Indicators are measuring devices. They define concepts in terms of the measurements and data it is possible to collect and analyze. They define **what data to collect** and **at what time intervals**.

To have good indicators, we need to have a clear vision of what we are trying to achieve and what we are trying to measure. The basic approach involves four steps as follows:

- Identify what is to be measured;
- Develop trial measures;
- Assess each trial indicator, using agreed-on criteria; and
- Select the best indicators for a specific project.

These steps are discussed in further detail below as well as the key actions involved in each process.

**Step 1: Identify all concepts to be measured, especially project objectives and outputs**

Some of the key actions involved in this process are:

- Review concepts, objectives, results, and output statements for clarification;
- Clarify whether the outcome sought is an absolute change, a relative change, or no change; and
- Determine the relationship between project activities and their outputs or objectives (are these outputs or objectives direct or indirect?)
Developing Performance Indicators for ICT in Education

Step 2: Develop a list of possible (trial) indicators

- Think of possible alternative indicators for each concept, objective, and output, without being too restrictive; and
- Conduct internal brainstorming sessions.

Step 3: Assess each trial indicator against criteria

- Establish an agreed set of criteria for indicators; and
- Use a scoring scale (1–5) to determine the usefulness of each trial indicator.

Step 4: Select the best indicators for this project

- Consider each indicator on its merits against the criteria;
- Consider the mix of indicators to construct a robust set consistent and complementary in terms of data-collection methods and time frames;
- Avoid having too many indicators; and
- Be prepared to update your indicators.

The table below summarises the criteria that can be applied in assessing potential indicators. These criteria are based on the recommendations of the Center for Development Information Evaluation, an institute of USAID.
Chapter 3: Developing and Using ICT Indicators in Education

### Criteria for assessing indicators

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Description</th>
</tr>
</thead>
</table>
| Direct measure | - Indicator is intuitively understood (high face validity)  
- Indicator is a direct measurement, rather than a proxy that depends on assumptions for its validity  
- Indicator is supported by a body of research |
| Objective | - Indicator is unambiguous about what it is measuring  
- Different people will collect comparable data based on the indicator  
- Definition remains stable over time, so change can be measured  
- Indicator is unidimensional (measures only one thing)  
- Indicator can be quantitative or qualitative, as long as it is clearly and consistently defined and interpreted |
| Adequate | - Either by itself or with a minimal companion set of indicators, the indicator provides reasonable confidence that it accurately measures the attribute  
- Object is to have as few indicators as possible per attribute (should be three or fewer) — more is not necessarily better  
- Number of indicators will depend on the complexity of the object, or what is being measured |
| Quantitative | - Quantitative indicators are more objective than qualitative ones  
- Qualitative indicators should be adequately specified to be objective and consistent |
| Disaggregated | - The more disaggregated the indicator, the more easily data can be manipulated to answer questions not anticipated at the outset |
| Practical | - Data can be collected at reasonable cost, given their utility  
- Data are available and can be collected at suitable time intervals  
- Data can be readily collected in various projects for comparison |
| Reliable | - Indicator is reliable within the context of the evaluation purpose and resources  
- Data-collection process is consistent across different time and space scales, using comparable methods and sampling procedures Indicator is based on representative data |

### Using indicators to assess impact of ICT in education

A. Synthesis of country experiences on ICT indicators and related issues (see Appendices I and II of this section)

Several countries, namely, Canada, Japan, Korea, New Zealand, Philippines, Slovenia, South Africa, United Kingdom and the United States conducted several researches and studies on ICT and its indicators. In some countries, specifically, Korea, Japan, and in Europe, their country’s vision for the ICT sector served as basis for the formulation of ICT indicators or benchmarks. For example, the government of
Korea has “Cyber Korea 21”, the government of Japan has the “eJapan Priority Programme” and Europe has the “eEurope” initiative. These programmes are all aimed at improving the ICT sector.

In other countries, certain organisations conducted the survey and thus, formulated the indicators. In the Philippines for example, the Senate Committee on Education, Arts and Culture commissioned SEAMEO-INNOTECH to conduct the national survey that will profile the ICT capabilities of elementary and secondary schools in the Philippines. SEAMEO-INNOTECH was responsible for formulating the indicators/items on the survey.

For other countries, the basis for their ICT indicators was not made clear.

The United States utilises a set of standards for the use of technology by students, teachers and school administrators. The International Society for Technology in Education (ISTE) came up with the National Education Technology Standards (NETS) Project. The primary goal of the ISTE NETS Project is to enable stakeholders in PreK-12 education to develop national standards for the educational uses of technology that will facilitate school improvement in the United States. The ISTE standards are also currently being adapted in Europe. Other countries did not indicate any standards for technology use in education.

The fact that the other countries did not indicate any existing standards that can monitor the use of technology reflects the lack of qualitative indicators. Many countries merely focus on providing the technology, that is, making computers and Internet access available. However, there have been few efforts to ensure that technology is used effectively and efficiently.

In most of the countries researched, the studies have been limited to ICT indicators used in the primary and secondary level. These countries are Canada, Japan, Philippines, Slovenia, Korea, UK and US. There are however, instances where other levels are included, such as the case of Korea where university level is included and Slovenia where pre-school is included. In the United States, those in physical education subjects and special education subjects in the primary and secondary levels were not included. Japan is noteworthy for its ICT policy, which includes even the schools for the blind and the disabled.

This situation tells us something about the issue of equity in the use of ICT in education. There are times when the government policy itself can serve as an aid or barrier to equity in access.

The number of computers or Internet connections in schools dominates statistics. In fact, only three countries specified indicators pertaining
to other ICT technologies such as telephone lines, fax machines, LCD projectors and the like. These countries are New Zealand, Korea and the Philippines.

Perhaps, future studies should also look into other ICTs. In doing so, there should be a clear definition of what ICT is. The following definitions can serve as a guide:

- **Information Technology (IT)** is the term used to describe the items of equipment (hardware) and computer programmes (software) that allow us to access, retrieve, store, organise, manipulate and present information by electronic means. Personal computers, scanners and digital cameras fit into the hardware category. Database storage programmes and multimedia programmes fit into the software category.

- **Communication Technology (CT)** is the term used to describe telecommunications equipment through which information can be sought and accessed, for example, phones, faxes, modems and computers.

Respondents for the different surveys and researches in the US, New Zealand, the UK, South Africa and Europe usually include teachers. Students are likely to be included in surveys aiming to determine their perceptions in the use of ICT technologies such as the case of surveys conducted in UK and South Africa. In other cases, school heads are taken as respondents such as in the Philippines and New Zealand. It was not clear from the results in other countries such as Canada, Japan and Slovenia who the respondents were.

Most countries use both quantitative and qualitative indicators. However, there are far more quantitative indicators than qualitative indicators in the countries included in our research.

Quantitative data usually include those pertaining to ICT infrastructure. ICT infrastructure consists of hardware, e.g. PCs, servers, etc., and the physical networks that connect the computers locally and globally.

Common indicators used for measuring or determining ICT infrastructure include:

- Availability of computer hardware; ratios of students per computer, computers per classroom, teachers per computer; types of computer set-ups (standalone, multimedia in network).
- Availability of connectivity and bandwidth of the computers: type of bandwidth of the connections, high-speed, broadband, wireless.
However, it is equally important to examine indicators that will show how ICTs have been used not only as a basic operational tool but also as a communications tool that promotes the development of creativity, interactivity, collaborative learning, critical thinking and problem-solving.

There are countries that are already attempting to include attainment and ICT impact in their indicators. Canada included “obstacles to fuller use of information technologies” in its list of indicators. Meanwhile, researches in Europe included “teacher confidence in the use of ICT, change in teaching methods and desirable ICT skills” in its list of indicators. In New Zealand, “obstacles faced by teachers in using ICT, factors that encourage use of ICT, student’s positive views about technology activities in school” are among the qualitative indicators.

South Africa attempts to measure the practical, foundational and reflexive competencies of educators. Researches in South Africa also include items on how well students enjoy ICT-related activities and learner's perception of how the use of computers improves learning and attitudes.

UK’s qualitative indicators include teacher confidence in the use of ICT and benefits of ICT in subjects. In the US, most qualitative indicators pertain to the teacher’s perceived value of Internet use relative to the teacher’s educational background, school level taught, location of access etc.

Researches in Japan, Korea, the Philippines and Slovenia show that these countries are still concentrating on providing ICT infrastructure, that is, making the technology available in their respective countries rather than measuring impact and effectiveness.

Some of the qualitative indicators mentioned in the researches are:

- How much students think they have improved;
- Change in teaching methods;
- Desirable ICT skills;
- Factors that encourage telecommunications use;
- Students who have positive views about technology activities in schools;
- Teachers agreeing that telecommunications technologies can enhance learning and teaching;
- How much learners think they have improved in various activities;
- Teacher confidence in the use of ICT;
- Development of practical, foundational and reflexive competencies;
- Impact of computers on educators and learners; and
- Barriers to computer related activities.
Some indicators are unique or were only mentioned for some countries. In Europe for example, ICT indicators include ICT policy and strategy of each country included in the Europe study namely: Denmark, Sweden, Finland, Norway and the UK. These indicators measure objectives of each country in national ICT projects, and the schedule for implementing national ICT education projects among others.

In Korea, the establishment of an education network (Korea Education Network) serves as one of the ICT indicators for higher education. Korea also uses the establishment of a networked research system (Research Information Service System) for higher education as another indicator.

B. Issues in ICT in education

While ICT has revolutionised business and industry and entertainment and has made very dramatic effects in the quality of products and services delivered by these sectors, it has not produced the hoped-for improved quality in student academic performance. The ICT promise appears to have fallen short of the expected effects on student learning outcomes. Moreover, ICT has created newer problems such as the oft-mentioned “digital divide,” exacerbating the problem of access to ICT between the well-off students, who have better access to ICT in the schools and even at home, and the mass of poor students, who have less access or no access at all.

This divide has even extended to the disparities in access between male and female students, between and among teachers and school administrators. As countries continue to invest in ICT for use in education, drawing financial resources from a variety of sources including the private sector and bilateral funding agencies, there is an even greater need for performance indicators to monitor the use and effects of ICT and to demonstrate accountability to these various funding sources and the public.

There is an urgent need, therefore, for a monitoring and evaluation (M and E) system if current efforts to make ICT use as an integral part of the education system are to succeed. Such M and E system should start at formulating a set of indicators of ICT use and impact in education.

This effort is not new in other parts of the world, e.g., the United States, Europe, the United Kingdom, Canada, Australia, New Zealand, and the like. However, in most of the Asia-Pacific countries, there has not been systematic work in the use of ICT indicators in the field of education.
Given that Asia-Pacific countries differ widely in regard to the scope and variety of use of ICT in education, it would be unrealistic and inappropriate to attempt to formulate a uniform set of indicators that can be used to frame data collection for ICT in education projects. What is realistic and appropriate, however, is for us to arrive at a consensus on common **core indicators** that can be used regardless of the ICT utilisation stage at of a country. Important criteria to be observed in formulating these core indicators includes local relevance and reliability and robustness when indicators are used for comparison of one ICT project or country with another.

C. Methods of collecting indicators

There are various ways of collecting data based on predetermined ICT indicators. Of course, the most popular one is the use of survey questionnaires distributed to a representative sample of schools, school heads and teachers.

Where the telephone system in a particular country is well developed enough so that most homes have access to a telephone and the cost of placing long distance calls is reasonably low, the telephone interview is a more cost-efficient method of collecting data based on indicators.

Where there is a saturation of Internet connectivity in the country, that is, most of the homes, schools and offices are connected to the Internet, use of questionnaires posted on the website of the institution/agency conducting the surveys can be an efficient method of collecting data on indicators. Communication by email between the respondent schools, school heads, teachers and even students will facilitate data gathering. Data entered into the web-based questionnaire can be automatically uploaded to the institution’s or agency’s computer server located thousands of miles away.

The method of data collection for ICT indicators will vary from country to country, depending on the spread of telecommunication use such as the telephone and the Internet. It will also depend on whether the Ministries of Education’s current M and E systems could accommodate additional data collection tasks to monitor and evaluate the use and impact of ICT in the schools, and additional variables based on ICT indicators could be integrated into the current database system.

D. Possible software or database systems for storing indicators

Below are a few of the software or database systems worth considering in developing the databases for the ICT indicators:
Spreadsheet programmes (e.g., IBM Lotus 123 and MS Excel);
Statistical Programmes (e.g., Statistical Package for the Social Sciences);
Customised database programmes using MS Access (for small databases);
SQL Server, MAGIC (for big databases); and
Database-driven web applications (Visual Interdev, Java, Visual Basic).

Other software available in the market can be used to create the ICT databases. Technical staff will be able to assist in determining the most feasible and user-friendly software adequate to answer specific needs.
### Appendix I

#### Situational Analysis of ICT Indicator-related Concerns in Different Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Basis for ICT indicators/agency who formulated ICT indicators</th>
<th>Presence of standards for technology use</th>
<th>Educational level covered</th>
<th>Respondents of studies</th>
<th>Technologies covered in studies</th>
<th>Presence of indicators addressing equity, ethics and investment issues</th>
<th>Presence of indicators on ICT integration in curriculum, impact etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>Two criteria for development of indicator set:</td>
<td>None</td>
<td>Elementary and secondary level</td>
<td>Not specified</td>
<td>Computers and internet</td>
<td>None</td>
<td>Yes, specifically, on what encourages teachers and students to use computers</td>
</tr>
<tr>
<td></td>
<td>● Type of education, information needed for policy development</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>● Practical availability of data</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indicators developed by Pan-Canadian Education Indicators Programme (PCEIP)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Europe 1</td>
<td>Indicators based on the eEurope initiative of the European Union, Action line: &quot;European youth into the digital age&quot;. The goal for the said objective is to turn digital literacy to a basic competence for all young Europeans/ SIBIS Study</td>
<td>Yes. ISTE (NETS) standards</td>
<td>Various researchers covered different level: public primary and lower secondary; primary, secondary and special schools; head teachers and teachers</td>
<td>School heads, teachers</td>
<td>ICT in general, computers and internet access</td>
<td>Yes, specifically on national policies and expenditure</td>
<td>Yes, on competency of ICT instructors</td>
</tr>
<tr>
<td>Country</td>
<td>Basis for ICT indicators/agency who formulated ICT indicators</td>
<td>Presence of standards for technology use</td>
<td>Educational level covered</td>
<td>Respondents of studies</td>
<td>Technologies covered in studies</td>
<td>Presence of indicators addressing equity, ethics and investment issues</td>
<td>Presence of indicators on ICT integration in curriculum, impact etc.</td>
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<tr>
<td>Europe 2</td>
<td>Eurydice</td>
<td>Yes, ISTE (NETS) standards</td>
<td>Primary and secondary level</td>
<td>Not specified</td>
<td>Computers and internet</td>
<td>Mainly on expenditure, distribution of budget</td>
<td>Yes, on integration of ICT in subjects</td>
</tr>
<tr>
<td>Japan</td>
<td>Eapanese priority policy programme/ various surveys conducted by e.g. government agencies on ICT in general. those conducted by the Ministry of Posts and Telecommunications Survey on Social Education</td>
<td>None</td>
<td>Elementary, secondary, university</td>
<td>Not specified</td>
<td>Computers and internet</td>
<td>Yes. Government general IT policy on elementary and secondary schools the same for schools for the blind and disabled</td>
<td>None</td>
</tr>
<tr>
<td>Korea</td>
<td>Cyber Korea 21, Vision: “To prepare students for the knowledge based society by realizing life-long learning via cyber-education system” Korea National Statistics Office</td>
<td>None</td>
<td>Elementary, secondary, university</td>
<td>Not specified</td>
<td>Computer, internet and other ICT related technologies such as LCD projects, camcorders etc.</td>
<td>Yes, specifically one of the goals of Cyber Korea 21 is to provide ICT training to 500,000 economically disadvantaged students and create CD-based software for vocational students</td>
<td>None</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Research conducted by the Telecom Education Foundation</td>
<td>None</td>
<td>Not specified</td>
<td>Teachers and principals</td>
<td>Telephone lines, fax machines, computers and internet</td>
<td>None</td>
<td>Yes, specifically on what encourages teachers and students to use computers</td>
</tr>
<tr>
<td>Country</td>
<td>Basis for ICT indicators/agency who formulated ICT indicators</td>
<td>Presence of standards for technology use</td>
<td>Educational level covered</td>
<td>Respondents of studies</td>
<td>Technologies covered in studies</td>
<td>Presence of indicators addressing equity, ethics and investment issues</td>
<td>Presence of indicators on ICT integration in curriculum, impact etc.</td>
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<tr>
<td>The Philippines</td>
<td>Senate Committee on Education, Arts and Culture with SEAMEO–INNOTECH</td>
<td>None</td>
<td>Public and private elementary and secondary schools</td>
<td>School heads</td>
<td>All ICT related technologies such as television, projectors, radio/cassette players, computers, computer peripherals and internet access</td>
<td>Yes, specifically those pertaining to use of computers by non-formal education students</td>
<td>None</td>
</tr>
<tr>
<td>Slovenia</td>
<td>Research on internet in Slovenia</td>
<td>None</td>
<td>Primary, secondary, youth hostels and kindergartens</td>
<td>Not specified</td>
<td>Computers and internet access</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>South Africa</td>
<td>School net</td>
<td>None</td>
<td>Not specified</td>
<td>Students and teachers</td>
<td>Computers and internet access</td>
<td>None</td>
<td>Yes, on competency of ICT instructors</td>
</tr>
<tr>
<td>UK</td>
<td>ISTE (NETS) standards</td>
<td>Primary and secondary schools</td>
<td>Students and teachers</td>
<td>Computers and the internet</td>
<td>Yes, mainly on expenditure and budget allocation</td>
<td>Yes, includes teacher confidence in the use of ICT and benefit of ICT</td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>Teaching, learning and computing – a study of teacher’s use of computer technology, their pedagogies, and their school context</td>
<td>ISTE (NETS) standards</td>
<td>Public and private schools, elementary, middle school and high school, all subjects except physical education and special education</td>
<td>Teachers</td>
<td>Computers, internet use (includes use of various software, CDROM etc.)</td>
<td>Yes, includes indicators that determines technology intensive areas, software saturation etc.</td>
<td>Yes, specifically pedagogical motivations for student computer use</td>
</tr>
</tbody>
</table>
Several studies have been conducted on ICT and its use and impact on education, some of which are included below.

A. Survey of information and communications technology in schools 2001 (England)

This survey on the information and communications technology (ICT) provisions in schools in England was carried out in April 2001, the findings of which were compared to similar surveys conducted in 1998, 1999 and 2000. The surveys collected information on the number and type of computers available in schools, expenditure in schools, the extent and benefit of the use of ICT across curriculum subjects, the use of internet and other electronic network communication links, and teacher usage of computers and their confidence in the use of ICT in the curriculum.

B. The networked readiness index: Measuring the preparedness of nations for the networked world

The Center for International Development (CID) at Harvard University conducted a research which came up with the Network Readiness Index (NRI), a major international assessment of countries’ capacity to exploit the opportunities offered by ICTs.

The Network Readiness Index is an assessment of a country’s capacity to make use of ICT resources. It shows how nations are performing with regards to their participation in the Networked World.

C. Profile on information and communications technology capabilities of elementary and secondary schools in the Philippines, 2000-2001 Project TAO CARES (Computer-Assisted Reforms for Schools)

This is a national population survey of public and private elementary and secondary schools conducted by SEAMEO INNOTECH in the Philippines under Project TAO CARES last March 2001. Its main objective is to determine ICT capabilities of schools. The survey questionnaire consisted of 42 items mostly focused on the readiness of schools in terms of infrastructure, hardware, software and manpower capabilities on ICT.
D. The 1996 national survey on computer education — Philippines

This study was conducted by the New Educational Technologies Foundation, Inc., a non-profit organisation composed of schools that believe in the capacity of IT in improving the quality of student learning and efficiency of teaching. The questionnaire was divided into two parts, the first part asked about perceptions, level of awareness and attitudes regarding the value of computer education and was answered by users and non-users of computers. The second part which deals with the actual use of computers was answered by users only.

E. The impact of networked ICT on Literacy Learning in English, 5 – 16

This report is the result of a literature review conducted, first, to identify a number of studies that might shed light on the major impact of ICT on literacy learning in English for 5 to 16 year olds, and the second, to undertake an in-depth review of the papers that were identified as being on the impact of networked ICT on literacy learning in English for ages 5 to 16.

F. Effective integration of IT in Singapore schools

The “Education research fund: Effective integration of IT in Singapore schools – pedagogical and policy implications” is a report on the key findings of a questionnaire survey aimed at identifying the degree of information technology (IT) integration among Singapore schools. The survey is the first part (Phase One) of a larger study funded by the Ministry of Education of Singapore aimed to examine and analyze where and how IT is integrated in Singapore schools to develop pupils’ higher order thinking skills.