

2021 ANNUAL CORE DATA REPORT

READINESS FOR DIGITAL TRANSFORMATION



2021 KENET COMMUNITY ANNUAL CORE DATA SURVEY REPORT

Readiness of member educational institutions for digital transformation

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JUNE 2022

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Executive Summary

The 2021 annual core data survey collected data for the period 2019 – 2021. Five (5) different questionnaires were used for the different membership categories, namely, universities, tertiary colleges, research institutions, teaching hospitals, and affiliate member institutions. The questionnaires needed to be approved by the respective heads of the 181 member institutions who also signed off the completed questionnaires. The questionnaires were administered over a period of six (6) months from November 2021 to April 2022. A total of 108 member institutions participated by completing the questionnaire representing about 80% of the community.

The majority of the participating institutions were educational institutions (91 of the 108 institutions). The 2021 Annual Core Data report therefore analyzed aggregated data collected from educational institutions only (i.e., universities and tertiary colleges). However, some of the insights and recommendations also apply to other membership categories especially in areas of automation and business continuity.

The collection of annual core data was a requirement of the KENET strategic plan 2016 – 2021 to track a subset of foundational e-readiness sub-indicators that were first defined in the 2018 annual core data report for the period 2016 – 2018. E-readiness measures the potential of an institution or community to leverage on ICT to achieve their missions. This report has added three more sub-indicators that are specific to educational institutions, namely, readiness for blended and online learning, availability of ICT human capacity, and student financing of Internet and ICT services in educational institutions.

Although the focus of this report is readiness of educational institutions for digital transformation of learning, teaching, research, and working environments, most of the sub-indicators analyzed are also relevant to other categories of member institutions. We encourage all the heads of institutions to read this short report to understand the benefits of tracking e-readiness indicators for the KENET community.

This report has analyzed the following sub-indicators of e-readiness of educational institutions

1. **Broadband Internet access** measured using Internet bandwidth per user (or per 100 or 1000 users for educational institutions). This is one of the sub-indicators of *internet availability indicator* of an institution or community.
2. **Broadband Internet affordability** measured as Internet expenditure as a percent of the total institutional recurrent expenditure. This is a sub-indicator of *ICT affordability indicator* of e-readiness framework.
3. **Readiness for blended and/or online learning** measured by percent of participating institutions that had deployed institution-wide learning management systems. This is a new sub-indicator of *Enhancing education with ICT* indicator.
4. Degree of **deployment of administrative information systems** or ERPs, one of the sub-indicators of the *e-campus* e-readiness indicator.
5. **Mitigation of institutional cybersecurity risks** measured using the availability of off-site backup or disaster recovery sites. This is one of the sub-indicators of the *networked campus environment* indicator.
6. **Availability of critical ICT human capacity** in an institution (i.e., network and systems administrators). This is a sub-indicator of *ICT Human Capacity* e-readiness indicator.
7. **Student financing of Internet and ICT services** in educational institutions. This is a new sub-indicator of *ICT financing indicator*

Table E1 below summarizes the indicators for universities and tertiary institutions.

Table E1: Summary of e-readiness sub-indicators FY 2020/2021

| E-readiness Sub-indicator | Performance for universities | Performance for tertiary colleges |
|--|------------------------------|-----------------------------------|
| 1. Availability of Internet bandwidth (<i>Internet bandwidth subscriptions in Mb/s per 1,000 users</i>) | 40.5 | 10.3 |
| 2. Affordability (% of Internet expenditure to total recurrent expenditure) | 0.8% | 1.9% |
| 3. Readiness for blended / online learning (<i>percent of institutions that had deployed an institutional-wide LMS</i>) | 99% | 61% |
| 4. Degree of deployment of administrative information systems (<i>percent that have completed implementation of ERP</i>) | 51% | 25% |
| 5. Security of information systems (<i>percent of institutions that have setup full-fledged off-site disaster recovery sites</i>) | 21% | 3% |
| 6. Availability of critical ICT staff (<i>median number of critical ICT staff per institution</i>) | 3 | 1 |
| 7. Student financing of Internet bandwidth services (<i>percent student ICT lab fees required to finance Internet expenditure</i>) | 31% | Not surveyed |

Table E1 shows that tertiary colleges had low levels of readiness for blended or online learning with close to 40% without an LMS. This was despite the disruptions of in-person learning by COVID-19 pandemic in 2020 and 2021. We recommend capacity development for lecturers and senior leadership in blended or learning practices. We note that only one university college reported that it had not deployed their own institutional LMS. Universities had therefore adopted blended and online learning practices.

Table E1 shows that the educational community was still at relatively low levels of full automation even for the universities category where only 51% of the members reported that they had completed ERP implementation. This figure is even lower at 25% for tertiary colleges. We recommend the formation of Working Group on ERP deployment to guide the selection and implementation of ERPs in our community. Automation is necessary for digital transformation.

One other observation based on the data is that educational institutions have inadequate number of critical ICT staff (systems and network administrators that keep information systems operational and available). The median number of the critical ICT staff was only three (3) for universities and one (1) for tertiary colleges. Moreover, the analysis of salary bands showed that average salary band for the critical staff was between KES 84,000 and KES 124,000 for universities and KES 38,000 and KES 50,000 for tertiary colleges. These salaries are below the 25th percentile of the industry salaries for the critical staff. critical ICT staff. We recommend that educational institutions prioritize ICT staffing by reviewing both the staff complements and salary bands to attract and retain high-end ICT talent. Anecdotal data suggests that this recommendation applies for other categories of member institutions that did not participate in the survey.

The analysis of the student lab fees revenues revealed that it was adequate for financing broadband Internet bandwidth and critical ICT recurrent expenditures. For example, Table E1 shows that the FY 2020/2021 total student ICT lab fees revenue represented only 31% of the annual Internet bandwidth expenditure for 50 of the participating universities.

Anecdotal evidence suggests that most educational institutions charge a student's ICT lab fees that are used to finance Internet bandwidth services and other ICT services.

In this report, the target for broadband Internet bandwidth was set at 40 Mb/s per 1,000 users or download speeds of up to 0.4 Mb/s per user assuming only 10% of users online at any one time. Table E1 shows that the actual Internet bandwidth available to students in October 2021 was on target at 40.5 Mb/s per 1,000 users for universities but only 10 Mb/s per 1,000 users for tertiary colleges. We note that the Kenya National Broadband Strategy 2018 – 2023 download speed target is 2 Mb/s per user compared to only 0.4 Mb/s per user KENET target even with 10% of the users online. The major constraint for universities was campus networks speeds and limited WiFi coverage that limited the consumption of Internet bandwidth even without bandwidth limits. Educational institutions will therefore need to increase their Internet expenditures and also upgrade their campus network infrastructure including expansion of WiFi coverage in order to achieve the 200 Mb/s per 1,000 users national broadband target.

This report makes the following recommendations:

1. **Educational institutions should ring-fence the annual student lab fees** in order to sustainably finance the broadband Internet bandwidth and ICT recurrent expenditures. This lab fees should also be used to extend WiFi coverage in educational institutions campuses. includes Internet bandwidth budgets and ICT staff.
2. **Member institutions must aim to improve terms and conditions of service for critical ICT staff** such as systems administrators, network administrators/engineers, cybersecurity engineers and application developers. Member institutions should use industry benchmarking data available, for example, from the PWC REM channel database. High-end ICT staff are required for full automation and execution of digital transformation strategies
3. **The relatively small tertiary colleges should setup shared blended and online learning platforms.** This would make it easier to develop and curate shared educational content using the champion lecturers and instructional designers. This would also enhance capacity building initiatives for the tertiary colleges.
4. **Institutions need to prioritize the implementation of ERPs.** We recommend selection of only few ERPs that can be deployed by a critical number of educational institutions. This ensures the KENET community develops capacity for implementation, support, and upgrade. KENET will create a Working Group on ERPs to drive the selection and implementation of ERPs.
5. **Institutional leaders need to prioritize business continuity** by setting up fully-fledged disaster recovery sites. This will protect institutions against any failures of critical and mission-critical information systems that would disrupt the operations of institutions or threats cybersecurity attacks.

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1. Introduction

KENET released the first Annual Core Data report in February 2020 which included analysis of the core data collected in the year 2016 and 2018 (see [2018 Annual Core Data](#)). This was just before the outbreak of COVID-19 pandemic in March 2020 that interrupted the collection of the 2019 and 2020 annual core data. This 2021 annual core data report is based on the data collected from November 2021 – June 2022 and includes annual core data for period 2019 to 2021.

The collection of annual core data was a requirement of the KENET strategic plan 2016 – 2021 to track a subset of foundational e-readiness sub-indicators that were first defined in the 2018 annual core data report for the period 2016 – 2018. E-readiness measures the potential of an institution or community to leverage on ICT to achieve their missions.

The annual core data was supposed to ensure that KENET could achieve two main outcomes of the strategic plan:

1. Tracking the readiness of the KENET member institutions to leverage on Internet connectivity and ICT services to achieve their missions.
2. Providing peer ICT benchmarking service to member institutions using the foundational e-readiness sub-indicators defined in this report.

Similar to the 2018 report, this 2021 report has analyzed the following subset of e-readiness sub-indicators based on core data for the period 2019 to 2021.

1. **Broadband Internet access** *measured using Internet bandwidth per user (or per 100 or 1000 users for educational institutions). This is one of the sub-indicators of internet availability indicator in an institution or community.*
2. **Broadband Internet affordability** measured as Internet expenditure as a percent of the total institutional recurrent expenditure. This is a sub-indicator of *ICT affordability* indicator of e-readiness framework.
3. **Readiness for blended / online learning** measured by percent of participating institutions that had deployed institution-wide learning management systems. This is a new sub-indicator of enhancing education with ICT indicator.
4. Degree of **deployment of administrative information systems** or ERPs, one of the sub-indicators of the *e-campus* e-readiness indicator.
5. **Mitigation of institutional cybersecurity risks** measured using the availability of off-site backup or disaster recovery sites. This is one of the sub-indicators of the *networked campus environment* indicator.
6. **Availability of critical ICT human capacity** in an institution (i.e., network and systems administrators). This is a sub-indicator of *ICT Human Capacity* e-readiness indicator.
7. **Student financing of Internet and ICT services** in educational institutions. This is a new sub-indicator of ICT financing indicator

KENET collects the annual core data through the respective ICT directors or heads of ICT directorates of each member institution but with the authorization of the respective CEOs (e.g., Vice-Chancellors or directors). The completed questionnaires must be signed off by both the ICT directors and the CEOs or their assigns to assure the credibility of the data.

The 2021 survey for the first time used different questionnaires for each of the membership categories shown on Table 1. The use of different tailored questionnaires is in recognition of the fact that the KENET community is diverse in terms of their missions and levels of e-readiness. For example, universities are on average at higher levels of e-readiness compared to tertiary colleges. Teaching hospitals exhibit elevated levels of awareness of cybersecurity threats compared to other membership categories.

Table 1 shows that the size of the KENET community consisting of the students, staff, researchers, and faculty of the 181 member institutions had grown to 905,948. The KENET community was still dominated by the university community represented about 73% of the overall size of the community. The member institutions had a total Internet bandwidth subscription of about 38 Gb/s representing an overall Internet bandwidth ratio of 32 Mb/s per 1,000 users. Assuming only 10% of the users are online at any one time, this translates to 0.32 Mb/s per user which is below the Kenya Broadband Strategy 2018-2023 target of 2 Mb/s per user.

The core data was collected from only 108 of the 181 member institutions. The total size of the community was therefore calculated from the 2021 core data for the 108 members and from previous membership or 2018 core data, and Kenya National Bureau of Statistics for all member institutions for institutions that did not submit their questionnaires. The subscription data was derived from KENET bandwidth consumption data.

Although the Internet bandwidth subscriptions are shown to be about 38 Gb/s in October 2021, this shall increase to 57 Gb/s with effect from July 1, 2022 due to the policy of reducing prices through Internet bandwidth allocations. Although this is a significant growth in bandwidth over the period 2016 to 2021, the Internet bandwidth of 32 Mb/s per 1,000 users is still below the KENET target of 40 Mb/s per 1,000 users or 0.4 Mb/s per user assuming only 10% of the users were online at any given time.

Table 1 – Community Size and Internet bandwidth subscriptions

| Survey Membership category | Size of Community as (staff, faculty, researchers + students) – October 2021 | Number of Connected institutions (October 2021) | Total Internet bandwidth subscription as of October – December 2021 quarter (Mb/s) | Internet bandwidth per 1000 users (Mb/s per user) |
|--------------------------------|--|---|--|---|
| Universities | 668,004 | 67 | 31,160.52 | 46 |
| Tertiary Colleges | 221,371 | 61 | 2,801.31 | 13 |
| Research Institutions | 4,832 | 19 | 1,728.39 | 36 |
| Teaching Hospitals | 7,460 | 9 | 495.67 | 7 |
| Capacity Building Institutions | 3,135 | 7 | 773.82 | 25 |
| Affiliate member institutions | 1,146 | 18 | 722.09 | 63 |
| Overall | 905,948 | 181 | 37,681.79 | 32 |

Source: Annual core data 2021 and KENET

The first annual core data collection exercise was conducted over a period of six months from November 2016 – May 2017 and the second collected in 2018 that covered 2017 data. Although the 2019 core data survey was interrupted by COVID-19 pandemic, 2019 core data has been collected as part of the 2021 annual core data. Thus, KENET has annual core data for the period 2016 – 2021 for member institutions that have participated consistently. Benchmarking over a

period of five years shall be possible for 68 member institutions that have participated since 2016. Benchmarking data shall also be available for the period 2019 – 2021 for the 108 member institutions that participated in 2021 survey.

Table 2 shows the number of members who released the annual core data in the 2018 and 2021 surveys for the various categories of members. Although there has been a significant increase in the number of tertiary colleges and hospitals category, only the universities and tertiary colleges participated in the data collection exercise in significant ways. We observe that the absolute number of tertiary colleges that participated increased from 18 to 36.

The lowest response rate was from affiliate and capacity building member institutions. In 2018, 12 out of 15 affiliate member institutions participated in the annual core data collection. In 2021, only 2 of 18 affiliate member institutions participated. The lack of data means it is exceedingly difficult to effectively support affiliate institutions. This report shall therefore focus on only two categories of member institutions, namely, universities and tertiary colleges.

Table 2: Annual Core Data Collection 2018 – 2021.

| Survey category | Membership | All Members (June 2018) | Members Completed Questionnaires | All Members (November 2021) | Members Completed Questionnaires |
|--|------------|-------------------------|----------------------------------|-----------------------------|----------------------------------|
| Universities | | 66 | 62 | 67 | 57 |
| Tertiary Colleges (TVETs, TTIs, Medical Colleges) | | 23 | 18 | 61 | 36 |
| Research Institutions | | 17 | 11 | 19 | 4 |
| Teaching Hospitals | | 2 | 2 | 9 | 5 |
| Capacity Building Institutions (e.g., CEMASTEIA) | | 7 | 5 | 7 | 4 |
| Affiliate member institutions (e.g., HELB, CUE, TVETA) | | 15 | 12 | 18 | 2 |
| Total | | 130 | 110 | 181 | 108 |

Organization of the Report

The rest of this brief is organized as follows: Section 2 presents the results of the broadband Internet access sub-indicator for the distinct categories of members as measured using the Internet bandwidth per 100 users. In section 3, we present results of the Internet affordability while Section 4 analyzes data on state of deployment of administrative information systems. Section 5 contains results on off-site disaster recovery and backup storage setup. The results of ICT staffing and their remuneration are presented in Section 6. In Section 7 presents results on student financing of Internet and ICT services in educational institutions. Section 8 contains our conclusions and recommendations.

2. KENET Community Broadband Internet Access 2016 – 2021

The broadband Internet access sub-indicator is measured in terms of Internet bandwidth per 1000 users. Since 2016, the universities have contributed the highest total Internet bandwidth subscription; in 2021 the universities contributed 82% of the total bandwidth capacity. *Note that students are never all on campus at the same time or online at the same time.* In general, we assume only 10% of the students are online at any one time for benchmarking purposes.

Table 3 shows the growth in Internet subscriptions, and corresponding Internet bandwidth per 1000 users for the university category of members. The table shows that the Internet bandwidth per 1000 users for university students was 15.2 Mb/s in 2016 and 40.5 Mb/s in 2021 if only 10%. The sampling data point for the Internet subscription was October – December quarter. Table 3 shows a significant drop in October 2020 mainly due to the COVID-19 pandemic that disrupted learning and therefore student consumption.

Table 3: Internet Access Indicators 2016 – 2021 for University Category

| Year | User Population | Average Internet BW subscription (Mb/s) | Internet BW per 1000 users |
|------|-----------------|---|----------------------------|
| 2016 | 602,023 | 9,133.80 | 15.2 |
| 2017 | 625,744 | 11,872.00 | 19.0 |
| 2018 | 631,346 | 13,894.20 | 22.0 |
| 2019 | 640,182 | 26,195.00 | 40.9 |
| 2020 | 605,886 | 14,426.00 | 23.8 |
| 2021 | 633,274 | 25,714.20 | 40.5 |

Table 4 shows the corresponding total Internet subscription trends for tertiary colleges. Although the bandwidth increased from 2.2 per 1,000 users in 2016 to 10.3 per 1,000 users in 2021, this was still below the KENET 2015 target of 40 Mb/s. The ratio for tertiary colleges was also about 25% the ratio for universities in 2021. That means that tertiary colleges will need to increase their annual Internet expenditures in the coming years. However, we note that the tertiary college community size increased by close to four times to over 221,000 in 2021 up from 51,000 in 2016 and the total subscriptions This was mainly due to new connected tertiary colleges.

Table 4: Internet Access Indicators 2016 – 2021 for Tertiary Colleges Category

| Year | User Population | Average Internet BW subscription (Mb/s) | Internet BW per 1000 users |
|------|-----------------|---|----------------------------|
| 2016 | 51,095 | 109.00 | 2.1 |
| 2017 | 74,003 | 315.00 | 4.3 |
| 2018 | 94,265 | 332.72 | 3.5 |
| 2019 | 137,455 | 1,250.55 | 9.1 |
| 2020 | 139,308 | 1,386.59 | 10.0 |
| 2021 | 221,371 | 2,280.02 | 10.3 |

We observe that there was no significant drop in Internet bandwidth subscription for tertiary colleges in 2020 during the peak of COVID-19 pandemic in Kenya. Unlike universities, tertiary colleges did not reduce their relatively low bandwidth subscriptions during COVID-19 period in 2020. In fact, there was an increase in the number of tertiary college campuses that were connected in that period. Anecdotal evidence suggests that tertiary college campuses in rural areas with limited Mobile 3G/4G coverage repurposed their campuses to provide affordable broadband connectivity to their users during the pandemic.

3. Internet bandwidth affordability 2016 – 2021

The UN State of Broadband 2022 Report (downloadable at <https://www.itu.int/itu-d/reports/statistics/global-connectivity-report-2022/>) defines fixed broadband affordability in terms of the monthly cost of 5 GB data bundle at advertised download speeds of 256 kb/s as a percent of the GNI per capita. The target was set at 5GB monthly data at less than 2% of the GNI per capita per month. However, this target is not meaningful for students who are not employed and whose typical monthly consumption of bandwidth might be higher than 5GB. There was a need to develop a different affordability indicator that is appropriate for universities or tertiary college that provide Internet bandwidth to students with relatively high consumption patterns for educational and research purposes.

KENET provides wholesale Internet bandwidth to connected campuses. The Internet bandwidth is then distributed through campus through LANs and WiFi networks (e.g., eduroam). This reports therefore adopted the e-readiness affordability sub-indicator defined as annual Internet expenditure of the institution as a percent of the total recurrent expenditure of the institution. This sub-indicator is then staged on a scale of 1 – 4 as shown in Table 5, where Stage 1 means the lowest level of affordability and Stage 4 is the highest level of affordability and can provide meaningful connectivity to the users. (See e-readiness framework at <https://ereadiness.kenet.or.ke>)

The e-readiness staging framework, therefore, measures Internet affordability as the ratio of the Internet expenditure to the total recurrent expenditure of an institution. Table 5 shows that institutions in Stage 1 were spending less than 0.4% of their recurrent expenditure on Internet bandwidth. This is inadequate allocation of Internet expenditure. Stage 4 means that institutions had Internet bandwidth expenditures that was at least 2% of the total recurrent expenditure of an institution.

In order to achieve Stage 4, the KENET target for connected campuses, institution would need to increase their Internet bandwidth expenditures to at least 2% of the recurrent expenditures. This sub-indicator can be used for peer benchmarking of different connected institutions in the same membership category.

Table 5: Internet affordability e-readiness stages

| % Of Internet expenditure to total expenditure | Stage |
|--|-------|
| < 0.4% | 1.0 |
| 0.4 – 0.99% | 2.0 |
| 1.0 – 1.99% | 3.0 |
| 2 and higher | 4.0 |

The annual core data was analyzed to derive the Internet expenditure ratio as summarized in Table 6 below. The participating universities remained, on average in Stage 2.0 for the period 2016 - 2021 with a 0.9% which is a decline from 2020 which was still at stage 2 but with 0.98%.

Tertiary Colleges maintained Stage 3 in 2021 where they were spending about 1.9% of their recurrent budget as shown in table 7. We note that the average aggregate bandwidth consumed by the participating universities was 25,714.20 Mb/s

in 2021 compared to only 2,280.02 Mb/s for the tertiary colleges. The higher level of affordability was therefore on account of low capacity procured and the lower annual recurrent expenditures of tertiary colleges (i.e., tertiary colleges were smaller in enrollment and size of the community of users as shown in Table 1.

The 93 member institutions (57 Universities and 36 Tertiary Colleges) that provided financial data in 2021 had a total annual Internet bandwidth expenditure of KES 833 million. The 57 universities that participated in the 2021 survey were responsible for the 88% annual Internet expenditure for the 93 educational institutions.

In order to derive the affordability sub-indicator, we required institutional financial data based on audited financial statements. In 2021, 98% of the participating institutions provided the financial data as compared to only 75% in 2018. Table 6 also shows that the Internet expenditure for the 57 participating universities dropped to KES 735 million in 2021 compared to peak of KES 830 million in 2019. We note that the Internet bandwidth expenditure was still below the pre-covid levels in 2019 by close to KES 100 million.

Table 6: Internet affordability 2016 – 2021 – Universities

| Year | Internet Expenditure | % Of Annual Internet expenditure to total recurrent expenditure | Stage |
|------|----------------------|---|-------|
| 2016 | 756,070,416.00 | 0.73% | 2 |
| 2017 | 783,716,219.00 | 0.79% | 2 |
| 2018 | 824,658,257.20 | 0.80% | 2 |
| 2019 | 830,257,219.80 | 0.82% | 2 |
| 2020 | 751,082,572.52 | 0.98% | 2 |
| 2021 | 735,857,590.22 | 0.90% | 2 |

Table 7 shows that the affordability trends for tertiary colleges are different from those for universities. In this case, the Internet bandwidth expenditure as a percent of the total recurrent expenditures as defined above increased from 0.68% in 2016 to 1.9% in 2021. The annual Internet bandwidth expenditure increased by about four times over the period for the participating institutions, partly due to the increase in the number of participating tertiary institutions (18 to 36). Overall, tertiary colleges were considered to be in Stage 3 in affordability compared to Stage 2 for universities mainly because their relatively low recurrent expenditures compared to universities.

Table 7: Internet Affordability 2016-2021 Tertiary Colleges

| Year | Internet Expenditure | % Of Annual Internet expenditure to total recurrent expenditure | Stage |
|------|----------------------|---|-------|
| 2016 | 21,410,294.00 | 0.7% | 2 |
| 2017 | 15,634,482.00 | 0.8% | 2 |
| 2018 | 58,447,369.00 | 1.1% | 3 |
| 2019 | 60,368,920.00 | 1.2% | 3 |
| 2020 | 92,790,300.00 | 1.1% | 3 |
| 2021 | 96,881,145.08 | 1.9% | 3 |

Although the Internet expenditure ratio increased to 1.9% for tertiary colleges, we note that the corresponding Internet bandwidth ratio shown in Table 4 at 10.3 per 1,000 users was still far below the target of 40 Mb/s per 1,000 users. This means that tertiary colleges still need to increase their Internet expenditures probably through student ICT lab fees as was the case for universities. In Section 7 we show universities were financing their Internet expenditures mainly from student ICT lab fees.

4. Deployment of information systems in member institutions

The annual core data collected was used to assess the extent of deployment of administrative information systems or ERPs. This is an indirect measure of the readiness of member institutions for digital transformation and the corresponding institutional efficiency and effectiveness. The administrative information systems support admission processes and financial management among other functions.

While the deployment of administration systems improves institutional management, it also exposes institutional ICT risks including loss of critical data and cybersecurity attacks. These are often mitigated by setting up off-site disaster recovery sites, providing clean power, and employing competent and motivated ICT staff in areas of accounting information systems, systems administration, and cybersecurity.

In the following sub-sections, we summarize the results for the University and Tertiary Colleges categories of member institutions that participated in the 2018 and 2021 annual core data survey.

4.1 Deployment of administrative information systems (ERPs)

In the period 2020 – 2021, the focus of heads of educational institutions shifted to remote teaching and learning and adoption of blended and online learning. The deployment of administrative information systems was not a topic of any of the VCs or Principals webinars in 2020 and 2021. This was expected in view of the disruptions of COVID-19 pandemic. The 2021 annual core data was therefore expected to track the changes in deployment of ERPs even with the focus by senior leadership of educational institutions on remote teaching and learning.

Table 8 shows the level of deployment of administrative information systems for the Universities and Tertiary Colleges categories of members and the corresponding vendors for the period 2018 – 2021. We highlight the following results as presented in Table 8:

- a. The University category registered an improvement in deployment of ERPs from 93% in 2018 to 98% in 2021. However, there were three universities that reported they still had no ERP deployed in 2018 compared to one in 2021.
- b. In 2018, 47% of the universities reported that ERP implementation was completed. This figure increased to 51% of the universities. This was not a significant increase over the three years
- c. 70% of the Tertiary Colleges stated that they had an ERP in 2021 but only 25% indicated that they had completed the ERP implementation (i.e., only 8 of the 36 tertiary colleges had completed implementation of the ERPs)
- d. Up to 26% of the tertiary colleges were hosting their ERPs in the public cloud or KENET community cloud compared to only 10% of the universities. This means that most of the participating educational institutions were hosting their administrative system in their server rooms or private clouds.

Table 8: Deployment of ERPs in 2018-2021

| Membershi p category | Members Providing data | | % Of members with an ERP | | % Completed ERP implementation | | %ERP servers hosted in community / public cloud | |
|-------------------------|---------------------------|-----------|-----------------------------|------------|-----------------------------------|------------|--|------------|
| Year | 2018 | 2021 | 2018 | 2021 | 2018 | 2021 | 2018 | 2021 |
| Universities | 59 | 57 | 93% | 98% | 47% | 51% | 8% | 10% |
| Tertiary Colleges | 11 | 36 | 64% | 70% | 27% | 25% | 11% | 26% |
| Overall | 70 | 93 | 79% | 84% | 37% | 38% | 10% | 18% |

The low level of completion of implementation is a big concern for the KENET community, and it appears there was very little change in the period 2018 – 2021.

4.2 ERP Vendors

The annual survey included questions on the ERP vendors (not the integrators). Table 9 shows that in 2021, 35% of universities that participated had deployed Microsoft Dynamic-based ERPs. This was not a significant increase compared to the 31% of universities that reported deploying Microsoft Dynamic based ERPs in 2018. At the tertiary college level, only two of the 36 colleges had deployed Microsoft Dynamics based ERPs.

The locally developed ERP, ABNO Unisol, was deployed in 14 of the 54 universities in 2021, an increase of two universities from 2018. However, ABNO was the dominant ERP deployed in tertiary colleges with 14 of the 36 tertiary reporting that they had deployed ABNO ERPs. Note that in 2018, only one of the 16 tertiary colleges that participated had deployed ABNO.

Table 9 also shows that 14 out of the 54 universities had deployed other ERPs. This included Oracle based ERPs, big brands such as Campus Nexus and Jenzabar system that were widely used in North America and SAP B1 and other internally developed or open-source solutions that are deployed by one university. This means that there is no local community support for these other ERPs.

Table 9: Types of ERPs used in the Universities 2018-2021

| Name of ERP | Types ERP Deployed in the Universities | |
|---|--|-----------|
| | 2018 | 2021 |
| Microsoft Dynamics -based ERPs | 17 | 19 |
| ABNO Unisol | 11 | 13 |
| UNIPLUS | 6 | 3 |
| Sage Pastel | 5 | 4 |
| Other types of ERPs (e.g., Jenzabar and Campus Nexus) | 12 | 14 |
| None | 3 | 1 |
| Total | 54 | 54 |

Table 10 shows that 10 of the 36 colleges that participated had not yet deployed any ERP. This is about 28% of the tertiary colleges that participated in 2021. In 2018, 50% of the tertiary colleges indicated that they had not deployed ERPs. It was not clear what were the possible barriers to ERP deployment at tertiary college levels, but anecdotal evidence suggests that it could be a senior leadership and ICT human capacity problem rather than financial constraints. KENET shall focus on addressing both technical and leadership barriers to ERP deployment in the FY 2022/2023 through forums and technical advisory services

The dominant ERP vendors for tertiary colleges was local brand ABNO (13 of the 36) followed by Ultimate ERP deployed in six tertiary colleges. Unlike universities, only two tertiary colleges had deployed Microsoft Dynamics Navision based ERP.

Table 10: Types of ERPs used in the Tertiary Colleges 2018-2021

| Name of ERP | Types ERP Deployed in Tertiary Colleges | |
|---|---|-----------|
| | 2018 | 2021 |
| Microsoft Dynamics Navision | 3 | 2 |
| ABNO Unisol | 1 | 14 |
| Ultimate ERP | 0 | 6 |
| Other types of ERPs (deployed by one college) | 4 | 4 |
| None | 8 | 10 |
| Total | 16 | 36 |

In summary, the results show that Microsoft Dynamics based ERPs are dominant at university level while ABNO is the dominant ERP in tertiary colleges. However, close to 40% of the universities and tertiary colleges were using other ERPs or are yet to select any ERP. Moreover, the implementation levels remain low at 51% for universities and only 25% for tertiary colleges.

KENET proposes to form a Working Group on ERPs in the FY 2022/2023 to address the critical issues of ERP deployment and to reduce the diversity of ERPs deployed to improve community knowledge and support.

4.3. Readiness for blended and online learning of participating educational institutions

Learning Management Systems (LMS) are critical for supporting blended and online modes of teaching and learning. At the onset of COVID-19 pandemic in March 2020, the government closed all educational institutions. Educational institutions that had operational LMSes transitioned from in-person learning to emergency remote teaching and learning. Most of the universities upgraded their LMS setup to support the large number of students taking blended and online classes. KENET was instrumental during this period to assist the learning institutions to setup Learning Management System (LMS). This was achieved through technical support in developing guidelines on resource requirements based on student population, technical expertise in the installation of Moodle LMS and hosting LMSes on the KENET community cloud.

Table 11 shows that 68 of the educational institutions were using open-source Moodle LMS, followed by three institutions using CANVAS LMS. Seven participating institutions were using other LMSes such as Sakai, Blackboard, Open LMS and Mzizi. We note that 15 of the participating institutions had no LMS, most of them tertiary colleges (only one university reported to have no LMS setup).

Table 11: Learning Management Systems in 2021

| Category | Moodle | Canvas | Other (Sakai, Google Classroom, Open LMS, Mzizi etc) | No LMS | Total institutions |
|-------------------|-----------|----------|--|-----------|--------------------|
| Universities | 50 | 3 | 3 | 1 | 57 |
| Tertiary Colleges | 18 | 0 | 4 | 14 | 36 |
| Overall | 68 | 3 | 7 | 15 | 93 |

4.4: Remote teaching platforms

Apart from the data the LMS types deployed, the survey collected data on the remote teaching platforms used by the participating institutions. Table 12 shows the different remote teaching platforms used by universities and tertiary colleges. The data shows that the most popular remote teaching platforms for universities was Zoom used in 38 universities followed by the KENET web conferencing platform used in 34 universities. In tertiary colleges, the most popular remote teaching platform was Zoom followed by Google Meet and Microsoft Team. The KENET web conferencing platform was only used by five tertiary colleges.

Overall, universities were in higher state of readiness for blended / online learning in terms deployment of LMSes. However, no data was collected on the number of courses that had been digitalized at either university level or tertiary level or even the degree of adoption of blended and/or online learning. This will be part of future comprehensive e-readiness survey of universities and tertiary colleges.

Table 12: Preferred Webinar platforms

| Webinar platform | No. of Institutions | |
|---------------------------------|---------------------|-------------------|
| | Universities | Tertiary Colleges |
| Zoom | 38 | 24 |
| KENET Web conferencing platform | 34 | 5 |
| Google Meet | 12 | 16 |
| Microsoft Teams | 10 | 10 |
| Webex | 1 | 1 |
| Total | 95 | 56 |

5. Deployment of Off-site backup and disaster recovery sites by educational institutions

To ensure business continuity in the unlikely failure of the primary information systems installation, institutions are required to setup fully-fledged off-site disaster recovery (DR) sites. In a fully-fledged disaster recovery setup, the unavailability of the primary site means that institutions can operate from the secondary disaster recovery site seamlessly. However, institutions unable to setup fully-fledged disaster recovery systems need, as a minimum, to setup off-site backup for critical ERP in order to ensure full recovery from ERP failure or unavailability. The information systems failures could be caused by power failure in the data centers or server rooms, hardware failure or even a successful cybersecurity attack.

Table 13 shows that only 12 of the 57 universities that participated in 2021 had established fully-fledged disaster recovery sites. This represented 21% of the universities compared to 15% in 2018. This means that most universities had not yet prioritized business continuity in the event of a disruption that includes power failures or cybersecurity breaches (e.g. , a Ransomware attack).

At the tertiary college category of institutions, only one out of the 36 colleges that participated in 2021 had established a fully-fledged DR site. This means that the senior leadership of tertiary colleges had not prioritized business continuity. This was not surprising since 40% of tertiary colleges were yet to setup administrative and academic information systems (or ERPs) and only 25% of the rest had completed ERP implementation.

Table 13 also contains results on offsite backup. Up to 56% of the participating universities had established off-site backup for critical ERP data. However, at the tertiary level, only 24% had established off-site backup sites.

Table 13: Deployment of off-site backup and disaster recovery sites

| Membership category | Members Providing Data | | No. of members with off-site backup (2018-2021) | | No. with fully-fledged disaster recovery site (2018-2021) | | No. of institutions without DR | |
|-----------------------|------------------------|------|---|------|---|------|--------------------------------|------|
| | 2018 | 2021 | 2018 | 2021 | 2018 | 2021 | 2018 | 2021 |
| Annual Core Data Year | | | | | | | | |
| Universities | 59 | 57 | 32 | 32 | 9 | 12 | 7 | 12 |
| Tertiary Colleges | 12 | 34 | 10 | 8 | 0 | 1 | 9 | 17 |
| Overall | 71 | 93 | 42 | 40 | 9 | 13 | 16 | 29 |

The physical location of both off-site DR and backup is now important with the enactment of the Data Protection Act of 2019 that requires all personal data to be resident in Kenya. We note that 24 of off-site backup and DR sites were located at the KENET community data centers. The results showed that in 2021, 31 of the off-site backup setups were in the public cloud outside Kenya. Moreover, 18 of the 58 off-site backup sites were on FREE storage offered by Google or Dropbox as shown in Table 14. Apart from the legal requirements, the use of FREE backup storage for corporate data is not a good practice and would not comply with IT audit compliance requirements.

Table 14: FREE Offsite Backup Storage

| Category | Exclusively FREE Offsite storage (e.g., Google Drive or Dropbox) | Supplementary Free Offsite Storage | Total |
|-------------------|--|------------------------------------|-------|
| Universities | 8 | 13 | 21 |
| Tertiary Colleges | 10 | 0 | 10 |
| Total | 18 | 13 | 31 |

In the FY 2022-2023, KENET plans to develop guidelines for setting up off-site backup and DR sites that are compliant with the Data Protection Act of 2019.

6. 2021 ICT staffing and Remuneration

The efficient operation of campus networks and institutional information systems require skilled network and systems administrators and/or engineers. These critical ICT staff ensure that ICT systems are operational on a 24/7 basis. These ICT staff also ensure that campus networks and information systems remain secure by setting up and administering firewalls, off-site backup, or fully-fledged disaster recovery sites. These critical staff need to be available in adequate numbers for different institutions and need to be regularly trained. The salaries of the critical ICT staff need to be benchmarked with industry in order to attract, retain and motivate competent and skilled staff.

In addition to the critical back-end ICT staff, there was a need for well-trained end-user support ICT staff. In educational institutions, this includes staff that manage the computer labs for students.

The 2021 annual ICT core data collects data on the ICT staffing levels for the critical staff, end-user and software developers and their respective salary bands. It also collects data on training budgets. However, it does not collect data on the level of competence or the professional qualifications of the staff. These additional data is important and shall be included in future annual core data surveys.

6.1 ICT staffing levels in universities and tertiary colleges

Table 15 shows the derived ICT staff indicators based on the 2018 and 2021 annual core data surveys. There were 1,060 staff employed by the 76 member institutions that provided data on ICT staff in the 2018 survey and 940 ICT staff members employed in 93 institutions in 2021. 754(80%) of the 940 ICT staff were employed by universities. We observe that in 2021, the median number of systems and network administrators was only three for universities and only one for tertiary colleges. These are inadequate staffing levels for educational institutions that are often large institutions.

Table 15: ICT staff 2018-2021

| Category of member institution | Number of Members providing data | | Total Users (Oct 2018 - Oct 2021) | | ICT staff numbers | | Median ICT network+ systems admins staff per institution | |
|--------------------------------|----------------------------------|-----------|-----------------------------------|----------------|-------------------|------------|--|----------|
| | 2018 | 2021 | 2018 | 2021 | 2018 | 2021 | 2018 | 2021 |
| Annual Core Data Year | | | | | | | | |
| Universities | 61 | 57 | 626,238 | 627,926 | 816 | 754 | 3 | 3 |
| Tertiary Colleges | 15 | 36 | 48,297 | 171,719 | 244 | 186 | 2 | 1 |
| Overall | 76 | 93 | 674,535 | 799,645 | 1,060 | 940 | 2 | 2 |

Table 16 above shows that in 2021, 93 member institutions had total ICT staff complement of 940 with 221 of these being the critical ICT staff and 434 being end-user support staff. The category of other staff represented up to 18% of the ICT staff complement. We note the small number of critical ICT staff employed by tertiary colleges at only 33 for the 36 colleges that participated. There were some tertiary colleges that had not employed any critical ICT staff.

Table 16: ICT staff numbers in 2018-2021

| Annual Core Data Year | 2018 | | | 2021 | | |
|---------------------------------|--------------|-------------------|--------------|--------------|-------------------|------------|
| Category of Institution | Universities | Tertiary Colleges | Overall | Universities | Tertiary Colleges | Overall |
| ICT network+ systems admins | 204 | 33 | 237 | 175 | 46 | 221 |
| Application Developers | 104 | 6 | 110 | 109 | 11 | 120 |
| End-user Support | 360 | 17 | 377 | 371 | 63 | 434 |
| Others (e.g., Casuals, Interns) | 148 | 188 | 336 | 99 | 66 | 165 |
| Total | 816 | 244 | 1,060 | 754 | 186 | 940 |

Table 17 shows that 43% of the institutions that provided data did not have a budget for training ICT staff. Since the ICT staff are responsible for monitoring and maintaining the operation of the ICT systems within the institution; maintaining a sufficient and suitable range of skills amongst ICT staff and developing knowledge and skills is a key aspect of successful information security of an institution. Institutions are therefore encouraged to allocate a budget for training ICT Staff to enhance the competency of the ICT staff to cope with the world's rapid technological advancements.

Table 17: Budget for ICT Staff Training

| | Budget for Training ICT Staff Training | | | |
|-------------------|--|-----------|-------------------|-----------------|
| | Yes | No | Percentages - Yes | Percentages- No |
| Universities | 32 | 23 | 37% | 26% |
| Tertiary Colleges | 20 | 14 | 23% | 16% |
| Overall | 52 | 37 | 60% | 43% |

6.2 ICT staff salary bands

The annual core data survey collects data on salary bands for critical ICT staff like systems and network administrators /engineers. Table 18 shows the salary bands for universities and tertiary colleges. The average upper salary band for systems / network administrators was KES 125,655 for universities while that for tertiary colleges was KES 49,571. The corresponding average lower in the salary band was about KES 84,243 for universities while that for tertiary colleges was KES 38,380. These salary bands are low for the ICT industry. However, we note that the highest upper band for systems / network administrator in a university was KES 287,000 but only a few of the large public and private universities were paying the higher and competitive salaries.

On average, these salary bands are not competitive compared to ICT industry salary bands. It is therefore exceedingly difficult for universities or tertiary colleges to attract and retain high-end ICT talent without aligning the salary bands to

industry salaries. Educational institutions could for example aim for 25th percentile in the PwC REM channel salary bands.

Table 18: ICT average staff salary bands 2021

| Category of member institution | Salary band for systems / network admin staff | |
|--------------------------------|---|-------------------|
| | Lowest (Average) | Highest (Average) |
| Annual Core Data Year | 2021 | 2021 |
| Universities | 84,243 | 123,655 |
| Tertiary Colleges | 38,380 | 49,571 |

7. Student Financing of Internet and ICT services

Educational institutions have high demand for high-speed Internet services as shown in Table 1 compared to other categories of member institutions. This is because of the large number of students who often access campus WiFi using multiple devices (laptops and smartphones). The demand for affordable high-speed Internet services is expected to grow in the future as educational institutions expand their WiFi coverage in learning spaces such as libraries and classrooms and extend WiFi to on- and off-campus student hostels and laptop ownership increases. Sustainable financing of Internet services is therefore critical for educational institutions.

Although the annual core data surveys for the period 2016 – 2021 did not collect data on sources of financing for Internet and ICT services, data on universities student ICT lab fees was obtained from the following supplementary sources:

1. Supplementary online survey of educational institutions conducted in April – May 2022
2. 2019 E-readiness survey data of 44 universities
3. Universities fees catalog published on respective websites

The data shows that the majority of public and private universities charged an annual student ICT lab fee. Table 19 summarizes the weighted average fee per student and the estimated total student lab fee revenues for the FY 2020/2021. Data was available from above sources for 50 of the 57 participating universities.

Table 19 shows that 31% of the aggregated student ICT lab fees of about KES 2 billion would be enough to finance the annual Internet bandwidth expenditure. In addition, only 51% of the student ICT lab fees would be enough to finance all the ICT recurrent expenditure. Thus, student labs fees charged by the universities could even be used to finance the expansion of WiFi coverage on an annual basis in universities.

Table 19: Student ICT fees revenue in participating universities (FY 2020/2021)

| | Participating Public universities/university colleges | Private universities/university colleges | Total |
|---|---|--|-------------------------|
| Number of participating universities | 29 | 21 | 50 |
| Student enrollment (October 2020) | 371,874 | 126,962 | 498,836 |
| Weighted unit student lab fees | 3,801.85 | 5,529.27 | 4,665.56 |
| Total student lab fees revenue (KES) | 1,504,353,536.00 | 482,328,271.00 | 1,986,681,807.00 |
| Total Internet expenditure (FY 2020/2021) as a percent of total ICT lab fees revenue | 28% | 42% | 31% |
| Total ICT Recurrent Expenditure (FY 2020/2021) as a percent of total ICT lab fees revenue | 37% | 93% | 51% |

Anecdotal evidence suggests that the large tertiary colleges also charge a student ICT lab fee to support campus Internet services. For example, in 2021, KENET conducted a comprehensive e-readiness survey of the 71 campuses of Kenya Medical Training College (KMTC) with a student enrollment of 48,000 and established that KMTC was charging student ICT lab fees to support Internet services. The 2022 annual core data survey shall include questions on sources of ICT financing for all member institutions.

8. Conclusions and Recommendations

The 2021 annual core data survey collected data for the period 2019 – 2021. This core data, along with public data and membership data available at KENET indicated that the size of the KENET community had increased to 905,948 as of October 2021. The total bandwidth subscriptions by KENET members was 37,681.79 Mb/s as of October 2021.

In the 2021 survey, a total of 108 out of the 181 members participated in the survey. As in the past surveys, the highest level of participation was among universities at 57 of the 68 members followed by tertiary colleges at 36 of the 61 members in this category. This report therefore focused on the data analysis for universities and tertiary colleges only.

This report has analyzed the following sub-indicators:

1. **Broadband Internet access** measured using Internet bandwidth per user (or per 100 or 1000 users for educational institutions). This is one of the sub-indicators of internet availability indicator in an institution or community.
2. **Broadband Internet affordability** measured as Internet expenditure as a percent of the total institutional recurrent expenditure. This is a sub-indicator of ICT affordability indicator of e-readiness framework.
3. **Readiness for blended / online learning** measured by percent of participating institutions that had deployed institution-wide learning management systems. This is a new sub-indicator of enhancing education with ICT indicator.
4. Degree of **deployment of administrative information systems** or ERPs, one of the sub-indicators of the *e-campus* e-readiness indicator.
5. **Mitigation of institutional cybersecurity risks** measured using the availability of off-site backup or disaster recovery sites. This is one of the sub-indicators of the *networked campus environment* indicator.

6. **Availability of critical ICT human capacity** in an institution (i.e., network and systems administrators). This is a sub-indicator of *ICT Human Capacity* e-readiness indicator.
7. **Student financing of Internet and ICT services** in educational institutions. This is a new sub-indicator of ICT financing indicator

Table 20 below summarizes the indicators for universities and tertiary institutions.

Table 20: Summary of e-readiness sub-indicators FY 2020/2021

| E-readiness Sub-indicator | Performance for universities | Performance for tertiary colleges |
|--|------------------------------|-----------------------------------|
| 1. Availability of Internet bandwidth (<i>Internet bandwidth subscriptions in Mb/s per 1,000 users</i>) | 40.5 | 10.3 |
| 2. Affordability (<i>% of Internet expenditure to total recurrent expenditure</i>) | 0.8% | 1.9% |
| 3. Readiness for blended / online learning (<i>percent of institutions that were using an LMS</i>) | 99% | 61% |
| 4. Degree of deployment of administrative information systems (<i>percent that have completed implementation of ERP</i>) | 51% | 25% |
| 5. Security of information systems (<i>percent of institutions that have setup full-fledged off-site disaster recovery sites</i>) | 21% | 3% |
| 6. Availability of critical ICT staff (<i>median number of critical ICT staff per institution</i>) | 3 | 1 |
| 7. Student financing of Internet bandwidth services (<i>percent student ICT lab fees required to finance Internet expenditure</i>) | 31% | Not surveyed |

The Internet bandwidth per 1,000 users was 40.5 per 1,000 users for universities compared to only 10.3 Mb/s per 1,000 users. KENET target for 2019 e-readiness survey was 40 Mb/s per 1,000 users or 0.4 Mb/s per user if only 10% of the users were online at any time. This speed is still below the Kenya National Broadband Strategy 2018-2023 which is 2 Mb/s per user or 200 Mb/s per 1,000 users. This would require an increase in annual Internet expenditures by close to two times on average. Anecdotal evidence also suggests that the increase in Internet bandwidth consumption by four times would not be possible without expansion of campus WiFi coverage and upgrade of campus LANs for all educational institutions.

Table 20 shows that tertiary colleges had low levels of readiness of readiness for blended or online learning with close to 40% without an LMS. This was despite the disruptions of in-person learning by COVID-19 pandemic in 2020 and 2021. We recommend capacity development for lecturers and senior leadership in blended or learning practices. We note that only one university college reported that it had not deployed their own institutional LMS. Universities had therefore adopted blended and online learning practices.

We conclude that Internet expenditure and ICT recurrent expenditure in educational institutions could be primarily financed using student lab fees. The student lab fees could also finance expansion of WiFi coverage for educational institutions. However, this assumes that student ICT lab fees are ring-fenced for ICT services only.

This report therefore makes the following recommendations:

1. **Educational institutions should ring-fence the annual student lab fees** in order to sustainably finance the broadband Internet bandwidth and ICT recurrent expenditures. This lab fees should also be used to extend WiFi coverage in educational institutions campuses. includes Internet bandwidth budgets and ICT staff.
2. **Member institutions must aim to improve terms and conditions of service for critical ICT staff** such as systems administrators, network administrators/engineers, cybersecurity engineers and application developers. Member institutions should use industry benchmarking data available, for example, from the PwC REM channel database. High-end ICT staff are required for full automation and execution of digital transformation strategies
3. **The relatively small tertiary colleges should setup shared blended and online learning platforms.** This would make it easier to develop and curate shared educational content using the champion lecturers and instructional designers. This would also enhance capacity building initiatives for the tertiary colleges.
4. **Institutions need to prioritize the implementation of ERPs.** We recommend selection of only few ERPs that can be deployed by a critical number of educational institutions. This ensures the KENET community develops capacity for implementation, support, and upgrade. KENET will create a Working Group on ERPs to drive the selection and implementation of ERPs.
5. **Institutional leaders need to prioritize business continuity** by setting up fully-fledged disaster recovery sites. This will protect institutions against any failures of critical and mission-critical information systems that would disrupt the operations of institutions or threats cybersecurity attacks.

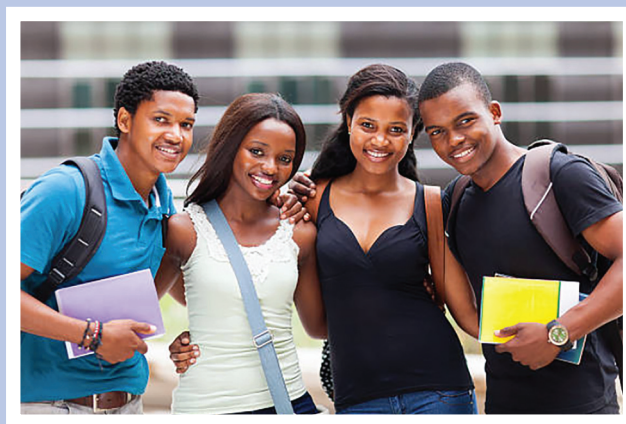
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Annex 1 – 2021 Annual Core Data Questionnaire for different membership categories

- i. [2021 Annual Core Data Questionnaire for Universities and University Colleges](#)
- ii. [2021 Annual Core Data Questionnaire for Tertiary Colleges](#)
- iii. [2021 Annual Core Data Questionnaire for Research Institutions](#)
- iv. [2021 Annual Core Data Questionnaire for Teaching Hospitals](#)
- v. [2021 Annual Core Data Questionnaire for Capacity Building Institutions](#)
- vi. [2021 Annual Core Data Questionnaire for Affiliate Member Institutions](#)

Annex 2 – [List of Participating Universities](#)



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