No. of Gram Panchayats	13184
10	No. of Habitations	50008
11	Population	4,93,86,799
A	Male	2,47,38,068
B	Female	2,46,48,731
12	Population Density	308 per Sq.Km
13	Population Growth Rate - 2001 – 2011	9.21
A	Rural	70.42
B	Urban	29.58
C	SC	17.10
D	ST	5.33
14	Sex Ratio (Females per 1000 males)	996
15	Literacy Rate – 2011	67.41
A	Male	74.83
B	Female	60.01
16	Literacy Rate – SC	64.47
A	Male	71.66
B	Female	57.38

[228] Adapted from: Samagra Shiksha Plan 2019-2020, State Government of Andhra Pradesh, 2019

17	Literacy Rate – ST	48.83
A	Male	56.91
B	Female	40.89
18	Assembly Constituencies	175
29	Lok Sabha	25

E. Attributes captured on each Individual Child

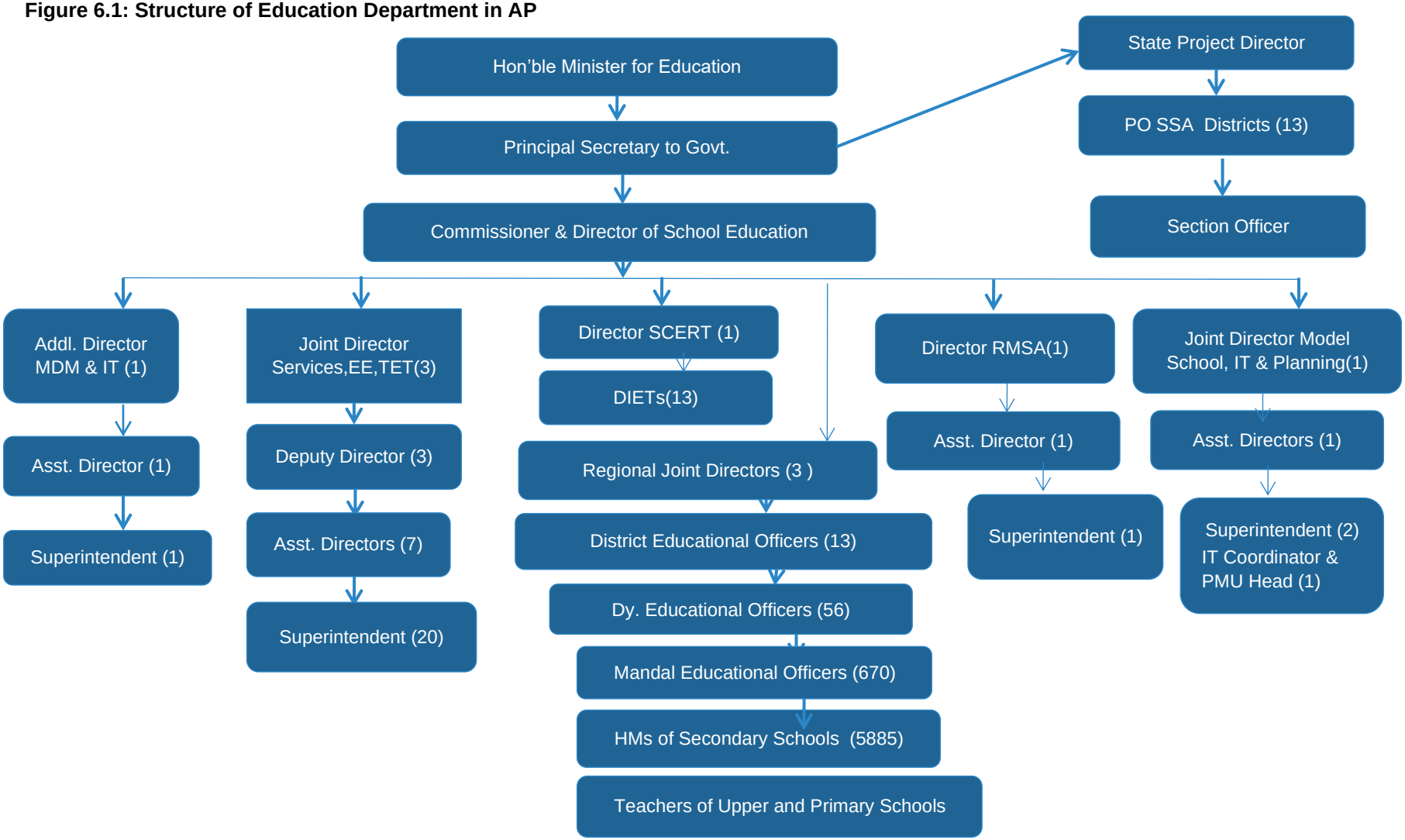
- Child ID*
- Class*
- Medium*
- Aadhar Number (Aadhar/EID)*
- District Name*
- Mandal Name*
- Revenue Village Name*
- Habitation Name*
- Sur Name* (Should be in Capital Letters)
- Name* (Should be in Capital Letters)
- Gender* (Boy/Girl/Other)
- Father Name* (Should be in Capital Letters)
- Mother Name* (Should be in Capital Letters)
- Date of Birth* (DD/MM/YYYY)
- Mobile Number (of Student/Parent/ Guardian)
- Social Category* (SC/ST/BC/OC)
- Sub Social Category
- Religion*
- Mother Tongue*
- Type of Disability (if any) *
- Facilities received by CWSN (Mandatory for CWSN Children)
- Email Address (of Student/Parent / Guardian)
- Child Belongs to (Rural/Urban/ Tribal) Area*
- Is staying in Hostel? (Yes/No)*
- Whether belong to Disadvantaged Group (Yes/No)*
- Height (In Cmts)
- Weight (In KGs)

- Parent Literacy Status (Literate/Illiterate)
- Socio Economic Status of the Child*
- Is Child having Insurance? (Yes/No)
- Distance from Home to School* Mode of Transport*
- Child Blood Group
- No of Uniform sets
- Complete Set of free Text Books (Yes/No/NA)
- Free Transport (Yes/No/NA)
- Free Escort Facility (Yes/No/NA)
- MDM Benificiary (Yes/No/NA)
- Child Attended Special Trainngs*
- Iron & Folic acid (Yes/No)
- Deworming tablets (Yes/No)
- Vitamin-A tablets (Yes/No)
- Date of Admission (DD/MM/YYYY)*
- Admission Number*
- First Language
- Second Language
- Studying in Section*
- Class studied Previous Year*
- Class in which Admitted*
- Status of Previous Year (If Studying in Class 1)
- No. of Days Child Attended School (In the Previous Academic Year)*
- Appeared in Last Annual Examination (Yes/No)*
- Passed in Last Annual Examination (Yes/No)*
- % of Marks Obtained*
- Students Bank Account Number
- Bank Name
- Branch Name
- IFSC Code

- Caste Certificate Number
- Income Certificate Number
- Ration Card Number Photo (For Class 10th)
- Moles (For Class 10th)

F. Structure of the Education Department in Andhra Pradesh

Figure 6.1: Structure of Education Department in AP



G. Sample School Report Card

Figure 6.2: UDISE Sample school report card

		SCHOOL REPORT CARD:	2016-17 *
State	Andhra Pradesh	District Name	PRAKASAM
Village Name	ETHAMUKKALA	Cluster Name	28184700007 - ZPHS, ETHAMUKKALA
Block Name	KOTHAPATNAM	School Code & Name	28184700612 , ZPHS,ETHAMUKKALA (VILL)
PINCODE	523280	Name of Head Maste	

Management	Local Body	School Category	Upper Primary & Secondary	Type of School	Co-Educational						
Location	Rural	Lowest Class	6	Highest Class	10	Instructional Days & Working Hours	Pri.	U.Pri.	Sec.	H.sec.	
Year of Establishment	1966	Approachable by all weather road	Yes	Shift School	No	Instructional Days	0	225	225	0	
Special Sch for CWSN	No	Visits by Resource Tch. for CWSN	0	Residential School	No	Sch. Hours for Children	na	7.00	6.00	na	
Academic Inspections	3	Visits by CRC Coordinator	2	Visits by Block Level Officer	2	Tch. Working Hours	na	6.00	6.00	na	
Pre-Primary Section	No	Total Students (Pre-Primary)	0	Total Teachers (Pre-Primary	0	Affiliation Board for Sec.			State Board		
Streams available						Affiliation Board for H.Sec.			NA		

	Year of Recog.	Year of Upgrade	Medium of Instruction: Medium 1	Medium 2	Medium 3	Funds:SSA(₹)	Recd.	Expd.	Grants:RMSA(₹)	Recd.	Expd.	Spillover
Elementary	1966	1966	Telugu	English	NA	TLM Grant	0	0	Civil Works	0	0	0
Secondary	1966	1966				School Devp. Grant	7000	7000	Annual Grant(Rec.	0	0	0
Hr.Secondary	0	NA				School Maintanence Gran	10000	10000	Others	0	0	0

School Building, Equipment & Facilities

Drinking water facility	Hand pumps	Drinking water functional	Yes	Boundary wall	Partial	Integrated Sci. Lab. (Sec.)				na
Medical check-up of Students	Yes	Ramp for disabled needed	No	Ramp available	na	Hand rails for ramp				na
# of classrooms for Teaching	16	Number of other Rooms	0	Library	Yes	# of books in school Librar				2000
Status of School Building	Government	Separate room for HM	Yes	# of Classrooms	Elem.	Sec.	Hr.Sec.	Toilet Seats	Boys	Girls
Playground	Yes	Land available for playgroun	na	Good Condition	5	2	0	Total	3	8
# of computers available	17	# of computers functional	15	Req. Major Repair	3	2	0	Functional	3	8
Electricity	Yes	Computer Aided Learning lab	No	Req. Minor Repair	2	2	0	Hand Wash	No	No
Measured Campus Plan	Yes	Internet	na	Land for additional Classroom			Yes	CWSN friendly Toile		No
Labs & Condition :	Not Application									

Staff Category

# of Teachers	Pri.	U.Pri.	Sec.	H.Sec.	General	SC	ST	OBC	ORC	Others		
Regular	0	11	10	0	11	3	0	7	0	0	Part Time Instructor as per RTE	0
Contrac	0	0	0	0	Teacher(s) male		13	Teacher(s) female		8	Teachers involved in Non-Tch assignments	0
Non-Teaching staff			0		Teachers aged above 55		5	Graduate & above		20	Avg. working days spent on Non-Tch assignments	0
											Teachers with Professional Qualification	21

Enrolment

Grade	Prev Year	Total			SC		ST		OBC		Muslim		Repeaters	CWSN
	All	All	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls		
I	0	0	0	0	0	0	0	0	0	0	0	0	0	0
II	0	0	0	0	0	0	0	0	0	0	0	0	0	0
III	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IV	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VI	135	147	77	70	17	17	7	6	43	35	4	4	0	2
VII	144	123	59	64	16	11	5	8	33	39	3	8	0	0
VIII	146	152	76	76	16	15	2	6	48	40	5	2	0	1
IX	150	137	71	66	20	19	5	10	32	23	9	1	0	3
X	148	144	50	94	16	23	2	3	25	49	4	7	0	3
XI	0	0	0	0	0	0	0	0	0	0	0	0	0	0
XII	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	723	703	333	370	85	85	21	33	181	186	25	22	0	9

Enrolment by Stream

Streams	Enrolment Class XI Boys	Enrolment Class XI Girls	Enrolment Class XII Boys	Enrolment Class XII Girls	Repeaters Class XI Boys	Repeaters Class XI Girls	Repeaters Class XII Boys	Repeaters Class XII Girls
Arts								
Sci.								
Comm.								
Voc.								
Oth.								

Caste	Examination Results Class X Appeared Boys	Appeared Girls	% Passed Boys	% Passed Girls	Class XII Appeared Boys	Appeared Girls	% Passed Boys	% Passed Girls
Gen.								
SC								
ST								
OBC								
Total								

Incentives (Prev. Year)

	Caste	Text Book Boys	Text Book Girls	Uniform Boys	Uniform Girls
Primary	Gen.	0	0	0	0
	SC	0	0	0	0
	ST	0	0	0	0
	OBC	0	0	0	0
	Muslim	0	0	0	0
Upper Primary	Gen.	22	30	14	14
	SC	47	43	40	30
	ST	14	19	10	14
	OBC	123	114	83	87
	Muslim	12	14	7	16

Hostel Facility

	Available	# Students
Boys	Yes	42.00
Girls	No	0.00

SMDC	SMC & SMDC same	Yes	Total	Male	0	Female	0	Prepared Sch. Improve.	Yes	Meetings Held	2	Separate Bank A/C	NA

Key Indicators

Pupil-Teacher Ratio	33	% SC Students	24.18	% OBC Enrolmen	52.20	% CWSN	1.28	Flow Rates	I-V	VI-VIII	IX-X		
Student-Classroom Ratio	44	% SC Girls to SC Enr	50.00	% OBC Girls to SC Enr	50.68	% Repeaters to Total Enr.	0.00	Promotion Rate		96.94	48.32		
% Girls Enrolment	52.63	% ST Students	7.68	% Muslim Students	6.69	% Tch. with Prof. Quali.	100.00	Repetition Rate		0.00	0.00		
Ratio of Girls to Boys Enr.	1.11	% ST Girls to ST Enr.	61.11	% Muslim Girls to Muslim	46.81	Transition Rate:	P to UP		UP to Sec.	93.84	Sec. to H.Sec.		

na: not applicable, NA: Not Available, CWSN:Children with Special Needs, SMDC:School Management and Development Committee

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H. Dropout Prediction Approach and Weightings

Table 6.5: Dropout Prediction Approach and Weightings

Feature	% Influence	Feature Description
FA_Language_Marks_Bin	21.89%	Marks are split into 4 Bins - 0-35%; 35-50%;50-75%, >75%
FA_English_Marks_Bin	16.79%	Marks are split into 4 Bins - 0-35%; 35-50%;50-75%, >75%
FA_Mathematics_Marks_Bin	10.51%	Marks are split into 4 Bins - 0-35%; 35-50%;50-75%, >75%
FA_Science_Marks_Bin	7.96%	Marks are split into 4 Bins - 0-35%; 35-50%;50-75%, >75%
Electricity	7.14%	Electricity available or not available/ not functioning
Good_Secondary_Classroom_Infra	5.08%	Classroom Infrastructure is split into Sufficient Infrastructure and Insufficient Infrastructure based on the number of students in elementary and secondary sections respectively The standard considered as per the inputs from education department is Atleast 1 Classroom for every 40 Students
Girls_Toilet_Infra	4.12%	Toilets and Urinals Infrastructure is split into Sufficient Infrastructure and Insufficient Infrastructure based on the number of students respectively The standard considered as per the inputs from education department is Atleast 1 Toilet for every 40 Students
SCHCAT	3.92%	
Child_age	3.89%	

Feature	% Influence	Feature Description
Girls_Urinals_Infra	3.36%	Toilets and Urinals Infrastructure is split into Sufficient Infrastructure and Insufficient Infrastructure based on the number of students respectively The standard considered as per the inputs from education department is Atleast 1 Toilet for every 40 Students
Total_Secondary_Classroom_Infra	3.00%	Classroom Infrastructure is split into Sufficient Infrastructure and Insufficient Infrastructure based on the number of students in elementary and secondary sections respectively The standard considered as per the inputs from education department is Atleast 1 Classroom for every 40 Students
Medium	2.89%	
Boys_Urinals_Infra	1.77%	Toilets and Urinals Infrastructure is split into Sufficient Infrastructure and Insufficient Infrastructure based on the number of students respectively The standard considered as per the inputs from education department is Atleast 1 Toilet for every 40 Students
Total_Elementary_Classroom_Infra	1.77%	Classroom Infrastructure is split into Sufficient Infrastructure and Insufficient Infrastructure based on the number of students in elementary and secondary sections respectively The standard considered as per the inputs from education department is Atleast 1 Classroom for every 40 Students
Water_Functioning	1.75%	
Caste	1.12%	
Boys_Toilet_Infra	0.97%	Toilets and Urinals Infrastructure is split into Sufficient Infrastructure and Insufficient Infrastructure based on the number of students respectively The standard considered as per the inputs

Feature	% Influence	Feature Description
		from education department is Atleast 1 Toilet for every 40 Students
Good_Elementary_Classroom_Infra	0.91%	Classroom Infrastructure is split into Sufficient Infrastructure and Insufficient Infrastructure based on the number of students in elementary and secondary sections respectively The standard considered as per the inputs from education department is Atleast 1 Classroom for every 40 Students
Furn_Teachers	0.65%	
Furn_Students	0.50%	
DistrictName	Not Significant	
Gender	Not Significant	
Religion	Not Significant	
MotherTongue	Not Significant	
Disability	Not Significant	
CWSNFacilities	Not Significant	
ChildAreaType	Not Significant	
Hostel	Not Significant	
DisadvantagedGroup	Not Significant	

Feature	% Influence	Feature Description
ParentLiteracy	Not Significant	
SocialStatus	Not Significant	
Commute_Safety	Not Significant	
MiddayMeal	Not Significant	
Health_Suppliments_Provision_Status	Not Significant	
DurationYears_Spent_in_School	Not Significant	
FA_Social_Marks_Bin	Not Significant	
SCHMGT	Not Significant	
Boys_Percentage_TotalStudents	Not Significant	
Girls_Percentage_TotalStudents	Not Significant	
LocationAreaCategory	Not Significant	
BuildingType	Not Significant	
Future_Elementary_Classroom_Infra	Not Significant	
Future_Secondary_Classroom_Infra	Not Significant	
HMRoom_Availability	Not Significant	

Feature	% Influence	Feature Description
Toilets_Avbl_Disabled	Not Significant	
Water_FacilityType	Not Significant	
Ramps_Availability	Not Significant	
HandRail_Availability	Not Significant	
Boundary_Wall	Not Significant	
PlayGround	Not Significant	
Library	Not Significant	
Land_for_Expansion	Not Significant	

I. School Record keeping Mapped to SIMS

The table below contains a list of record books maintained by the school and their relationship to SIMS.

Table 6.6: School record keeping mapped to SIMS

School record keeping (hardcopy)	UDISE/SMIS
Census register	The census register contains the information concerning how many children are likely to join the school and the list of specific children. This is sent to the Mandal for entry into SIMS.
Student UID (Aadar) register	The details which are entered in the census register, the data for the forthcoming children for entry into class 1. CRP will enter into the system at the Mondl at resource centre into child info
Teacher attendance register	Captured through Biometric device Functional in all schools in the clusters
Staff Order Register (staff leave, issues, additional responsibilities, duties)	Teachers will apply leave through the eHazar App through their mobil devices. The Mondl Nodal person looks after eHazar for the entire Mondl. He monitors the app and in case of teachers who apply the leave he informs to the CRP. The CRP does not receive the notification directly. Only Mondl Nodal person and MEO. The CRP will enter into the App only with HM. They teacher must make a written casual leave application for leave. The HM will receive the information through the eHazar. They can see the daily through mobile or biometric device (eHazar). Teachers phone contains AppTell only for the purpose of applying leave. eHazar contains teacher attendance, teacher details, student attendance, student details. For emergency leave the staff member must call the HM and apply leave through the app in their own android phone.
Pupils attendance register	On a daily basis this is only stored in the MDM application as roll, present, number, meal taken. At district and mondle level these are compared against enrolment
Consolidated attendance register (month wise)	Monthly average attendance is entered into the assessment App – this is only accessible at Mondle resource centre so the HM goes with books to Mondle level and CRP enters the data into the computer (desktop)

School record keeping (hardcopy)	UDISE/SMIS
	No notification comes back after entering into the system from District or Modal office discusses at the monthly mondal meeting with the HM
Grading (Continuous Competency Evaluation (CCE)) register	HM travels to the mondle with the books as done by Average Attendance. HM or CRP enters this data depending on competency. All information in the CCE register is stored in the app. No notification comes back after entering into the system from District or Modal office discusses at the monthly mondal meeting with the HM.
MDM register (classwise totals on roll, attendance, MDM)	This data is Input as is daily through the MDM application. They review at the monthly mondal meeting using a hardcopy generated from the system by the CRP/Mondal office MIS. During the meeting they discuss school development, average attendance of the children, MDM attendance and meals taken. If differences are there they ask and discuss different activities to take during the month. Also a review on children's assessment (via CCE)
Parents meeting register (Parents Committee)	Monthly they organize the Parents Committee which has recently replaced the PC. On average 70% of parents attend. They discuss the needs of the children (parents meeting register). Numbers of parents attending the meeting and number of meetings are entered into UDISE once a year. The HM reports to the Parents Committee information derived from hardcopy books. The agenda includes pupils attendance, pupils performance, school development, Facilities and WASH (cleaning and maintenance -presently no drinking water and hand washing), long leave for teachers requesting the parents committee to ensure a volunteer.
Library register	Not recorded in SIMS
Assembly Register	Attendance taken twice in a day, in the morning session and the afternoon session. This is the 30 min activities (Aneandea Vedika) – this is entered into the MDM app and informs the MDM register for the attendance field.
Radio lessons Book and register lessons (TV lessons)	Not applicable
HM staff meeting and review register	Not recorded in SIMS
Habitation Plan – yearly (details of the population, activities in the village, school age children, inclusive needs	HM enters the habitation plan details and school development plan details into the App School Information data (UDISE). Only elements will go into UDISE/School plan

School record keeping (hardcopy)	UDISE/SMIS
etc.). A school catchment area may contain more than one Habitation area (village etc.). Therefore it will participate in more than one habitation plan. Other centres such as health, child welfare etc. contribute.	The Habitation plan is prepared in a meeting with the Parents committee
School Development Plan (much of which is UDISE format and data required) (annual)	They enter the habitation plan details and school development plan details into the App School Information data (UDISE) The school plan is informed from any habitation plans into which the school catchment area falls. It consists of School information Enrolment OOSC Number teachers working PTR Expenditure Inclusive children (Special needs) Average attendance students Quality with regards performance students Information for uniforms (based on enrolment) Special needs children and their needs for materials Infrastructure and physical facilities Last year activities taken and progress Current year proposed budget estimates Right to education act implementation and status with supplementals

J. Estimated Budget for the Implementation of SIMS

Table 6.7: Estimated Budget for the Implementation of SIMS

Item and number	2015		2016		2017		2018		2019	
	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs
AP Online (services)	24	1,00,00,000	24	1,00,00,000	24	1,00,00,000	24	1,00,00,000	24	1,00,00,000
Procurement of servers for operation of SMIS (server centre)	2		2		2		2		2	
Other Costs associated with the deployment of servers (server centre)	---		---		---		---		---	

Item and number	2015		2016		2017		2018		2019	
	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs
Broadband Internet to schools, Mondl Education Office, District Education Office			5683	20458800	5683	20458800	5683	20458800	5683	20458800
Tablets procured for SIMS for schools (e-hazar)					71928	345254400	71928	345254400	71928	345254400
3G for tablets for SIMS for schools (e-hazar)					70000	35280000	70000	35280000	70000	35280000
Biometric readers for										

Item and number	2015		2016		2017		2018		2019	
	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs
schools and offices										
Computer repair or procurement for Districts and Mondl							748	11220000		
Communication and advocacy associated with SIMS	2	200000	2	200000	2	200000	2	200000		
Training Teachers for SIMS			1	65000			1	65000		
Training Administrators at Mondl, District level for SIMS			13		13		13		13	

Item and number	2015		2016		2017		2018		2019	
	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs	Number (If applicable)	Total Cost Rs
Training staff in IT Cell										
Other (specify) – specific to SMIS										

K. Estimated Budget for the Implementation of SIMS