

INFORMATION GATHERING AND CONFIRMATION STUDY CONCERNING GLOBAL KAIZEN E-LEARNING

FINAL REPORT

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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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**INFORMATION GATHERING AND CONFIRMATION STUDY
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ABBREVIATIONS

Abbreviation	English
A4AI	Alliance for Affordable Internet
AI	Artificial Intelligence
AR	Augmented Reality
ASP	Application Service Provider
AUDA-NEPAD	African Union Development Agency - New Partnership for Africa's Development
BI	Business Intelligence
CARS	Certification, Accreditation and Registration System
CFT	Cross Functional Team
C/P	Counterpart
CRT	Class Room Training
DDMKI	Dire Dawa Management and KAIZEN Institute
DK	Digital Knowledge
EKI	Ethiopian KAIZEN Institute
GSMA	GSM Association
IaaS	Infrastructure as a Service
ICT	In Company Training
ICT	Information and Communication Technology
IoT	Internet of Things
IT	Information Technology
ITU	International Telecommunication Union
JDS	Japan Development Service Co., Ltd.
JICA	Japan International Cooperation Agency
JPC	Japan Productivity Center
LMS	Learning Management System
MES	Manufacturing Execution System
MoE	Ministry of Education
MOFA	Ministry of Foreign Affairs
MoTI	Ministry and Trade and Industry
OS	Operating System
PaaS	Platform as a Service
PC	Personal Computer
QCC	Quality Control Circle
SaaS	Software as a Service
TICAD	Tokyo International Conference on African Development
TVET	Technical Vocational Education and Training
VPS	Virtual Private Server

1. Outline of the Study

1.1 Background of the Study

JICA has been implementing a number of technical cooperation projects in nine countries (Egypt, Ethiopia, Kenya, Tanzania, Zambia, Ghana, Tunisia, Cameroon and South Africa) since 2006 to facilitate industrial development in Africa. In addition, JICA has provided guidance on Kaizen to more than 25 African countries through training in Japan and third country training.

As positive outcomes of JICA's cooperation efforts, there has been increasing interest in Kaizen as well as an increasing need for the dissemination and further development of Kaizen, reflecting the local necessity for strengthening of the competitiveness and improving the productivity of the manufacturing sector in Africa. At the summit meeting of the New Partnership for African Development (NEPAD) held in June, 2016, the role of the NEPAD to spread Kaizen in Africa was recognized. This was followed by an announcement by the Government of Japan at the Sixth Tokyo International Conference on African Development (TICAD VI) held in June of the same year that "Japan will promote Kaizen in entire Africa through the Kaizen Initiative and will aim at improving the productivity of plants, etc. which introduced Kaizen by 30%" in collaboration with the NEPAD. To achieve this commitment of Japan, JICA and the NEPAD signed a consensus document regarding "the Africa Kaizen Initiative" in April, 2017.

This Initiative aims at (1) promoting industrial development and a change of the economic structure in Africa, (2) creating decent work and employment and (3) developing competitive as well as innovative human resources in the 10 year period from April, 2017. To achieve these aims, the dissemination and further development of Kaizen are in progress based on four pillars, i.e. ① enlightenment at the policy level, ② consolidation of the center (s) of excellence, ③ standardization of Kaizen activities and ④ networking.

The Study intends verification of the possible use of e-Learning (hereinafter referred to as e-Learning) as a method to facilitate ② consolidation of the center(s) of excellence and ③ standardization of Kaizen activities. e-Learning is expected to be an inexpensive and sustainable way of achieving Kaizen training in countries for which JICA is not providing assistance for the dissemination of Kaizen and for those areas and target persons which the counterparts of JICA's technical cooperation project find difficult to reach.

1.2 Purpose of the Study

The Study intends the gathering and examination of available information in relation to effective e-Learning in developing countries/regions against the background of many different ways of providing an e-Learning service. Moreover, through the implementation of the pilot project, the Study examines an effective method for e-Learning and compile recommendations for the spread of such e-Learning method in many countries.

1.3 Outline of the Study

(1) Target countries of the Study

Literature survey : Egypt, Ethiopia, Ghana, Cameroon, Kenya, Sudan, Tanzania, Tunisia, Burkina Faso and South Africa

Field survey : Ethiopia

(2) Related ministries/organizations

- Ethiopian Kaizen Institute (EKI)
- Kaizen organizations at the state and municipal levels
- Technical and Vocational Education and Training (TVET)
- New Partnership for Africa's Development (NEPAD)

(3) Basic Implementation Policies of the Study

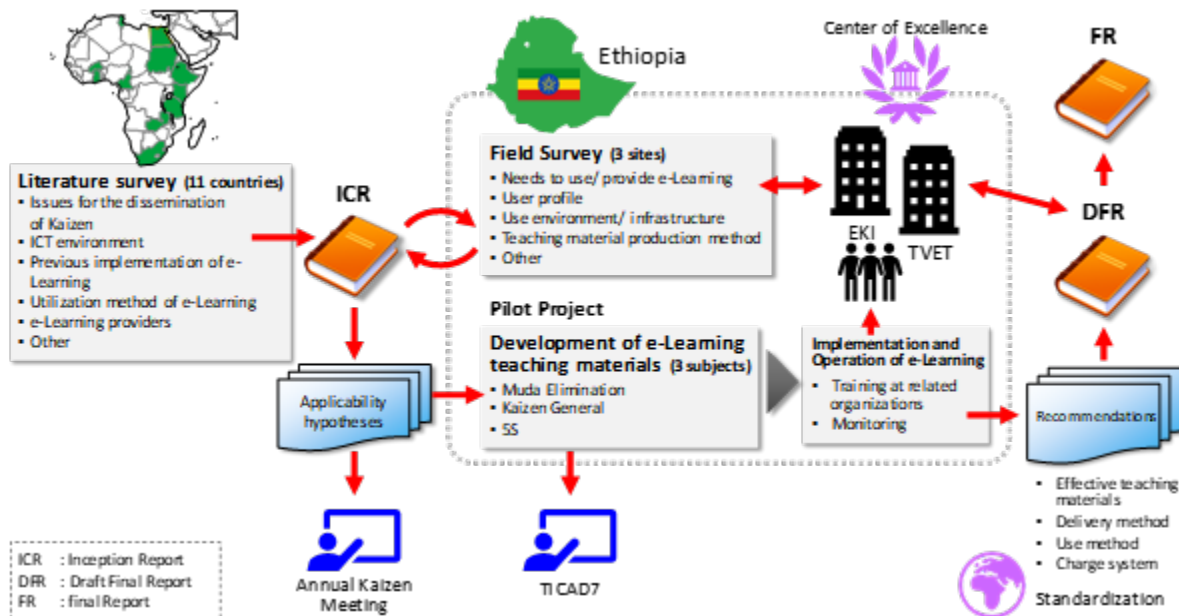


Fig.-1 Overall image of the Study and relationship to its results

2. Basic items of consideration for implementing e-Learning

2.1 Implementation methods of e-Learning using existing teaching materials

For the purpose of the Study, the initial understanding is that teaching materials using PowerPoint, etc. already exist and that what is required is the development and operation of e-Learning teaching materials using existing teaching materials. There are many approaches to achieve e-Learning and there are many possible combinations of the cost, personnel and infrastructure, etc. In view of such diversity, it is essential to sort out these approaches and combinations to examine an e-Learning materialization method which is most appropriate for the purpose of the Study.

Table-1 shows the functions which are generally considered to be essential for the implementation of e-Learning using existing teaching materials such as PowerPoint, etc. and their technical requirements. This does not mean all functions listed here are required, but the e-Learning implementation method will vary depending on the functions to implement.

Table-1 Necessary functions for e-Learning and technical requirements

Function	Technical requirement to achieve the function
① Use of existing teaching materials (PP)	PowerPoint format can be used as it is or can be automatically changed to another appropriate format.
② Modification, renewal and/ or deletion of teaching materials	Modified/renewed teaching materials can be distributed/provided to all users simultaneously and promptly. Meanwhile, old contents prior to modification/renewal/deletion should be instantly nullified (should not be left with users). ¹
③ Progress control of learning (measurement of progress, quizzes, etc.)	The degree of progress and quiz results of each user can be saved. The operator can obtain data on the progress of each user as required (this is not essential).
④ Judgement on the completion of learning (final test, etc.)	The operator can identify users individually (user management). The level of understanding of each user can be measured (by means of an online test, etc.) and the operator can judge the completion of learning based on the results of such test, etc.)
⑤ Control of learning sequence of multiple teaching materials	The learning sequence, such as from the Basics to Applied Learning can be presented to users and can be controlled in a proper manner (control to prevent learning which ignores the set sequence).
⑥ Self-learning at home or place of work	Self-learning at home or place of work is possible instead of in a classroom where teaching equipment, etc. is properly provided (it is necessary to investigate the take-up rates of smart phones, PCs, home Internet, etc.)
⑦ Provision of service to multiple regions or target countries	When the provision of the service beyond national boundaries is intended, the Internet is basically the only realistic choice for the service.
⑧ Ensuring the sustainability	Responsible organization in the country should be capable of performing all the above functions by themselves. This means the operation cost should be recovered by means of introducing fee-paying contents, advertisements, etc.

Among these functions, reliance on the Internet is essential to materialize function ⑦. Meanwhile, the distribution of teaching materials by e-mail, etc. is not possible for implementing functions ②, ③, ④ and ⑤, and the “learner management” function ⑤ through the Internet is required. This means that “a server equipped with a database function” on the Internet is required to implement these functions. In the case of e-Learning, a system to implement the management functions required of the operator side (②③④) is commonly called a LMS (Learning Management System). There are many options to implement such a LMS and there are basically 3 kinds of implementation methods applicable to the KAIZEN e-Learning as listed in Table-2 (We will discuss further in detail in 7.5).

¹ For this reason, the distribution of teaching materials using e-mail or CD-ROM, etc. is not realistic in terms of the necessary labor and cost to recover old contents and redistribute new contents.

Table-2 Implementation method of LMS

Method	Web server of C/P Organization	Rental Server	Existing e-Learning Service
Description	In the case where the C/P organization already has a Web server which can be used for the purpose of e-Learning	Use of a rental server which is operated by the government of a recipient country of which can be used in general	Use of a private sector e-Learning facility which offers all of the previous listed functions except function ⑧
Initially required set-up	Introduction of a software capable of materializing the functions listed in Table-1	Introduction of a server and a software capable of materializing the functions listed in Table-1	User registration
Operations required for system management	Operation and maintenance of the software	Operation and maintenance of the server as well as the software	None (conducted by the service provider)
Temporary cost	Cost of introducing the software (in the case of fee-paying software)	Cost of introducing the software (in the case of fee-paying software)	Registration fee
Continual cost	Web server operating cost; software usage fee (in the case of fee-paying server access and software)	Rental server usage fee; software usage fee (in the case of fee-paying server access and software)	System usage fee (which considerably varies depending on the number of contents and number of users, etc.)
Advantages	Can use many free software (Moodle, etc.); information on operation and maintenance can be obtained free of charge	As left. Secured use of a dedicated server makes it possible to absorb future increases of the access load	All functions can be used from the start; no system maintenance is required
Shortcomings	Dependence on the capacity of the existing server; technology transfer regarding the operation and management of the system is required	Continual payment for use of the rental server; some technical knowledge is required to maintain the server; technology transfer regarding the operation and management of the system is required	Continual payment for a high usage fee; The function and supply of contents stop immediately payment stops; the functions are dependent on a specific service
Range of feasible functions	All functions	Almost all functions	Functions ① through ⑦

There are 2 possible cases for the environment of users in Kaizen e-Learning.

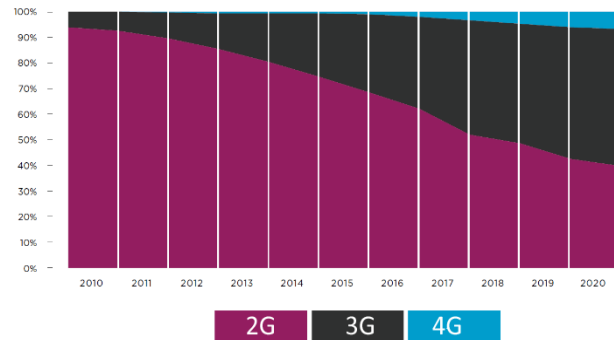
Table-3 Implementation method on the part of e-Learning users

Method	Web Browser	Smart Phone App
Required set-up	None; a PC, tablet or smart phone connected to the Internet is required	Downloading of an application; automatic update
Cost	Basically free (a cost is incurred if a fee-paying service is used)	
Advantages	Only a software for the web browser is required	Easy to use for new generation people; can be used even when not connected to the Internet; no need for a PC ²
Shortcomings	Cannot be used unless connected to the Internet; equipment, such as a PC, is required (a smart phone may be used)	Involves the cost of the development of an application and developer registration

² In recent years, a method to materialize e-Learning incorporating the advantages of both smart phone application and web browser is available (for example, a smart phone application which can operate on a web browser).

2.2 Internet connection speed and quality in the target countries

It is true that the expressive power and appeal of e-Learning teaching materials will certainly be improved by the use of still photographs, videos, sound, etc., thereby improving the learning efficiency of the learners. However, the Internet environment in African countries tends to be inferior to that in industrialized or semi-developed countries. There is a strong possibility that both the coverage and speed of the Internet connection services are extremely low in the vast rural areas of Africa. As shown in Fig.-2, the prevailing Internet service in many areas is based on 2G (maximum practical speed: 40 kbps, similar to that of an old telephone modem), such as GSM³ from the viewpoint of the reachable distance and transmission infrastructure, making the distribution of a high volume of data (videos, etc.) extremely difficult except in urban areas.⁴



Source: The Mobile Economy Africa 2016, GSM Association

Fig.-2 Share of each type of mobile phone connection in Africa

In such an environment, it may be impossible to use teaching materials with many photographs, videos, sound, etc. Even it may be possible in a large city area from the viewpoint of line speed, the line usage fee for e-Learning users could become extremely high because of the huge volume of data involved in videos and other media. For this reason, the careful comparison of various options will be conducted under the Study for the design and development of e-Learning teaching materials to find the best way to strike a balance between the expressive power of teaching materials and the several limitations described above.

2.3 Teaching materials with taking the cultural and social backgrounds of a target country into consideration

When examining the possible introduction of e-Learning in a developing country, there may be a case where consideration of the cultural and social backgrounds listed below become very important unlike industrialized countries.

- Literacy rate (as e-Learning is based on self-learning instead of teaching by a teacher, learning is impossible without the ability to read)
- Language to use (for example, e-Learning should be provided in multiple languages in Ethiopia as it is a multi-ethnic nation)
- IT literacy (how much the target persons are able to use a PC and other information equipment)

³ <https://en.wikipedia.org/wiki/GSM>

⁴ <http://www.gsma.com/mobileeconomy/Africa/>

- Religious restrictions (prohibition of idol worship and the use of specified symbols and images under Islam)
- Physical limitation of the Internet line (mentioned earlier)
- Social and political restrictions for use of the Internet (for example, shutting-down of the Internet during a period of emergency declared in February, 2018 in Ethiopia)

In view of the above, careful attention should be paid to prohibitions originating from the cultural and social backgrounds of each target country in the design and development of e-Learning teaching materials for the country concerned. When the development of teaching materials to serve multiple countries is planned in the future, careful examination of whether or not the contents of the teaching materials should be applicable to all countries or (partially) different contents should be prepared for certain countries will be necessary.

3. Result of literature survey and the derived hypothesis

In this chapter, we present the result of literature survey on 11 target countries as well as the hypotheses of applicability of utilizing e-Learning in Africa derived from the result. Verification result of these hypotheses by the result of implementing pilot program is described in 6.8.

3.1 Gathering of Relevant Materials and Information and Their Analysis Results











The result of literature survey is summarized in inception report, but the content is updated in this report by the latest information obtained afterwards as needed.

(1) African Cases of Reported Kaizen Projects in Progress and Those Introduced by Mass Media, etc.

The reports concerning Kaizen projects past and present and those reported by the mass media, etc. were reviewed. An on-line questionnaire survey concerning the applicability of e-Learning for actual Kaizen education and the relevant conditions for implementation in relation to the existing Kaizen projects of JICA was then conducted based on the review results, with 7 replies received. The findings of this questionnaire survey are described below.

① Applicability of e-Learning to Kaizen

Question	Reply (circled figure indicates the number of relevant replies)								
What kind of people do you assume to be effective targets for e-Learning? (multiple choices allowed)	<ul style="list-style-type: none"> • Consultant candidate (for consultant training) ■ 6 • Consultant who has already obtained certificate (renewal of certificate, training for upgrading) ■ 4 • Corporate executives and managers (promoting enterprise ability to implement Kaizen) ■ 6 • Younger people (expansion of Kaizen practitioners) ■ 5 • Other 								
Where do you think e-Learning can be used in Kaizen training?	<ul style="list-style-type: none"> • Only for CRT (classroom training) ■ 1 • Only for ICT (in-company training) 0 • Both CRT and ICT ■ 6 								
How many Kaizen training subjects does your organization have using CRT?	• 0~32 (Average: 9.3)								
For what subjects do you think e-Learning is effective? Please list the top three subjects.	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;">Subject</th> <th style="width: 20%;">Votes</th> </tr> </thead> <tbody> <tr> <td>5S, Quality Control / Management</td> <td style="text-align: center;">3</td> </tr> <tr> <td>Introduction of KAIZEN</td> <td style="text-align: center;">2</td> </tr> <tr> <td>3M, Visualization, Layout, Visual Control, Muda elimination, Toyota production system, Kaizen Management Skill Training, Kaizen Consultants Development Program, Kaizen Practitioners' Training, Production management (basic theories), Industrial engineering (basic theories), Visual management boards, Problem Solving</td> <td style="text-align: center;">1</td> </tr> </tbody> </table>	Subject	Votes	5S, Quality Control / Management	3	Introduction of KAIZEN	2	3M, Visualization, Layout, Visual Control, Muda elimination, Toyota production system, Kaizen Management Skill Training, Kaizen Consultants Development Program, Kaizen Practitioners' Training, Production management (basic theories), Industrial engineering (basic theories), Visual management boards, Problem Solving	1
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For what subjects do you think that complementary e-Learning (combined with CRT) can be introduced?	<ul style="list-style-type: none"> • 7QC Tools (Basic), Muda-dori, New 7QC Tools • 5S • Industrial engineering • Intermediate Kaizen Technologies (TPS, TPM, TQM, JIT, Economic Engineering Motion/ Time Study, Line Balancing....) • IE / QC / TPM / Toyota Production System • Executive management 								
For what subjects do you think that substitute e-Learning (replacement of CRT with no need for real lectures) can be introduced?	<ul style="list-style-type: none"> • 5S • 5S, QCC, Total productive maintenance • Basic Kaizen Training (Kaizen Overview, 5S, Muda, Team Development (QCCs), 7 Quality Control Tools....) • Any theoretical / introductory part • Shop floor training 								
How do you think e-Learning can be utilized for ICT (in-company training) (multiple choice)	<ul style="list-style-type: none"> • It can be used when you want to review part of the CRT in the middle of ICT ■ 4 • For topics necessary for the implementation of ICT but not covered in CRT ■ 4 • When students encounter problems in ICT, it can be used as a system to provide clues for solutions ■ 5 • Other 								

Question	Reply (circled figure indicates the number of relevant replies)
Regardless of subject, are there any learning elements (example: practical training, etc.) which are likely to have a positive effect on education if e-Learning is introduced?	<ul style="list-style-type: none"> • Yes, like simulation models • Examples, practical activities and group work • Case method, good practice • Expansion of the Knowledge (outreach) • It is important to find a way to get online training through a practical internship in a company
What are the limiting factors when considering the introduction of e-Learning? (multiple choice)	<ul style="list-style-type: none"> • Internet connection quality and speed  7 • Penetration rate of mobile devices and mobile phones  2 • PC ownership rate  5 • Cost of installation and use of e-Learning system  6 • Other <ul style="list-style-type: none"> ➤ The people here are not very familiar with e-Learning. ➤ Level of education, level of language ➤ Simplified contents
Do you want to introduce e-Learning in your project? (not considering the budget)	<ul style="list-style-type: none"> • Already introduced  0 • Yes, we would like to introduce (if all conditions are met)  7 • No, we do not want to introduce  0
Ask anyone who answered “Already introduced” to the previous question, “What kind of e-Learning do you have?” (Please also provide the URL if possible)	N/A
Ask anyone who answered “Yes, we would like to introduce” to the previous question “When would you like to introduce it?”	<ul style="list-style-type: none"> • Now (as soon as possible)  1 • Within one year  3 • Before the end of the project  0 • Other <ul style="list-style-type: none"> ➤ Must be discussed with the hierarch and Kaizen project team ➤ After the end of the project when all the dissemination and control structures will be put in place with a strong certification system of KAIZEN professionals

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From the above results, the person in charge of JICA’s Kaizen-related projects believes that e-Learning is useful for both CRT and ICT, and there is no project that has already introduced the e-Learning, but all projects want to introduce it. I knew it was there. As for the limiting factors for the introduction, all projects mentioned the quality and speed of the Internet connection, followed by the possible cost of introduction and usage. On the other hand, although the penetration rate of PCs could be a limiting factor, there were many projects who answered that the penetration rate of mobile terminals and mobile phones is not a constraint (the penetration rate is sufficient).

② Required infrastructure for the implementation of e-Learning

Question	Reply (circled figure indicates the number of relevant replies)
What is the situation of PC usage (for students) for the current Kaizen training in your project?	<ul style="list-style-type: none"> • Students do not (cannot) use a PC 0 • Students bring their own PC 5 • There is a classroom equipped with PCs and students can use the PCs 0 • Students use their own tablet PC 0 • Students use their own smart phone 1 • Other ➢ Some have PCs, but others do not. Most of them have smart phones.
How many participants of the Kaizen training in your project have a smart phone?	<ul style="list-style-type: none"> • Almost everyone 5 • 90% 1 • 80% 1 • 0~70% 0
What is the Internet environment (such as ease of connection, stability, speed, etc.) at our project site (including local areas) like? Examples: Difficult to browse normal websites; difficult to watch web videos, etc.	<ul style="list-style-type: none"> • Good • At the project site, it is easy to have good quality connection • Sometimes (in regional revolt), it is impossible to use the internet. • Difficulties in the speed of the internet is resolved. We've upgraded the capacity to increase efficiency. • Stability and speed of internet change from day to day and are very low in some local areas. • Connected, but weak and unstable. hardly watch web-video. • Internet is not always stable. It's sometimes good but sometimes almost impossible to connect.
What is the general Internet environment in the urban areas of your country like?	<ul style="list-style-type: none"> • Very good • Good quality, we have many internet providers such as ORANGE, CAMTEL, MTN and recently NEXTEL • Depending on areas, there are some areas where it's hard to use the internet. • Good • It depends on the facility of a building such as a hotel or government office or site. • Mobile modem is available, but expensive for the students. • From time to time it's difficult to connect to the internet. The connection is not stable
What is the general Internet environment in rural areas of your country like?	<ul style="list-style-type: none"> • Good/Fair • Some rural areas are not covered by the internet. For areas that are covered, the quality is sometime not very good or very low • Generally speaking, it is hard to use the internet in rural areas than urban area. • Not so bad • It is difficult to connect to the internet. • Very less accessible • Some localities are not accessible to the internet at all

From the above results, as far as JICA's Kaizen project is concerned, trainees often have their own PCs, and almost everyone has a smartphone. On the other hand, Internet connection have practical speeds in urban areas, but are often slow or unreachable in rural areas, and it can be seen that instability is a problem even in urban areas.

③ Your opinion and/or requests for the use of e-Learning

Question	Reply (circled figure indicates the number of relevant replies)
Do you have any comments or suggestions regarding the use of e-Learning in the Kaizen?	<ul style="list-style-type: none"> • Since 2015 the JICA and the Cameroonian government have been running the Kaizen project. The second part of this project has started since February 2019. One of the main project's goals is the promotion of Kaizen in Cameroon, to be known by many people. We think the e-Learning of Kaizen could make more people know about Kaizen and could help us to promote Kaizen in Cameroon. • Since the explanations in e-Learning sometimes accelerate sleepiness of the students, the way of speaking is very important. • e-Learning can be useful but is not almighty. Better to be selective. On the other hand, if it is with the only reading materials, people get tired easily. Minimum visual contents (exercises) might be needed. • It is good to offer KAIZEN training online. However, it is important to ensure that they are followed by practical training in the field, for example in companies. • With KAIZEN, the online training and the CRT are incomplete and must be completed by OJT training for a better understanding and a better efficiency of the trained people.

Among the requests, the characteristic opinion is that e-Learning should be used in combination with training in the field, and that visual content should be included so that learners do not get bored.

(2) ICT Environment (Including Internet Environment), Implementation Situation of e-Learning and Contents Development Market Essential for the Development of e-Learning Teaching Materials

1) Historical Changes of Compulsory Education Enrolment Rate and Literacy Rate

The primary and lower secondary education enrolment rates in the target countries are shown in Table-4. A blank column means that there is no relevant data.

Table-4 Primary and lower secondary education enrolment rates in the target countries

Country	Compulsory Education Age	Primary Education Enrollment Ratio		Lower Secondary Education Enrollment Ratio	
		Boys	Girls	Boys	Girls
Burkina Faso	6-15 years old	71%	67%	27%	26%
Cameroon	6-11 years old	97%	87%	44%	40%
Egypt	6-15 years old	98%	98%	83%	88%
Ethiopia	6-13 years old	89%	82%	35%	33%
Ghana	4-14 years old	87%	88%	50%	50%
Kenya	6-14 years old	83%	87%		
South Africa	7-16 years old	97%	97%		
Sudan	6-13 years old	52%	55%		
Tanzania	7-13 years old	79%	81%		
Tunisia	6-15 years old			80%	85%
Zambia	7-13 years old	86%	88%	31%	30%

Source: UNICEF “The State of the World’s Children 2017”, MOFA Japan

This table suggests that the primary education enrolment rate is fairly good except in Sudan and that there is no significant gender gap. However, the enrolment for lower secondary education drops in many countries. Historical changes of the literacy rate in the target countries are shown in table below.

Table-5 Literacy rate in the target countries (15 years old or more)

Country	Year of Survey																	Latest Data
	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2017	2018	
Burkina Faso			22%		24%	22%	29%							35%			41%	41%
Cameroon	68%						8%			71%							77%	77%
Egypt					71%	66%				72%		74%	76%			81%		81%
Ethiopia				36%	30%		39%									52%		52%
Ghana	58%									71%							79%	79%
Kenya	82%						72%							79%			82%	82%
South Africa							89%		93%	93%	93%	94%		94%	94%			94%
Sudan	61%							54%									61%	61%
Tanzania		69%								68%		78%			78%			78%
Tunisia			74%				77%	78%		79%	80%	80%		79%				79%
Zambia		69%					61%			84%							87%	87%

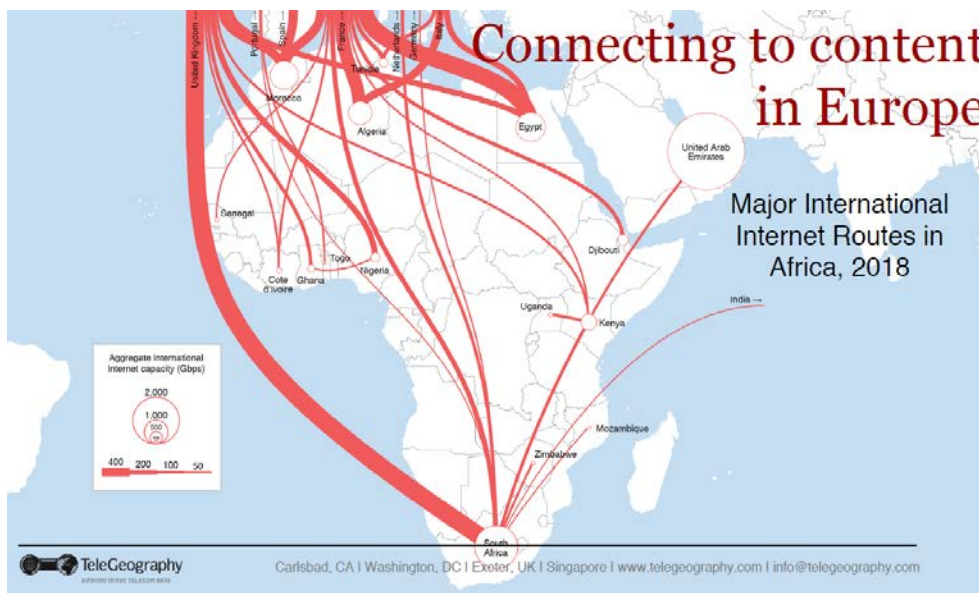
Source: World Bank, World Development Indicators, etc.

The table shows that the literacy rate greatly varies from one country to another. Apart from the simple fact that some people are illiterate, there is a possibility that people of many ethnic groups in African countries (for example, there are more than 80 ethnic groups in Ethiopia) speak their own language and cannot read the official language of their country. This situation suggests that people for which e-Learning is relevant may be restricted to those who can speak and read an

official language or international language, such as English or French. However, as this situation is the same when printed teaching materials are used, people who are capable of attending a Kaizen learning course should be able to take an e-Learning course.

2) Situation of Internet Connection (International Connection, Domestic Connection and Speed, etc.)

International Internet connection with Africa (the backbone connection) has been dominated by connection with North Africa which is near Europe until very recent years. In 2012, the international Internet connection with Sub-Saharan Africa accounted for 33% of the entire backbone connection. This share increased to 50% in 2016, partly because of the recent mobile revolution. Nevertheless, high speed international Internet connection (≥ 250 Gbps) is dominated by North African countries (especially Egypt, Algeria and Morocco). In Sub-Saharan Africa, South Africa is the only country with Internet connection of 250 Gbps or faster. The situation of Africa's international Internet connection (mainly with Europe) is shown in Fig.-3.

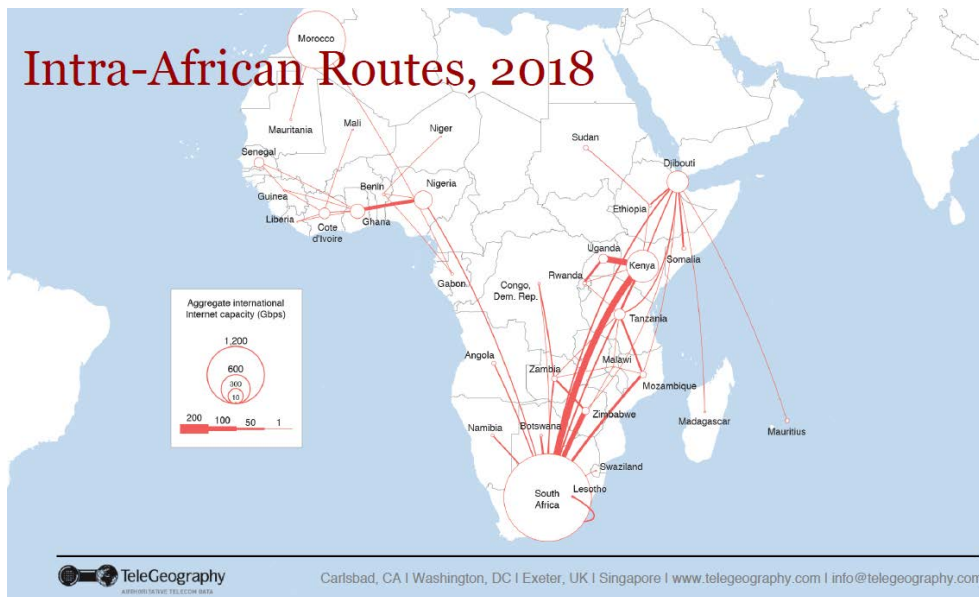


Source: TeleGeography⁵

Fig.-3 Situation of international connection in the entire Africa

Countries not indicated in this figure have either no international connection (with advanced countries) or have very limited bandwidth. Among the target countries, Burkina Faso, Cameroon, Ethiopia, Ghana, Sudan and Zambia fall in this category and their access to the Internet is via one of the listed countries in Fig.-3 which have relatively fast international connection. The situation of such bilateral connection in Africa is shown in the next figure.

⁵ <https://www.afpif.org/wp-content/uploads/sites/26/2018/08/01-International-Internet-Bandwidth-and-Pricing-Trends-in-Africa-%E2%80%93-Patrick-Christian-Telegeography.pdf>



Source: TeleGeography

Fig.-4 Situation of bilateral connection in Africa

The general state of international Internet connection in the target countries is shown in Table-6 based on the information described above (connection with European countries with a broadband service is indicated in bold). The band value has a significant impact on the ease of connection and speed (likelihood of congestion) when access is made from an African countries to a website, etc. in an advanced country. In the case of access from Burkina Faso to a Japanese website for example, the bodily sensed Internet connection speed may in the worst case be 100 times slower than similar access from Egypt.

Table-6 Situation of international Internet connection in the target countries (2018)

Country	International Connection Band (Gbps)	Main Country for Access
Burkina Faso	~10*	Ghana
Cameroon	~10*	Nigeria
Egypt, Arab Rep.	~1,250	France, Italy, UK
Ethiopia	~50	Djibouti, Kenya
Ghana	~300	UK, Nigeria
Kenya	~700	UK, France, South Africa
South Africa	~1,800	UK, France, Kenya
Sudan	~100	Ethiopia
Tanzania	~200	Kenya, Mozambique
Tunisia	~400	France, Italy
Zambia	~100	Zimbabwe, South Africa

Sources: TeleGeography, ITU*














3) Internet Penetration Rate and Cost

The Internet penetration rate in Africa is relatively high in the case of mobile connection. The biggest barrier to use of the Internet is the cost. There is a standard ratio of the Internet downloading cost of 1 GB of data to the monthly income proposed by the A4AI (Alliance for Affordable

Internet) and agreed by the UN. Africa is a region where the cost is the highest in the world. The average figure for Africa in 2017 is 8.8% (that is the level where the cost of using 11 GB of data is equivalent to the monthly income). This is approximately six times higher than the Asian average (1.5%) and 1.6 times higher than the world average (5.5%).⁶ The Broadband Commission for Sustainable Development of UNESCO targets an average figure of 2% or less.⁷

The mobile internet penetration rate and cost (prepaid) in the target countries are shown in Table-7.

Table-7 Penetration rate of mobile Internet connection and cost (as of 2017)

Country	Penetration Rate	Data Download Charge per 1GB (Pre-Paid)		Pre-Paid Ratio	Ratio of 3G Connection or Higher	
		Ratio to monthly GNI per capita	Cost (US\$)			
Burkina Faso	11.4%	13.5 %		6.9	100%	10%
Cameroon	20.7%	6.1 %		6.9	99%	7%
Egypt, Arab Rep.	37.1%	0.5 %		1.3	89%	50%
Ethiopia	11.6%	12.2 %		7.5	98%	67%
Ghana	28.1%	3.7 %		4.6	97%	41%
Kenya	66.8%	4.0 %		4.8	96%	23%
South Africa	51.9%	1.2 %		5.6	87%	51%
Sudan	26.6%	6.8 %		13.5	97%	40%
Tanzania	13.5%	5.4 %		4.0	98%	39%
Tunisia	56.0%	1.1 %		3.3	94%	44%
Zambia	21.0%	12.6 %		13.7	96%	22%
Japan (Reference)	93.3%	1.5 %		47.2	0%	98%
USA (Reference)	88.2%	0.7 %		32.6	26%	90%

Source: Digital in 2017⁸, ICT Prices (2017 - ITU)⁹

As shown in Table-7, the data cost in the target countries is cheaper than Japan or the USA but is extremely expensive in some countries when the said cost is compared to the average monthly income per capita. The differences in terms of the ratio of the data cost to the monthly income is some 27 times between the most expensive country (Burkina Faso: 13.5%) and the least expensive country (Egypt: 0.5%). As far as the payment method is concerned, it must be noted that the pre-paid system is still dominant in African countries while monthly charge is almost 100% in Japan. The ratio of high speed connection of 3G or faster in Africa significantly lags behind Japan where the ratio is almost 100%.

Meanwhile, fixed line Internet connection using ADSL or optical fiber connection serves only 7% of households in Africa as of 2017 and this penetration rate is the lowest in the world.¹⁰ The reasons for this are (i) areas where connection can be physically made tend to be restricted to some parts of large cities and (ii) the cost tends to be higher than that of mobile connection because of

⁶ <https://a4ai.org/new-mobile-broadband-pricing-data-2018>

⁷ <https://webfoundation.org/2018/01/u-broadband-commission-adopts-new-target-for-affordable-internet/>

⁸ <https://wearesocial.com/special-reports/digital-in-2017-global-overview>

⁹ <https://www.itu.int/en/ITU-D/Statistics/ICTprices/Pages/default.aspx>

¹⁰ <https://blog.telegeography.com/fixed-broadband-market-africa-subscribers-seychelles-reunion-south-sudan-chad>

the inclusion of the cable laying cost in the service cost. The situation of fixed line Internet connection in the target countries is shown in Table-8.

Table-8 Penetration rate of fixed line Internet connection plan and cost, etc. (as of 2016 - 2017)

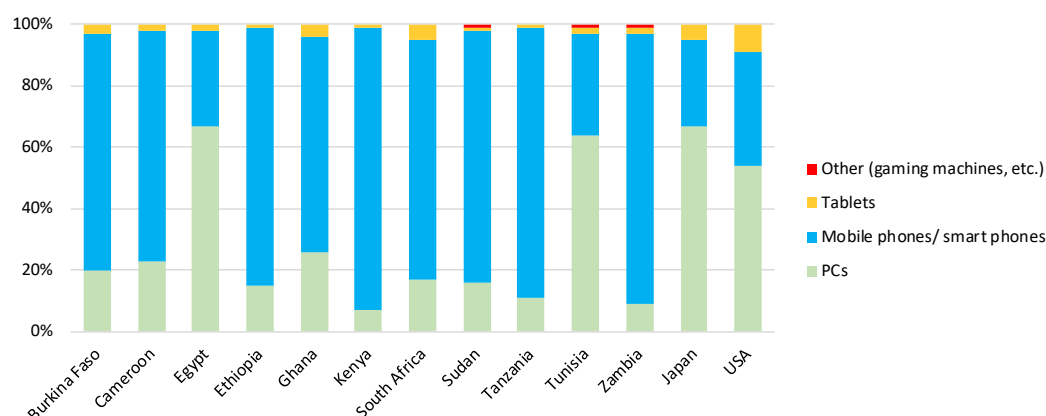
Country	Penetration Rate	Cheapest Broadband Fixed Price Plan (With Ad)				
		Ratio to monthly GNI per capita	Cost (US\$)	Speed (Mbps)	Data Download Limit (GB)	
Burkina Faso	0.1%	42.2%	21.5	0.3	Unlimited	
Cameroon	0.2%	22.6%	25.6	2.0	Unlimited	
Egypt, Arab Rep.	5.4%	1.3%	3.2	1.0	10.0	
Ethiopia	0.6%	18.5%	11.4	0.5	2.0	
Ghana	0.2%	18.5%	23.0	4.0	20.0	
Kenya	0.6%	37.9%	45.5	15.0	Unlimited	
South Africa	3.0%	2.7%	12.4	1.0	1.0	
Sudan	0.1%	7.6%	15.0	0.5	15.0	
Tanzania	3.2%	25.0%	18.8	1.0	Unlimited	
Tunisia	7.0%	1.5%	4.3	4.0	Unlimited	
Zambia	0.2%	24.2%	26.3	2.0	10.0	
Japan (Reference)	31.7 %	1.0%	31.7	12.0	900.0	
USA (Reference)	33.9 %	1.0%	50.0	15.0	Unlimited	

Source ICT Prices (2017 - ITU), World Bank, TeleGeography

Fixed line Internet connection is believed to be unsuitable for Internet connection for e-Learning because (i) the penetration rate of fixed line connection is significantly lower than that of mobile connection, (ii) the service cost is extremely high except in Egypt, South Africa and Tunisia and (iii) the connection speed is not dramatically faster than mobile connection.

4) Equipment Used for Internet Connection

The types and shares of equipment used for Internet connection in the target countries are shown in Fig.-5.



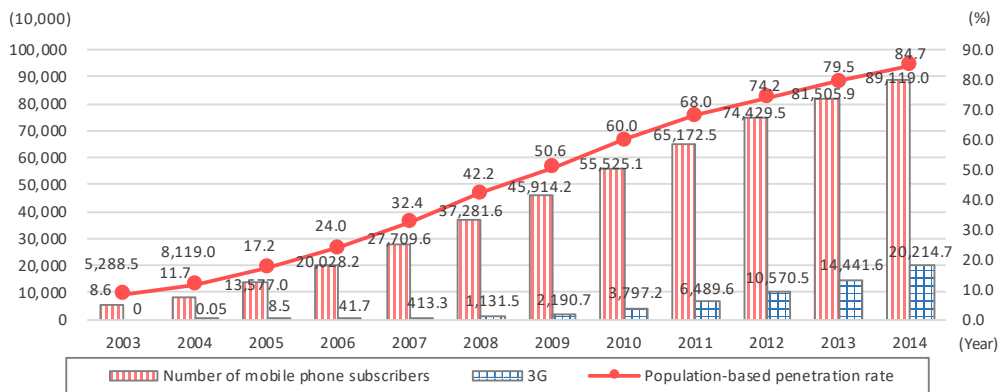
Source: Digital in 2017

Fig.-5 Equipment used for Internet connection

As shown in Fig.-5, access by PC is relatively popular in those countries where broad international Internet connection bands are available and the penetration rate of fixed line connection is relatively high (Egypt, Tunisia and advanced countries, such as Japan and the USA). In other countries, however, mobile phone (smart phone) connection is by far the most popular mode of connection.

5) Historical Changes of the Mobile Phone/Smart Phone Penetration Rate

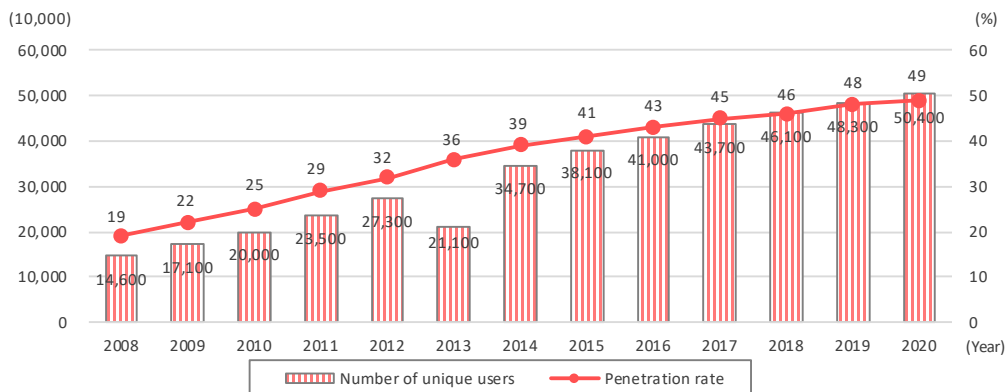
According to the 2017 White Paper on Information and Communication published by the Japan’s Ministry of Internal Affairs and Communications, the penetration rate of mobile phones in African countries has dramatically increased in recent years with the number of subscribers increasing by seventeen times in the 11 years from 2003 to 2014 and the simple ratio to population reaching as high as 84.7% in 2014 even though this percentage does not consider the possibility of multiple ownership by individual persons.



Source: Information Communication White Paper 2005

Fig.-6 Historical changes of the number of mobile phone subscribers and penetration rate in Africa

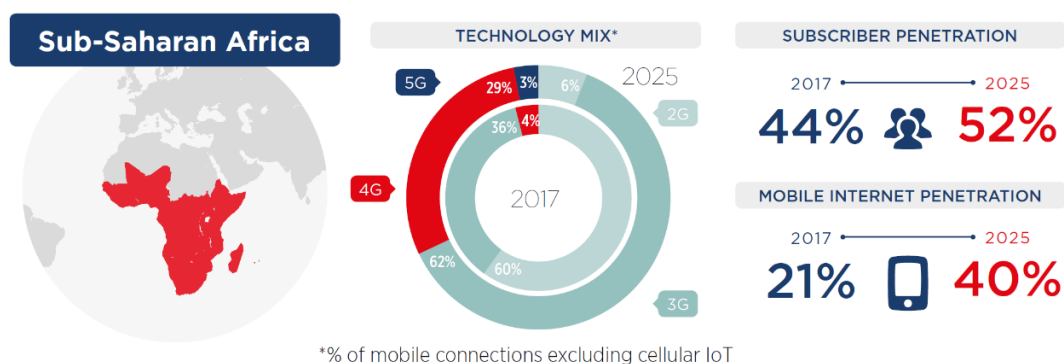
Meanwhile, the penetration rate based on the number of unique users to the population in Sub-Saharan African countries (46 countries) predicted by the GSMA was approximately 46% in 2018. In view of the ratio of the adult population of this region of 30 – 40%, the penetration ratio among the adult population is likely to be 60 – 70%.



Source: Information Communication White Paper 2005

Fig.-7 Historical changes of the number of unique mobile phone subscribers and past and estimated future penetration rate in Africa

In regard to mobile phones, the penetration rate of those models with a function to connect to the Internet (almost the same definition of a smart phone) in the population is 21% as of 2017 according to the latest report by the GSMA.¹¹ This figure is approximately half of the mobile phone penetration rate of 44% for the same year, suggesting that the smart phone penetration rate for the adult population is perhaps 30 – 40% level (approximately half that of mobile phones). The said report states that the ratio of smart phones in mobile phones in Sub-Saharan Africa is 34% which is still lower than the global average of 59% or the average for developing countries of 55%.



Source: GSMA, “The Mobile Economy 2018”

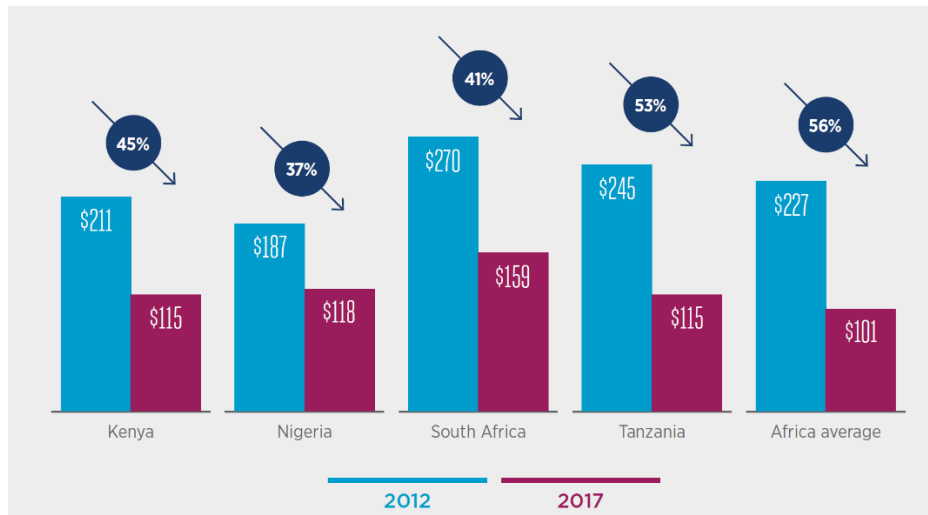
Fig.-8 Penetration rate for mobile phones/smart phones in Africa and prediction for the future

6) Purchase and Upkeep Costs of Mobile Phones/Smart Phones

The price of a smart phone in major African countries has shown a steady declining trend, making it possible to purchase a smart phone at just about US\$ 100 in many countries. Historical changes of the average price of a smart phone in major African countries are shown in Fig.-9 along with the average price in whole Africa. In 2017, the average price in Africa was US\$ 101. As the price in major African countries was higher, the sales price in other African countries would have been lower than the average price.

The average monthly income in the target countries varies from US\$ 122 (Ethiopia) to US\$ 1,249 (South Africa), indicating that the purchase price of a smart phone is similar to the average monthly income in some countries.

¹¹ The Mobile Economy Sub-Saharan Africa 2018 (<https://www.gsma.com/r/mobileeconomy/sub-saharan-africa/>)



Source: GSMA “The Mobile Economy: Sub-Saharan Africa 2018”

Fig.-9 Historical changes of the average smart phone price in Africa

As far as the upkeep cost of a smart phone is concerned, hardly any providers in Africa charge a monthly fee unlike Japan and the popularity of the pre-paid system means that an additional charge seldom occurs unless a phone is actually used.

7) e-Learning Services Already in Use in the Target Countries

Appendix-1 lists the major e-Learning providers that provide e-Learning services in the countries surveyed, and Appendix-2 lists the major educational institutions that provide e-Learning in the Survey, and Appendix-3 shows examples of e-Learning courses conducted by a provider.

3.2 Hypotheses for the Use of e-Learning in Africa

Based on the results of the above-mentioned literature survey and the first field survey (described below), the following alternatives are proposed as hypotheses regarding the possibility of using e-Learning in the target countries. These hypotheses have been verified after the pilot program, and the results are described in 6.10. First, as hypotheses common to all cases, the following points are derived from the survey results.

(1) Hypotheses common to all cases

- Mobile connection is basically the only connection to be considered for Internet connection for e-Learning in the target countries as fixed line Internet connection should not be considered in view of its extremely low penetration rate. However, in the case of adopting CRT as an embodiment of e-Learning, it is considered possible to provide a common fixed internet connection via Wi-Fi for the students to access the contents.

- For the same reason as above and for the serious problem of power outage in the target countries, smart phones instead of PCs should be considered to be the main equipment for e-Learning. However, this also does not exclude options such as the use of a PC provided in the classroom and co-viewing of content on a large screen though a shared PC when e-Learning is implemented as CRT.
- As the mobile connection penetration rate is recognized as being sufficient, at least in urban areas, e-Learning using mobile Internet connection is judged to be relevant as the dissemination method for Kaizen in urban areas where enterprises and factories are generally concentrated.
- As far as the Internet usage cost is concerned, every effort should be made to contain the data charge for e-Learning users because of the low penetration rate of 3G and other high speed connections and the very high ratio of data charge to the average income in some countries. For this reason, the necessity and effects of using video and audio requiring the transmission of mass data should be carefully examined, and images should not be used in large quantity simply for decorative purposes. Also, in some cases, it may be necessary to consider an implementation method that does not force individual users to bear data charges even if the convenience of e-Learning is sacrificed to some extent.
- It is difficult for desk research to determine the actual speed and stability of Internet connection in individual countries. For example, even if the band width is sufficient for international connection in one country, the simultaneous use of the Internet by a very large number of users makes the band width per user very narrow, reducing the bodily sensed speed. However, as a general trend in African countries, there is a high possibility that the speeding up and lowering of cost of mobile Internet will rapidly advance, so it is considered that this will not be a major problem in the future.

(2) Hypotheses for the use of e-Learning according to the KAIZEN training methods

Next, there are two types of training methods for KAIZEN: CRT (Class Room Training) and ICT (In Company Training), and the following uses of e-Learning are possible for each of them.

[Hypothesis A1] Use for alternative training to CRT on Kaizen

This hypothesis envisages the complete replacement of part of CRT for the dissemination of Kaizen by e-Learning. The strategy for e-Learning application in this case involves careful selection of the subjects for CRT and as broad a range of target persons as possible as shown in Table-9.

Table-9 Applicability of e-Learning as alternative training to CRT

Type of Use	<ul style="list-style-type: none"> Alternative Training to CRT
Target Subjects	<ul style="list-style-type: none"> Kaizen basics and all other basic subjects to be learned by all target persons Theoretical and methodological subjects not requiring practical training at the shop floor, etc. Subjects designed to publicize Kaizen to people who do not know about Kaizen
Target Persons	<ul style="list-style-type: none"> Beginners hoping to become Kaizen consultants Business owners considering the introduction of Kaizen Young people interested in Kaizen or learning Kaizen at school, etc. (new Kaizen generation)
Target Areas	<ul style="list-style-type: none"> Any part of Africa with Internet connection (including those areas with slow connection speed)
Mode of Learning	<ul style="list-style-type: none"> Completely on-line registration, learning, testing and certification of course completion (including the issue of the completion certificate) No involvement of a Kaizen lecturer
Composition of Teaching Materials	<ul style="list-style-type: none"> Prepared based on existing teaching materials (PowerPoint files, etc.); the progress of learning is managed by checking the level of understanding of each topic by means of quizzes. There is basically a linear line of learning progress (no branching out). A sufficient volume of explanations and helpful information for users are included to assist self-learning by users. The questions made by users are received and replied to on-line as necessary.
Technical Notes	<ul style="list-style-type: none"> The equipment used is mainly smart phones. The volume of data used by each teaching material is kept to the minimum necessary so that each teaching material can properly function in areas with a slow connection speed or by smart phones with a low processing capability. Video and audio are used as little as possible.
Remark	<ul style="list-style-type: none"> Use of the e-Learning course is assumed not only for all Kaizen projects of JICA but also for open access by the public.

[Hypothesis A2] Use for supplementary training to CRT on Kaizen

Here, the supplementary use of e-Learning to CRT on Kaizen by a Kaizen lecturer is envisaged. The strategy for e-Learning application in this case involves the use of e-Learning to demonstrate exercises on the shopfloor and examples of Kaizen, all of which cannot be fully covered by CRT, to enhance the awareness of Kaizen issues in ICT.

Table-10 Applicability of e-Learning as supplementary training to CRT

Type of Use	<ul style="list-style-type: none"> Supplementary Training to CRT
Target Subjects	<ul style="list-style-type: none"> Contents which can simulate ICT exercises on the shopfloor Supplementary teaching materials on Kaizen examples, etc. designed to facilitate understanding of lectures Exercise materials which must be repeatedly practiced
Target Persons	<ul style="list-style-type: none"> Participants of CRT on Kaizen Persons who have already mastered Kaizen theories but whose understanding of Kaizen in the field is inadequate
Target Areas	<ul style="list-style-type: none"> Areas with relatively high speed and stable Internet connection (urban areas, etc.)
Mode of Learning	<ul style="list-style-type: none"> Automatic e-Learning registration for students who have registered for CRT
Composition of Teaching Materials	<ul style="list-style-type: none"> Exercises requiring input and operation by the user AV teaching materials, such as photographs and audio of Kaizen application sites, illustrations of tools, etc. Inclusion of FAQ (Frequently Asked Questions) on the e-Learning teaching materials and links to relevant information

	<ul style="list-style-type: none"> As far as the teaching direction is concerned, it is necessary to make branching out, skipping of certain contents and return to previous steps possible to reflect the progress of the CRT.
Technical Notes	<ul style="list-style-type: none"> The equipment used is smart phones or PCs. As teaching materials which are appealing to both the visual and auditory senses are the main materials, the use of relatively fast Internet connection is assumed. Interactive elements are incorporated as much as possible.
Remark	<ul style="list-style-type: none"> Use of the e-Learning course is assumed for all Kaizen projects of JICA.

[Hypothesis A3] Use for field reference in ICT on Kaizen

Here, the use of e-Learning as a dynamic reference is considered to solve questions encountered during ICT on Kaizen.

Table-11 Applicability of e-Learning as a field reference for ICT on Kaizen

Type of Use	<ul style="list-style-type: none"> Field Reference for ICT on Kaizen
Target Subjects	<ul style="list-style-type: none"> Glossary for use in ICT and explanatory information on technical elements Reference material compiling the learning contents of CRT FAQ for the entire Kaizen training
Target Persons	<ul style="list-style-type: none"> Participants of ongoing ICT on Kaizen Persons in charge of Kaizen at enterprises practicing Kaizen at the shop floor
Target Areas	<ul style="list-style-type: none"> Areas with relatively high speed and stable Internet connection (urban areas, etc.)
Mode of Learning	<ul style="list-style-type: none"> No requirement for registration (in the case of a reference material for all) Automatically accessible by participants of ongoing ICT
Composition of Teaching Materials	<ul style="list-style-type: none"> Contents which allow a search using entries, etc. like a dictionary Links from individual contents to related contents Videos and images, etc. can be displayed to supplement explanations for individual items. However, it is the decision of the user to use this function or not.
Technical Notes	<ul style="list-style-type: none"> The equipment used should be smart phones since they are used in the fields. Use of searchable features, such as Wiki and databases, unlike ordinary e-Learning teaching materials. A random access function is required.
Remarks	<ul style="list-style-type: none"> Use of this reference e-Learning facility is assumed not only for all Kaizen projects of JICA but also for open access by the public.

(3) Hypotheses for the implementation method of e-Learning system

On the other hand, from the results of the field survey, the following five hypotheses can be considered for the implementation method of e-Learning system according to the development status of the ICT infrastructure necessary for the e-Learning implementation in Africa. These are not hypotheses that are mutually independent and exclusive but should be selected as an optimal method depending on the situation of the implementing body (organization) of e-Learning and the target student group. In addition, it is desirable to select these hypotheses in combination with hypotheses according to the training method of KAIZEN listed in the previous section.

[Hypothesis B1] Online Personal Training

This is the most common method of implementing e-Learning, allowing students to individually learn at any time and at any place by accessing the e-Learning system on the Internet, and the administrator can track and manage their progress.

- Currently, this format is referred to as the standard e-Learning.
- Issue a login account for each user and a management account for the manager of the implementing organization.
- Users need to access by their own internet connection, and the cost must be borne by the user (unless they use public free Wi-Fi etc.). Therefore, depending on the economic status of the user, it may be an economic and psychological burden for e-Learning participation.

[Hypothesis B2] Blended Learning with CRT

This is a form that was requested by multiple organizations in the field survey. Students are gathered in the classroom, and view the contents such as video and PPT on the big screen. While the pre-study / review, test etc. is implemented in the e-Learning system. This method is basically the same as the above-mentioned hypothesis B1 except that the content is simultaneously viewed and listened by all students, and individual management of students is also possible.

- An account is issued for each user as in Hypothesis B1, and a management account is also issued.
- Content is almost the same as Hypothesis B1, but some adjustments may be necessary for B2. In addition, there is an advantage that the burden on the Internet is less at the time of viewing since a single content is viewed, so that there is a possibility to use more video and other materials.
- The biggest advantage of this to hypothesis B1 is that the implementing entity can provide the Internet connection in the classroom to the user by Wi-Fi etc., and the user does not have to pay the data charge to access to the e-Learning system. In African countries where data charges for mobile are high, this is a huge economic and psychological benefit for users.

[Hypothesis B3] CRT with Online / Offline contents

This is a further simplification of Hypothesis B2, and is basically a traditional CRT using digital teaching materials that are online or offline previously downloaded. Materials and tests (even if they can be downloaded from the site) are basically printed and paper-based.

- Issues only an administrator account for accessing online content. Teachers use this account to view and download teaching materials.

- It should be noted that even in this case, all content exists on the Internet, and the e-Learning provider can always manage the latest version of teaching materials in a centralized manner. For example, addition of new subjects or updating of existing subjects only requires editing the content on the Internet, and all teachers and users can always use the latest contents automatically. This is very different from the method of distributing content by DVD or the like. If it is assumed that the teaching materials are distributed by physical media such as DVDs, the DVDs must be copied and physically distributed to all the places where the teaching materials are needed, including remote areas. Addition or update of the contents always involves the rebuilt of DVDs and their physical distribution, and its management cost is enormous. Therefore, even if schools are already equipped with co-viewing equipment such as plasma displays and PCs, distributing teaching materials in physical media should be avoided unless access to the Internet is impossible. Even in areas where the Internet connection is slow, the risk of using physical media can be avoided by using file sharing software (DropBox, One Drive, etc.) to download the latest teaching materials automatically, for example.
- Challenges of this method include those when the Kaizen training organization tries to earn income by implementing e-Learning in the future, since it is difficult to grasp the number of students and to prevent unauthorized use of downloaded content.

[Hypothesis B4] Unmanaged e-Learning by open access contents

This is a form of online e-Learning specialized for providing teaching materials only, and provides public contents that anyone can access without requiring an account or login.

- Since anyone can access without login, it is effective for publicizing the basic idea of KAIZEN to the public. For example, by actively publicizing Kaizen introductory subjects as public content for free, then performing user registration at the stage of advancing to the next contents after that, or then guiding users to a Kaizen training organization, it becomes an effective marketing method for Kaizen.
- No need for an account means that it is not possible to measure the progress or comprehension level of individual users. However, it is still possible to insert a quiz to record the general rate of correct answers, or to insert an optional questionnaire at the end of the content to widely collect opinions and comments.

[Hypothesis B5] Providing contents to organizations who have their own e-Learning system

This is a utilization method of Kaizen e-Learning by providing only the content to an institution that already has its own e-Learning system such as a university or a training institution. For example, it may be possible to provide the contents of the Kaizen subject as a part of their e-Learning curriculum by signing an agreement or a contract regarding the use of the content.

- Technically, however, in order to use existing e-Learning content in another e-Learning system, in most cases the data format of the e-Learning content needs to be largely reworked, and it is in one sense not so realistic considering its cost and labor.
- It will not be impossible to achieve this if the data format is well adjusted such that viewing content is prepared as video content or in PPT format, and other parts such as quizzes are made as raw data in text format. However, even in such cases, it is always necessary to recompile the content by the receiving institution.

The said 5 hypotheses regarding implementation method of e-Learning system are combined with the hypotheses of the e-Learning utilization method according to the Kaizen training method described in the previous section, and the results are summarized in a table on the next page.

Table-12 Summary of hypotheses regarding implementation method of e-Learning system and the hypotheses according to Kaizen's training method

Hypotheses according to Kaizen's training method		Online Provided Materials							Use Environment			Account Required			Individual Learner Management	Monetize by e-Learning	Expected Users
Hypotheses regarding implementation method of e-Learning system		A1 Alternate	A2 Supplemental	A3 for ICT	Videos	Quiz	Test	Questionnaire	Internet connection provided by:	Data cost is borne by:	Device used for e-Learning	Learners	Teachers	Administrators			
B1	Online Personal Training	○	×	○	Δ _{*1}	○	○	○	Learner	Learner	• Learner's device only	✓	✓	✓	○	○	Company managers, EKI, Kaizen consultants, Universities
B2	Blended Learning with CRT	○	○	Δ	○	○	○	○	IB + Learner ^{*4}	IB	• PC and large screen of IB • Learner's device or provided PC by IB	✓	✓	✓	○	○	Company employees, EKI, TVET, Universities
B3	CRT with Online / Offline contents	○	○	×	○	×	×	×	IB	IB	• PC and large screen of IB • No device needed for Learners		✓	✓	Δ _{*2}	Δ _{*5}	Company employees, TVET, Schools
B4	Unmanaged e-Learning by open access contents	○	×	Δ	Δ _{*1}	Δ _{*3}	×	Δ _{*3}	Learner	Learner	• Learner's device only			✓	×	×	General Public
B5	Providing contents to organizations who own their e-Learning system	Depending on the provision method of the IB														Δ	University, Large Company

IB = e-Learning Implementing Body (Organization, Company, School, etc.)

*1 ... While sufficient in terms of available bandwidth (speed), data charges for downloading huge video data may increase.

*2 ... Done by offline method (such as papers etc.).

*3 ... Since individual users can not be identified, statistics will be given by anonymous data.

*4 ... Students do not need to use their own mobile connection by using Wi-Fi etc. in the classroom.

*5 ... In the case of permitting content download, it is necessary to sufficiently take measures against illegal copying.

4. Result of field survey

The field survey has been implemented in Addis Ababa, the capital of Ethiopia, and in representative local cities that have been successful in dissemination activities of KAIZEN and are suitable for pilot implementation, Dire Dawa and Kombolcha (partly in nearby Dese). A total of five field surveys were conducted. The first and a part of the second survey were for the survey on the needs of KAIZEN e-Learning in Ethiopia, its environment for the use of teaching materials, and the request for participation in a pilot program. The remaining field surveys were for the preparation, operation, monitoring, learning support, and feedback collection of the pilot program. Appendix-4 shows the detailed schedule of the first and second field surveys. This section shows the results of surveys other than the implementation of pilot program (see 6.).

4.1 Visited places and their status of Kaizen activities

The visited places were basically selected as organizations and companies that EKI and DDMKI provide Kaizen consulting, and other organizations that provide education on Kaizen were also included. We also visited foreign-affiliated companies that are resident in some local industrial parks. The following are the lists of destinations in each city visited during the field survey, and the status of Kaizen activities at the destinations.

(1) Addis Ababa

Table-13 Sites visited in Addis Ababa and their status of Kaizen activities

Name of visited site	Category	Status of Kaizen activities
Ethiopian Kaizen Institute (EKI)	Kaizen dissemination organization	An organization responsible for promoting Kaizen. JICA's C/P organization for Kaizen-related projects, providing consulting and training on Kaizen to companies and others.
Ministry of Trade and Industry	Ministry (EKI belongs to)	Until October 2015, the ministry was responsible for EKI as the former Ministry of Industry, and there is a Kaizen department in the ministry.
Federal Civil Service Commission	Government organization (EKI belongs to)	It is a high-ranking organization (formerly Ministry of Public Service Human Resources Development) to which EKI directly reports, and has a person in charge of Kaizen.
Federal TVET Agency	Government organization	An organization that oversees TVET nationwide. TVET nationwide teaches Kaizen as part of their classes. They are currently building a new Internet server system that allows e-Learning.
Addis Ababa University (IE Faculty)	University	There is a department that study productivity improvement, including Kaizen, and students also provide Kaizen guidance to various institutions as practical training. Already have an e-Learning system on campus.
Leather Industry Development Institute	Vocational training institute	Working on Kaizen under the guidance of EKI and has a dedicated Kaizen team.
Chamber Academy	Industry training institute	A training institution attached to the Chamber of Commerce and teaches Kaizen to member companies.
Red Cross Society	Public organization	Has been working on Kaizen activities for some time, and has an e-Learning system.
Anbessa Shoes Factory	Manufacturing	Working on Kaizen activities company-wide.
NA Metal Engineering	Manufacturing	Working on Kaizen activities company-wide.

(2) Dire Dawa

[Reason for selection]

Dire Dawa is the second largest city in Ethiopia and hosts the Dire Dawa Management and Kaizen Institute (DDMKI) which is a subsidiary office of the EKI. The potential need for Kaizen among local industries is believed to be strong. It has been reported that Internet connection is extremely poor despite the size of the city. In the light of the purpose of the Study, this local situation provides an environment which can act as a touchstone for examination of a desirable way of establishing effective e-Learning in a developing country or region.

Table-14 Sites visited in Dire Dawa and their status of Kaizen activities

Name of visited site	Category	Status of Kaizen activities
Dire Dawa Management and KAIZEN Institute (DDMKI)	Kaizen dissemination organization	Engaged in Kaizen promotion activities in the Dire Dawa area as a local Kaizen organization. The number of staffs is small but they are very active.
Dire Dawa University	University	A dedicated Kaizen department has been set up to carry out Kaizen activities on campus facilities (especially research facilities).
Ethio-Italy Polytech College	Vocational training institute	Efforts have begun with an instructor in charge of Kaizen.
Legehare Primary and Secondary School	Elementary education school	Has been conducting Kaizen activities at primary education institutions, and the effort has been commended. Teaches students the basics of Kaizen.
Sabina General Hospital	Medical institution	A relatively large, core hospital of the region, and has a Kaizen staff member working on materials management, etc.
Dile Chora Referral Hospital	Medical institution	Although it is a small hospital in the suburbs, staff members are carrying out Kaizen efforts.
National Cement	State-owned enterprise	Large-scale state-owned enterprises that has introduced full-fledged Kaizen activities, and have set up Kaizen teams in each part of the factory.

(3) Kombolcha

[Reason for selection]

The city has Kombolcha Textile, the state-owned enterprise that has been engaged in KAIZEN activities on a large scale from the earliest days in Ethiopia, as well as TVET, which is also active in KAIZEN activities. There is also a recently completed industrial park with state-of-the-art facilities, and it is considered that we could introduce Kaizen e-Learning to foreign-affiliated companies and invite them to participate. In addition, the size of the city was very small compared to Dire Dawa, and I there was a high possibility that the Internet environment could be compared.

Table-15 Sites visited in Kombolcha and their status of Kaizen activities

Name of visited site	Category	Status of Kaizen activities
Wollo University	University	KAIZEN training is provided to staff, and KAIZEN is applied to equipment management on campus.
Kombolcha Polytech college	Vocational training institute	In addition to teaching the basics of Kaizen, also conducting Kaizen activities to manage training equipment.
W/ro Sihen Polytech College	Vocational training institute	In addition to teaching the basics of Kaizen, also conducting Kaizen activities to manage training equipment. A school in the neighboring town of Dese.
Kombolcha Textile Industry	State-owned enterprise	A large state-owned factory and has been promoting Kaizen activities for a long time. There is even a courtyard called Kaizen Park.
Kombolcha Industrial Park	State-owned enterprise	A brand new industrial park, attracting foreign-affiliated companies. They know KAIZEN, but have not been specifically implemented.
Carvico Ethiopia PLC	foreign-affiliated company (Italy)	Company in the above industrial park. The Italian-style production management close to Kaizen is implemented.
Saytex spinning	foreign-affiliated company (China)	Company in the above industrial park. Kaizen is not particularly implemented, but Chinese style production management is performed.

4.2 The needs for KAIZEN e-Learning

In the field survey, the Study Team explained about the overview of the survey and the implementation of pilot program, and asked about their intention to participate in the pilot. Almost all the sites visited showed high interest in e-Learning in the KAIZEN field, and responded that they had the need. However, this might be a natural result, since these organizations are selected because they are already conducting Kaizen activities. In the industrial park of Kombolcha, visits were also made to its resident foreign-affiliated companies that had not been selected in advance. The Italian company showed interest, while the Chinese company did not (since they said they are doing China-style production management). Even for organizations who responded they are interested, different opinions on the reasons were obtained as follows.

- Universities and Hospitals: For the training of their internal KAIZEN staff and team.
- TVET : For the sustainable training on KAIZEN (because lecturers who teach KAIZEN are difficult to stay permanently).
- Private companies : Already engaging in KAIZEN but for convenience of self-learning of employees. (No need to gather at classroom, and learn at any time as they like.)

In addition, there are few places where e-Learning has been used so far, except for some places such as universities and the Red Cross Society, and it is hard to say that most organizations fully understand exactly what e-Learning is. In general, they tend to have perception to study with digitalized materials in the classroom rather than to be able to study individually online.

4.3 Learning environment of e-Learning

The result of the survey on learning environment of e-Learning at each visited site is described below.

(1) Status of ICT infrastructure and Internet access at the site visited

The table-16 shows the summary of status of ICT infrastructure and Internet access at each site visited.

Table-16 Status of ICT infrastructure and Internet access at each site visited

City	Name of visited site	ICT infrastructure for e-Learning			Internet speed (bps)			PO*
		LAN ¹	PC ²	Note	Fixed	Mobile	Gen.	
Addis Ababa	Ethiopian Kaizen Institute (EKI)	Δ	○	Old LAN equipment	35M	5.2M	3G	Yes
	Ministry of Trade and Industry	○	○		10M	3M	4G	Yes
	Federal Civil Service Commission	○	○		50M	3M	4G	Yes
	Federal TVET Agency	○	○		5M	3M	3G	Yes
	Addis Ababa University (IE Faculty)	○	○	Has internal e-Learning system	50M	4M	4G	Yes
	Leather Industry Development Institute	○	○		50M	1M	4G	Yes
	Chamber Academy	○	○		15M	4M	4G	Yes
	Red Cross Society	○	○		10M	3M	4G	Yes
	Anbessa Shoes Factory	○	○		20M	1M		Yes
	NA Metal Engineering	○	Δ	No PC in the field	4M	2M	4G	Yes
Dire Dawa	Dire Dawa Management and KAIZEN Institute (DDMKI)	○	○		6M	2.3M	3G	Yes
	Dire Dawa University	○	○		50M	1M	3G	Yes
	Ethio-Italy Polytech College	○	Δ		8M	2M	3G	Serious
	Legehare Primary and Secondary School	×	Δ		4M	2.4M	3G	Yes
	Sabina General Hospital	○	Δ		4M	2.2M	3G	Yes
	Dile Chora Referral Hospital	○	○		5M	3M	3G	Yes
	National Cement	○	Δ	No PC in the field	60M	4.2M	3G	Yes
Kombolcha	Wollo University	○	○		150M	1.3M	3G	Yes
	Kombolcha Polytech college	×	Δ	3 PCs at library	6M	3.3M	3G	Serious
	W/ro Sihen Polytech College	Δ	Δ		8M	3.2M	3G	Yes
	Kombolcha Textile Industry	○	○		8M	2M	3G	Yes
	Kombolcha Industrial Park	○	○		10G	4M	3G	Some
	Carvico Ethiopia PLC	○	○		20M	4M	3G	Some
	Saytex spinning	○	○		20M	4M	3G	Some

* ... Problem of power outage

1 ... ○: Has organization-wide LAN, Δ: Has LAN in limited places, ×: No LAN environment

2 ... For potential target users of e-Learning, ○: Has enough PCs, Δ: PCs are not enough, ×: No PC at all

- As a general trend, private companies and universities have relatively improved ICT environments, and many have organizational LANs and server rooms. On the other hand, TVET, primary education institutions, hospitals, etc. did not have good ICT environment such as LAN in the organization and PCs for all staff members, and there were some problems for introducing regular e-Learning.

- Most sites have power outages as the biggest problem, not only in organizations that do not have a UPS, but also in those who do have UPS but power outages often exceed the capabilities of the UPS or have a generator but it doesn't work due to maintenance issues. Even if some use notebook PCs that can operate for a relatively long time even during a power outage, they cannot connect to the Internet if the Wi-Fi device is turned off. From these facts, when using a PC for e-Learning, it is necessary to thoughtfully consider the risk of a power outage.
- Regarding the Internet connection, many organizations use the fixed line Internet, but considering the number of users using the line, the bandwidth (several Mbps to several tens of Mbps) is often not sufficient. On the other hand, the mobile Internet has a sufficient speed (about several Mbps) as long as using 4G line by a single user, and is a better choice than fixed line in terms of availability since it can keep connection even in a power failure by the mobile base station with a backup power supply. However, the area of 4G coverage is limited to metropolitan areas, and since many users still use 3G lines, the bandwidth is not enough to access contents with a large amount of data such as video. In addition, since data download requires a pay-as-you-go fee, it is important to determine whether the user can bear the cost.
- The stability of Internet lines in Ethiopia, whether fixed or mobile, is not very good. Measuring the speed of the Internet often gives very different numbers each time, and there are times during the day when you cannot connect at all. The following figure shows an example of changes in response time (time required to receive the first response) when accessing the Ethio-telecom website from Addis Ababa city. The change is intense. For example, there are quite a few cases where the response time exceeds 10 seconds, and this means that it takes more than 10 seconds from the start of accessing the website until “starting to display the page”, and it means in the case of e-Learning that it takes 10 seconds plus downloading time of the teaching material to show the teaching material.

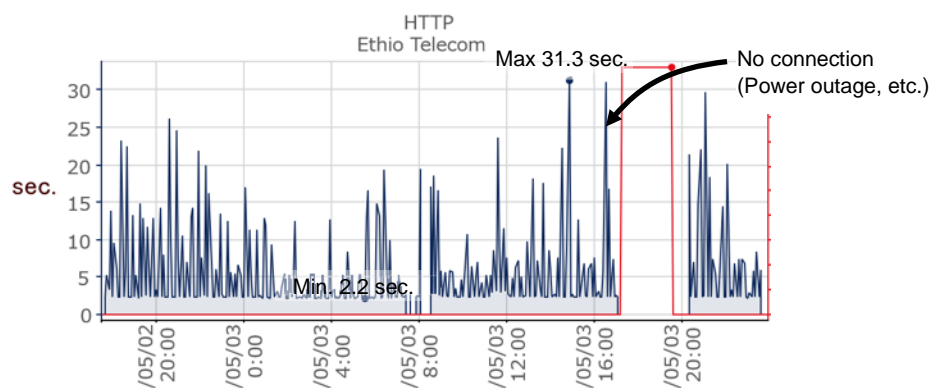


Fig.-10 Example of HTTP response time (Ethio-telecom)

At the time of the first field survey (April-May 2019), the speed was still relatively stable, but the situation deteriorated in both line stability and average speed since the second field survey.

(2) Status of e-Learning providers, content development companies, and ICT infrastructure providers

- As a result of searching a local company that produces e-Learning content in Addis Ababa, we found the following company and we visited there to discuss the possibility of cooperation in the pilot project.

- Lucy Academy (<https://www.lucyacademy.com/>)

The company offers e-Learning services to Jimma University¹² and to 4 other local universities, and has a simple recording studio within the office. The studio records online lessons by university lecturers and provides e-Learning services mainly via the customer's in-house LAN and Internet. However, since it is a small company with only a few employees and had barely the required minimum level of equipment, the company was not selected for this survey.

- In order to provide e-Learning services, a web server for hosting the e-Learning system is required, but in Ethiopia there is only a hosting service provided by Ethio Telecom¹³, and their plan is basically for the government and for state-owned enterprises. Other private companies have their own servers (on premise) or use hosting services in the United States and Europe.

- In the field survey, we also visited representative ICT solution providers and development companies in Ethiopia. The results of the Ethiopian ICT industry are summarized below.

- When developing Web for Ethiopian companies and organizations, the development work itself is done by a local Ethiopian company, but the Web server mostly uses an overseas hosting service.

- However, Internet sites used by many people such as Google and Facebook have their official caching server (mirror server) in Ethiopia, and these mirrors are accessed from within the country. This means that internet users in Ethiopia can access contents in domestic mirrors without going through expensive international lines.

- Some Ethiopian solution providers also develop smartphone apps, but those with large businesses are mainly engaged in customizing existing systems (open source software, ERP¹⁴, etc.).

¹² <https://www.lucyacademy.com/ju/>

¹³ <https://myportal.ethiotelecom.et/>

¹⁴ https://en.wikipedia.org/wiki/Enterprise_resource_planning

- At the time of the third field survey, based on the recommendation from Mr. Mekonnen (Director of EKI), we visited Adama University of Science and Technology, which has the latest equipment and teaching materials for e-Learning.
 - The facilities of this university were equipped with the cooperation of KOICA. There is a full-scale production and broadcasting studio with professional equipment, and in the adjacent multimedia classroom, it is possible to give lecture with e-Learning teaching materials produced in the studio. A dedicated team for the teaching material production has been organized and dispatched to Korea to receive technology transfer. Some video teaching materials have already been produced, and the teaching materials can be distributed via the Internet. An online entrance exam is already being conducted.
 - Photos of the university’s e-Learning facility are listed in Appendix-7.

(3) Status of the local ICT-related equipment market

- Cell phone shops, including smartphones, are ubiquitous, even in small towns like Kombolcha.
 - According to statistics, smartphone brands with the largest market share in Ethiopia are Samsung in Korea at No. 1 and Huawei in China at No. 2 (see the figure below), but these two smartphones are luxury products in Ethiopia due to their high price, therefore the market share based on the sales amount is high. If you go to a mobile shop in Addis Ababa, the most popular brand is actually Techno¹⁵ of Hong Kong, which has a manufacturing base in Ethiopia. China (Shenzhen) itel¹⁶ follows.

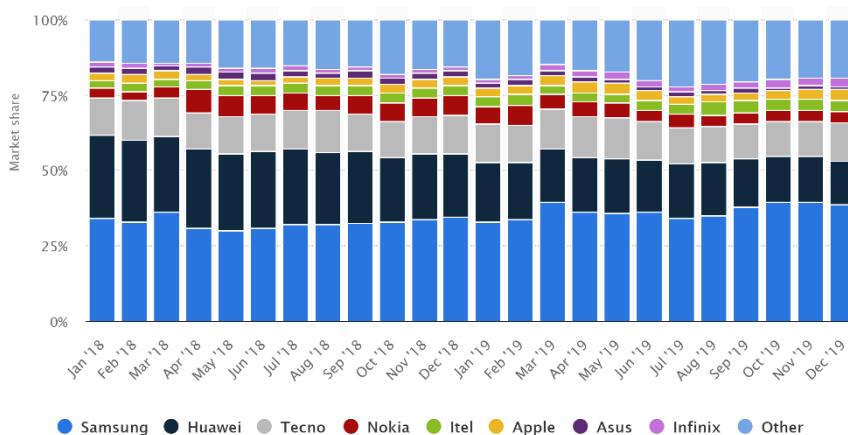


Fig.-11 Market share of smartphones by maker¹⁷

¹⁵ <https://www.tecno-mobile.com/>, https://en.wikipedia.org/wiki/Tecno_Mobile

¹⁶ <http://www.itel-mobile.com/>, <https://en.wikipedia.org/wiki/Transsion>

¹⁷ <https://www.statista.com/statistics/1061447/market-share-held-by-mobile-phone-vendors-in-ethiopia/>

- In small towns, they sell many feature phones¹⁸ that are cheaper than smartphones¹⁹. Major manufacturers of feature phones are itel and Techno, with some made by Nokia.

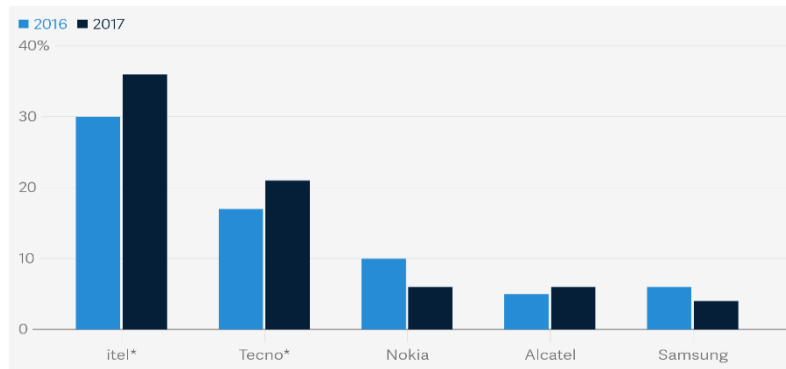


Fig.-12 Market share of feature phones by maker²⁰

The price ranges for these mobile phones are shown in the table below.

Table-17 Mobile phone price range in Ethiopia

Category	Price range	Examples
Feature phones	1,500 - 3,000 Birr (~JPY 5,500 - 11,000)	itel, Techno is the mainstream
Entry-level smart phones	2,000 - 5,000 Birr (~JPY 7,400 - 18,500)	Techno, itel is the mainstream
Luxury smart phones	30,000 Birr or more (~JPY 110,000 or more)	iPhone X: 47,000 Birr (~JPY 174,000) Galaxy 10: 37,000 Birr (~JPY 137,000)

* ... 1 Birr = JPY 3.7 (rate used in this document)

- The PC market is not as big as smartphones. Most notebook PCs sold in shops are second-hands.
 - The most preferred brand is Toshiba, followed by Dell and HP.
 - Typical second-hand notebook PC model and price are:
Dell Vostro 15 3000 (RAM:4GB, HDD:1TB) ≈ 26,000 Birr (~JPY 96,000)
 - Tablet PCs are not common. Some stores sell 2 in 1 PCs²¹, for example, local brand STIP²² sells a small 2 in 1 PC made in Ethiopia for 7,000 Birr (~JPY 26,000) (CPU: Atom, LCD: 10", 4GB RAM, 32GB SSD).
 - Wi-Fi routes are also popular. Typical model is:
TP-Link TL-WA901ND 450Mbps ≈ 4,500 Birr (~JPY 16,700)

¹⁸ https://en.wikipedia.org/wiki/Feature_phone

¹⁹ <https://www.dw.com/en/ethiopia-simpler-phone-smarter-choice/a-37701383>

²⁰ <https://qz.com/africa/1206462/smartphones-lost-market-share-to-feature-phones-in-africa-last-year/>

²¹ <https://www.weblio.jp/content/2in1>

²² <https://www.facebook.com/STIPEthiopia/>

- There are few internet cafes, but some regular cafes and restaurants offer Wi-Fi service.
 - The initial cost of ADSL is about 7,000 Birr (~JPY 26,000) and the monthly fee is about 2,000 Birr (~JPY 7,400) (depending on the contracted bandwidth).
- The price difference between Addis Ababa and other local cities is as follows.
 - The price of notebook PCs is generally cheaper in Addis Ababa and there are also more choices.
 - Smartphone prices are almost the same even in rural areas at regular dealers, but in Dire Dawa smartphones brought directly from abroad without passing through regular routes are sold cheaply.

5. Participation to KAIZEN-related events

5.1 Africa Kaizen Annual Conference

Participated in the Africa Kaizen Annual Conference 2019 held in Tunisia from June 23 to 26, 2019 as a part of this survey, and presented a summary of the study and the implementation of pilot program in the 4th breakout session “Utilizing Digital Technology in Kaizen Dissemination and Implementation”. Appendix-6 shows the material of presentation made on the day.

The presentation focused on the contents of the Inception Report of the Study, and presented the overview of the Study, the results of the literature survey, and hypotheses on e-Learning implementation methods. Session participants did not have any particular questions about the hypotheses of the e-Learning implementation method, which was the main theme of the presentation, but the participant in the surveyed countries pointed out that the data of Internet fees etc. in the literature survey result was incorrect (too expensive). Since the results of the literature survey were based on reports from international organizations such as the ITU, it was not possible to amend the data at that time. However, in this final report, the literature survey result data has been updated based on the comment.

5.2 The 7th Tokyo International Conference on African Development (TICAD 7)

At TICAD 7 held in Japan in August 2019, the Study Team introduced a video material of “Muda Elimination” developed for e-Learning pilot program as a side event of the conference, and gathered opinions and comments from the participants. They were reflected in the improvement of the teaching materials and the development of the remaining two subjects.

Even though it was a side event, in fact, we only played teaching material video continuously, so we could not obtain opinions or comments on the detailed contents of the teaching materials. But the most frequent comment was that the speed of narration in the video was too fast, so some adjustments to slow the narration speed down were made.

6. Implementation and operation of the pilot project

6.1 Outline of the pilot project

The overall image of the pilot project is shown in Fig.-13.

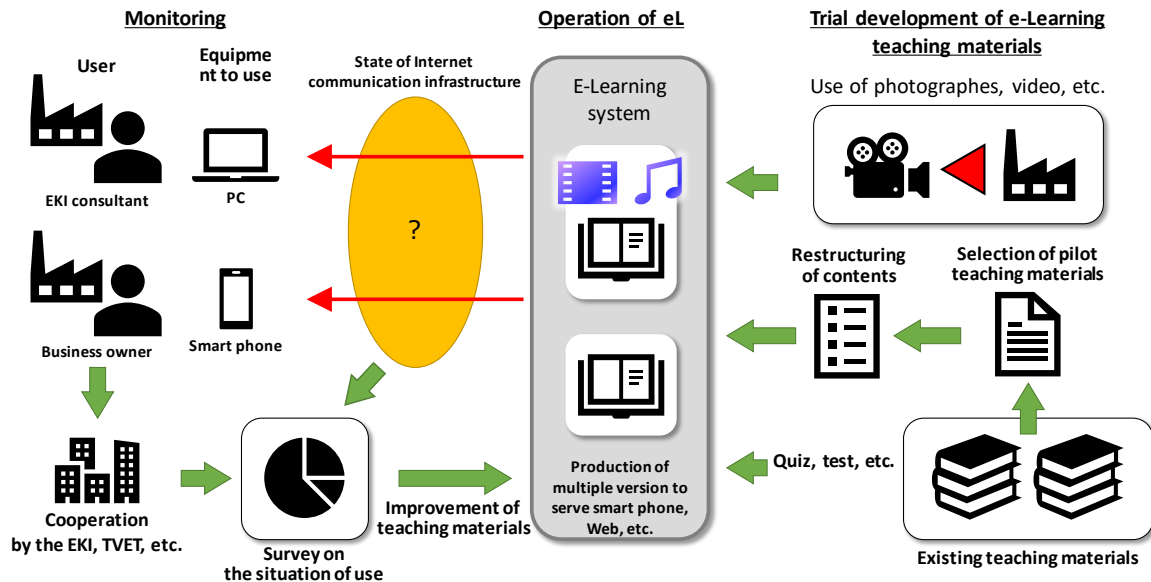


Fig.-13 Overall image of the pilot project

6.2 Development of teaching materials

In this pilot program, teaching materials for three subjects were developed as follows. Each subject was developed one by one in chronological order, and a development schedule was set up so that the first teaching material to be developed could be introduced on TICAD. The reason why we decided to develop “Muda Elimination” as the first material instead of “5S” is as follows.

- Toyota is one of the leading companies in Kaizen, and Toyota Production System (TPS) is called a lean production system in the world that thoroughly eliminates Muda (waste). Therefore, Kaizen can be said to be elimination of Muda.
- In addition to Muda that is taken up in everyday life, there are Mudas that are hard to be considered in common sense. Muda in KAIZEN has broad meaning.
- Furthermore, there are various types of Muda, such as those that can be easily removed by the use of 5S, and those that use advanced techniques such as experimental design and operations research. Muda handled by Kaizen is deep.

In order to dispel the stereotype of Kaizen = 5S and renew the awareness that Kaizen = Muda Elimination, we adopted a visually easy-to-understand “Muda Elimination” as the first teaching material to be developed.

- Teaching material 1 : “Kaizen General” (introduction to Kaizen training)
 - Teaching material 2 : “Muda Elimination” (to be developed first for its demonstration at the TICAD VII)
 - Teaching material 3 : “5S” (very basics of Kaizen)
- * As it is believed to be appropriate that the curriculum used for the pilot project should be complete for the teaching of basic Kaizen, the first teaching material titled “Kaizen General” will describe general knowledge concerning Kaizen in a concise manner.
- * The “Kaizen General (General discussion)” is similar to the results of each curriculum of Module I in the standard curriculum of the project study “Survey on Standard Approach for African Region Kaizen Support”, but in this survey, we call the technologies that are selected based on the Kaizen technology that targets not only one but also multiple targets (e.g., 5S, 7 QC tools, project management) and meta-Kaizen technology that deals with operation method of individual Kaizen technology (e.g., PDCA, QC story) as “KAIZEN GENERAL”.

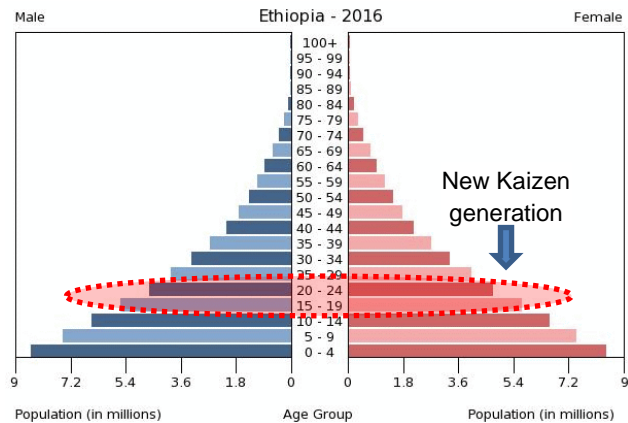
The outline of the pilot curriculum is shown below. The details are shown in Appendix-5.

Table-18 The outline of the pilot curriculum

No.	Subject	Contents	Study Duration
1	Kaizen General	<ul style="list-style-type: none"> ● Meaning of Kaizen ● Kaizen mind ● Implementing units (CFT: Cross-Function Team; QCC: Quality Control Circle, etc.) ● QC story ● Measurement of Kaizen effects 	Approx. 6 hours
2	Elimination of Waste	<ul style="list-style-type: none"> ● 3M (Muda (waste), Mura (unevenness), Muri (overburden)) ● 7 types of Muda ● What is Muda? ● Muda discovery method ● Kaizen means the elimination of Muda ● How to eliminate Muda 	Approx. 3 hours
3	5S	<ul style="list-style-type: none"> ● Meaning of the 5S ● 5S as the starter for Kaizen ● What are Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize) and Shitsuke (sustain)? 	Approx. 6 hours

As stipulated in the survey specification, EKI Kaizen Consultants and corporate managers who are going to learn Kaizen are assumed to be the primarily target of e-Learning, but the material has been developed with the “easiness of understanding” in mind in order to be able to apply for “New Kaizen generation” (see the Fig.-14) of around 15 to 24 years old in the future. In addition, as the existing Kaizen teaching materials to be used, we aimed to utilize PPT teaching materials of the Kaizen Manual, which had already been developed in the Kaizen Project in Ethiopia for the efficient development of teaching

materials. However, since nearly 5 years have passed since the creation of the manual, the overall composition of the teaching material was revised by incorporating revisions obtained from the trainings. In addition, digital media such as videos, images, animations, voices, and manga are often used for e-Learning teaching materials, but considering the status of internet connection, we decided to minimize the use of videos, and adopted a form in which voice narration flows on the still image of the slide in this pilot program.



Source: CIA World Factbook

Fig.-14 New Kaizen generation in Ethiopia

Concrete development method of teaching materials

e-Learning teaching materials with the following contents were prepared by restructuring and adding new digital media to existing teaching materials.

a) Lecture contents

- PPT contents: Total of 150 slides for some 6 hours of learning
 - * Sound and animation are added to the PPT slides
- PDF contents: Total of some 150 pages
- Video contents: Total duration of 2 – 3 hours
 - * These videos explain the key points of training. It is assumed that they will be used on-line and as secondary teaching materials for EKI consultants.

b) Contents to test learning progress

- Pre-learning test : 3 varieties (one of which is used based on random selection)
- Intermediate test (drill type) : The number of questions is assumed to be 20 – 30 based on the examination results of the e-Learning course configuration by the study team.
- Post-learning test : 3 varieties (one of which is used based on random selection)

In general, there are three types of e-Learning process as described below.

1. Complete substitution of conventional classroom training (alternative type)
2. Emphasis on drill type exercises to supplement conventional training (CRT + ICT: in-company training (practical training)) (supplementary type)
3. Distribution of reference materials, exercises, etc. synchronizing with conventional training (CRT + ICT) (mixed type)

For the pilot project, Type 1 and Type 2 teaching materials were developed as the EKI lacks the equipment, etc. required for the Type 3 e-Learning process to distribute audio-visual contents.

As for the order of development, the e-Learning teaching material on “Muda Elimination” was prepared using a solution which is believed to be able to exploit the strength of e-Learning to the maximum among the several hypotheses presented in the Inception Report. As it is assumed that the demonstration of this teaching material will take place at the TICAD VII, its contents incorporated videos and other digital media and interactive features, etc. as much as possible so that the advantages of e-Learning can be easily understood by the participants of the TICAD VII and the EKI as a user. For the production of the contents, we have first considered the possibility of subcontracting local company, but since its production facility and quality did not meet our standard, the contents were developed in Japanese production company in order to meet with the production schedule to be ready for TICAD VII.

Subsequently, e-Learning materials for Kaizen General, the most basic subject, was developed. Since all Kaizen learners should learn first, it is necessary to deal with the widest range of cases for both user groups and devices. Therefore, the content is set to be receivable even in an environment where the Internet line is poor, and those with large data such as videos, etc. were not used.

Finally, teaching material for 5S was developed. By using the lessons learned from the development of the above two teaching materials, the technology elements and distribution were adjusted to be the most feasible and highly appealing content in Ethiopia.

6.3 Participating organizations and registration

The pilot project initially targets only the organizations and companies that we visited during the field survey, and was planned to be implemented with a total of 500 learners by accepting up to about 30 participants from each organization. However, after the pilot started, there was a request from the EKI managers to include client companies and organizations of EKI consultant. Finally, a total of 867 people registered including 129 from EKI, 70 from EKI client companies and organizations, and 668 pilot organizations. The number of participants from each institution is shown in the table below. Ethiopian Chamber of Commerce has a large number of participants in the table below because it has received participants from member companies of the Chamber of Commerce. Those are: Awash Wine, Country Trading, Ethiopian Leather Industries Association, Ethiopian pulses oil seeds producers and exporters association, Horizon Tire, Ethiopian Chamber of Commerce and Sectoral Associations, Oromia Chamber of Commerce and Sectoral Associations, Spice, Herbs and Aromatic sector association.

Table-19 Participating organizations and the number of participants

EKI		EKI client organizations		Pilot organizations	
EKI	9	Ethiopian Shipping Lines	5	Dire dawa Admin Management and Kaizen Institute	14
EKI/CBRAS	25	CICIDI	5	Lege Hare Primary and Secondary School	9
EKI/CSOS	9	Federal Transport Authority	5	Anbessa Shoes Factory	24
EKI/IUSS	29	Ethiopian Public Health Institute	5	Ministry of Trade and Industry	20
EKI/MS	37	ETIDI	7	Kombolcha Industrial Park	37
EKI/RCS	20	ELICO	5	NA Metals Industry	18
		Amahra road works	5	Ethiopian Red Cross Society	21
		Harari Kaizen Institute	5	Dire Dawa University	23
		Adama University	5	Civil Service Commission	32
		Filwuha Spa Enterprise	5	Leather Industry Development Institute	96
		SSNPR Science and Technology Institute	3	W/ro Sihen PolyTech College	34
		Addis Ababa Education Bureau	5	National Cement	31
		Amhara Leadership Academy	5	Kombolcha Textile Industry	33
		Trans Ethiopia	5	Ethiopian Chamber of Commerce	112
				Federal Tech. & Vocational Edu. & Training Agency	19
				Ethio-Italy Polytech College	30
				Wollo University	44
				Dil Chora Hospital	30
				Kombolcha Polytech College	10
				Sabyan Hospital	31
Subtotal	129	Subtotal	70	Subtotal	668
					Total: 867

The differences between the EKI client companies / organizations and the pilot **organizations** are as follows.

- The EKI client companies / organizations are the organizations where the EKI consultants actually provide support on Kaizen, but the Study Team did not visit. e-Learning progress management is performed by the EKI consultant in charge.
- The pilot organizations are the companies and organizations that were targeted for the pilot program from the beginning of the plan, including organizations that were supported by EKI, but some organizations that are independently engaged in Kaizen activities. The Study Team visited all the organizations and gave detailed explanations of the purpose and participation procedures. Each organization was required to assign a training manager who is in charge of e-Learning progress management.

Participation registration of pilot organizations was done according to the following schedule.

Table-20 Schedule of participation registration for the pilot program

Procedure	Deadline	Task of training manager	Task of Study Team
Application for the participation as an organization	27 August 2019	Apply through Google forms	
Send the format for user registration	3 September 2019		Send Excel format to training managers
Send user list of registration	24 September 2019	Send the user list via email to JICA Study Team	
Creating user accounts and their notification	30 September 2019		Create user account on e-Learning system based on the user list sent, and notify the login information to each user.
Start of the pilot	1 October 2019		

6.4 e-Learning system used in the pilot program

In this pilot program, we used a Web service based e-Learning system “Knowledge Deliver²³” of Digital Knowledge Co., Ltd. This is equivalent to “Existing e-Learning Service” in Table-2, and the following expenses were incurred as the production cost of contents for pilot implementation and the e-Learning service usage fee.

- Contents production fee (3 courses): JPY 3,970,000 (excluding VAT)
- e-Learning system (for 6 months including test period): JPY 1,348,800 (excluding VAT)

Among these, the breakdown of the costs involved in the e-Learning system is as follows.

- Cloud based e-Learning system “Knowledge Deliver Global” usage license fee
For 1,000 users: JPY 195,000 x 6 months = JPY 1,170,000 (excluding VAT)
- Video distribution server usage fee (Minimum plan, 10GB disk space, 100GB total bandwidth): JPY 29,800 x 6 months = JPY 178,800 (excluding VAT)

Since these costs are pay-as-you-go rates, the costs vary depending on the number of users, the number of contents, the number and size of video to be used, etc.

6.5 Monitoring and the support for learners

During the implementation of pilot program, the monitoring and support of the 867 learners were done by the following method.

- Each organization or company that has registered for participation is requested to assign a “training manager”, and the training manager manages the learning progress and provides basic support for participants in the organization. In the case of EKI client companies / organizations, the role of this training manager was performed by the EKI consultant in charge.

²³ <https://www.digital-knowledge.co.jp/product/kd/>

- Two types of e-Learning system usage manuals have been prepared for general learners and training managers so that they can be downloaded or viewed on the system at any time.
- Learners and training managers can use the mentoring function at any time to ask questions using the mentoring function if they have any issue that cannot be solved by the above manual.
- The question asked through the mentoring function is sent to the person in charge at Digital Knowledge Co., Ltd. first, then forwarded to the local consultant and supporting staff of the Study Team, and the answer to the question is sent directly to the questioner .
- In addition, during the 4th field survey, the Study Team visited major pilot participating organizations, and interviewed and provided support on issues specific to each organization.

6.6 Implementation schedule of the pilot program

The pilot program was implemented according to the following schedule.

Table-21 Implementation schedule of the pilot program

No.	Course	Implementation Period
1	Kaizen General	1 October 2019~31 January 2020 (4 months)
2	Muda Elimination	1 October 2019~31 January 2020 (4 months)
3	5S	1 November 2019~31 January 2020 (3 months)

6.7 Result of pilot implementation

The following table shows the results of pilot implementation by organization. As a whole, the difference between organizations that actively participated in e-Learning and those that did not is large. Actively participated organizations (such as DDMKI) have almost all participants who completed all 3 courses except for staffs who resigned the organization. On the other hand, organizations that were not active had only a training manager or a few others who barely participated, and many other users had little participation.

Table-22 Results of pilot implementation by organization

Course	Kaizen General						Muda Elimination						5S				All 3 Courses			
	Users	Enrolled	Completed	Ave. Progress	Ave. Score		Enrolled	Completed	Ave. Progress	Ave. Score		Enrolled	Completed	Ave. Progress	Ave. Score	Completed	Ave. Score			
EKI	9	2	1	22%	11%	56%	4	1	44%	11%	12%	52%	2	1	22%	11%	43%	1	11%	87%
EKI/CBRAS	25	9	5	36%	20%	68%	11	8	44%	32%	34%	70%	9	6	66%	24%	58%	5	20%	85%
EKI/CSOS	9	0	0				1	0	11%	0%		0	0					0		
EKI/IUSS	29	18	14	62%	48%	54%	22	15	76%	52%	51%	66%	19	16	84%	58%	78%	13	45%	88%
EKI/MS	37	17	12	46%	32%	33%	16	12	43%	32%	36%	76%	15	12	80%	32%	70%	12	32%	86%
EKI/RCS	20	6	2	30%	10%	31%	6	2	30%	10%	10%	45%	4	1	25%	12%	62%	1	5%	83%
EKI Total	129	52	34	40%	26%	28%	60	38	47%	29%	31%	65%	49	36	28%	29%	69%	32	25%	87%
Ethiopian Shipping Lines	5	4	4	80%	80%	78%	4	4	80%	80%	77%	75%	4	4	80%	78%	85%	4	80%	84%
CICIDI	5	4	2	80%	40%	43%	3	2	60%	40%	39%	58%	3	2	60%	46%	70%	2	40%	89%
Federal Transport Authority	5	3	1	60%	20%	25%	1	1	20%	20%	19%	82%	2	1	50%	19%	30%	1	20%	74%
Ethiopian Public Health Institute	5	4	1	80%	20%	38%	1	1	20%	20%	18%	70%	1	1	100%	20%	81%	1	20%	76%
ETDI	7	3	1	43%	14%	23%	1	1	14%	14%	13%	63%	1	1	100%	14%	88%	1	14%	72%
ELICO	5	4	0	80%	0%	8%	1	0	20%	0%	0%	8%	1	0	0%	1%	25%	0		
Amahra road works	5	2	0	40%	0%	3%	1	0	20%	0%	3%	61%	0	0				0		
Harari Kaizen Institute	5	3	0	60%	0%	3%	0	0					0	0				0		
Adama University	5	2	0	40%	0%	3%	0	0					0	0				0		
Filwaha Spa Enterprise	5	2	0	40%	0%	13%	0	0					0	0				0		
SSNPR Science and Technology Institute	3	1	0	33%	0%	3%	0	0					0	0				0		
Addis Ababa Education Bureau	5	1	0	20%	0%	1%	0	0					0	0				0		
Amhara Leadership Academy	5	0	0				0	0					0	0				0		
Trans Ethiopia	5	0	0				0	0					0	0				0		
EKI Client Organization Total	70	33	9	47%	13%	30%	12	9	17%	13%	63%	12	9	13%	13%	67%	9	13%	86%	
Dire dawa Admin Management and kaizen Institute	14	13	11	93%	79%	78%	11	10	79%	71%	70%	79%	10	10	100%	70%	88%	10	71%	87%
Lege Hare Primary and Secondary School	9	6	6	67%	67%	64%	6	6	67%	67%	65%	82%	6	6	100%	65%	83%	6	67%	83%
Amhara Shoes Factory	24	24	16	100%	67%	75%	23	15	96%	63%	74%	60%	22	16	73%	78%	61%	15	63%	84%
Ministry of Trade and Industry	20	16	11	80%	55%	68%	15	12	75%	60%	65%	72%	14	13	93%	69%	85%	11	55%	85%
Kombolcha Industrial Park	37	30	25	81%	68%	67%	25	21	68%	57%	58%	62%	24	23	96%	60%	76%	20	54%	76%
NA Metals Industry	18	12	10	67%	56%	55%	10	10	56%	56%	54%	81%	11	9	81%	50%	68%	9	50%	85%
Ethiopian Red Cross Society	21	17	12	81%	57%	63%	14	10	67%	49%	52%	63%	12	11	92%	52%	79%	10	48%	82%
Dire Dawa University	23	16	14	70%	61%	63%	15	12	65%	52%	56%	77%	11	11	100%	47%	83%	9	39%	86%
Civil Service Commission	32	19	11	59%	34%	37%	15	11	47%	34%	35%	63%	11	10	91%	33%	85%	10	31%	86%
Leather Industry Development Institute	96	44	27	46%	28%	32%	31	27	52%	28%	28%	68%	28	27	97%	28%	81%	26	27%	81%
W/ro Sihen PolyTech College	34	27	12	79%	35%	40%	16	9	47%	26%	32%	66%	14	11	79%	32%	73%	9	26%	84%
National Cement	31	17	7	55%	23%	24%	8	7	23%	22%	22%	72%	7	7	100%	22%	88%	7	23%	86%
Kombolcha Textile Industry	33	11	6	33%	18%	21%	8	6	24%	18%	18%	61%	6	6	100%	18%	90%	6	18%	85%
Ethiopian Chamber of Commerce	112	62	26	55%	23%	30%	32	29	18	16%	21%	59%	25	16	64%	18%	60%	13	12%	82%
Federal Tech. & Vocational Edu. & Training Agency	19	12	3	63%	16%	22%	5	3	26%	16%	20%	65%	4	3	75%	15%	60%	2	11%	86%
Ethio-Italy Polytech College	30	15	6	50%	20%	26%	12	4	40%	10%	20%	51%	8	4	50%	21%	61%	3	10%	85%
Wollo University	44	5	2	11%	5%	5%	5	2	11%	5%	5%	45%	2	2	100%	4%	84%	2	5%	81%
Dil Chora Hospital	30	5	2	17%	7%	9%	3	1	10%	3%	8%	45%	3	1	33%	6%	41%	1	3%	93%
Kombolcha Polytech College	10	1	1	10%	10%	78%	1	1	10%	10%	10%	63%	0	0				0		
Sabyan Hospital	31	3	0	10%	0%	8%	1	0	3%	0%	0%		0	0				0		
Pilot Organization Total	668	355	208	53%	31%	35%	256	184	28%	30%	65%	218	186	28%	29%	74%	169	25%	83%	

Other notable points in the results of implementation are as follows.

- The overall enrollment rate of the organizations covered by the pilot is generally good. According to a member of Digital Knowledge Inc., it is at a good level compared to e-Learning for general organizations in Japan.
- On the other hand, the enrollment rate of client organizations of EKI consultant was very poor except for a few organizations. This is probably due to the fact that the EKI consultant, the training manager, was busy with their work, and could not provide most of the training support to client organizations.
- The average score of users who completed all three courses is very high, ranging from 83% to 87%. This is in contrast to the individual average scores for each course being quite low (30% to 74%). The reason may be that many users quit on the way without completing the course.
- Among the pilot participating organizations, some of the institutions in Dire Dawa (Dil Chora Hospital, Sabyan Hospital, etc.) have poor enrollment rates. According to interview to those institutions by telephone, this is due to the unstable security situation and internet connection in

Dire Dawa since November 2019, and they could not physically continue e-Learning. In fact, the Study Team could not go to Dire Dawa since November 2019 due to security concerns.

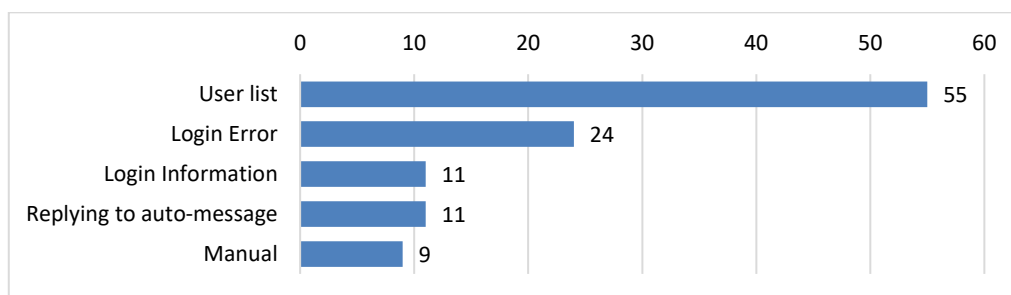
6.8 Analysis of the pilot implementation result

(1) User-support Analysis (9/26/2019 – 31/1/2020)

- 1) Total number of received emails to the supporting address: 149

The list of received emails from users to the supporting address is shown in Appendix-8.

- 2) The average number of the incident per day during the period was 1.97.
- 3) The top 5 reasons for users sending an email to the support was as follows.



- **User list-related (55 incidents):** Sending or modifying the user list, etc.
 - **Login error (24 incidents):** Could not access with the given login ID, how to change the language setting etc.
 - **Reply to the auto-generated message (11 incidents):** Reply to automatic messages sent from the system that should not be replied
 - **Manual related questions (11 incidents):** Request for sending manual, how to change the course to study, etc.
 - **Ask for login Information (9 incidents):** User has not received login info, what is the user/password, how to change the password, request to correct the profile information, etc.
- 4) Issues confirmed by user support
 - There were quite a few users who were not fluent in English, and supporting team could not understand the content of the question. In that case, the local consulting support team called the user directly to identify the question.
 - There were many questions regarding login ID, password, and correction of registered information. This is a similar trend for e-Learning in Japan, where inquiries are concentrated in the early stages of learning.

(2) Learning time (Final result)

- The total study time was 4,195 hours, and the average learning time of the learners who have completed all 3 courses was around 9 hours. Time for each course is shown below.

Table-23 Total learning time of each course (All participants)

Course	Users	Learning time	Average study time
Kaizen General	441	1,889 hrs.	4 hrs. 20 minutes
Muda Elimination	329	1,353 hrs.	4 hrs. 6 minutes
5S	281	731 hrs.	2 hrs. 36 minutes

- The total study time for the learners who have completed the course are described below.

Table-24 Total learning time of each course (All those who have finished the course)

Course	Users	Learning time	Average study time
Kaizen General	252	1,496 hrs.	5 hrs. 55 minutes
Muda Elimination	232	1,145 hrs.	4 hrs. 56 minutes
5S	233	673 hrs.	2 hrs. 53 minutes

The reason why the total learning time of those who have finished the course is longer is probably the data of all participants include the data of those who have quit in the middle of the course.

(3) Access Log Data Analysis

As a result of analyzing the technical information when the user accessed the e-Learning system, the following facts became clear.

- 86% of learners used PC and the smartphone usage was just 14%.
- Many learners use Windows7 operating system of which support has been discontinued in January 2020
- Type of the browser used are Chrome and FireFox for 82%, and there was 8% of Opera which is not common in Japan.

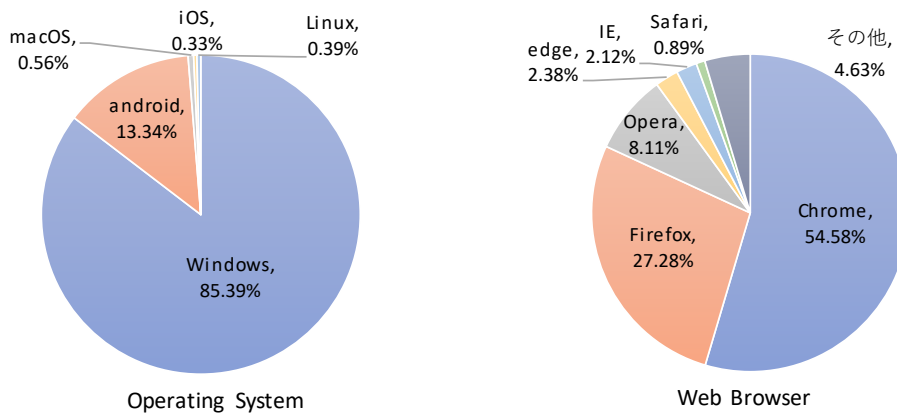


Fig.-15 Statistics of OS and Web browser used by learners

- Learners tend to study during the daytime on a weekday. We can assume that the majority of the learners are taking a course during the work time with their personal computer provided by the company/organization

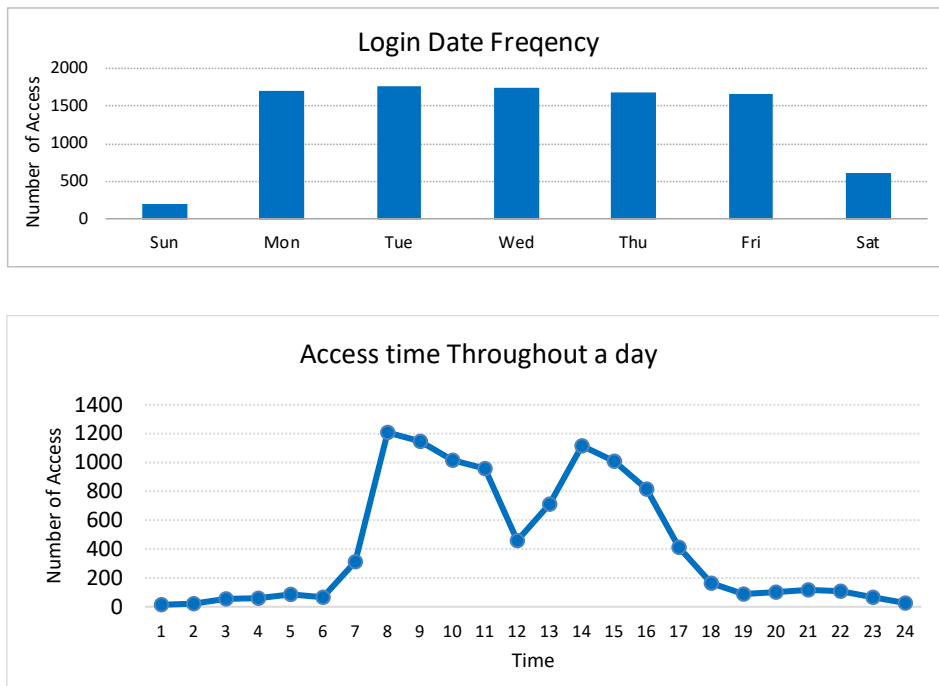


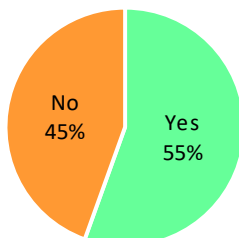
Fig.-16 DoW and time of access by the users

6.9 Getting feedback from e-Learning users by questionnaire and individual interview

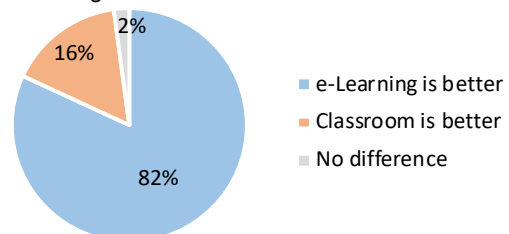
In this pilot implementation, learners are asked to complete an online survey at the end of the course. The results are shown below. In general, learners and EKI consultants have given favorable reviews. Although evaluations from EKI consultants were somewhat harsh, nonetheless, there were many very positive responses regarding the importance of e-Learning and its future extension.

(1) Feedback from Learners (including training managers)

Q1. Have you taken any Kaizen course before?

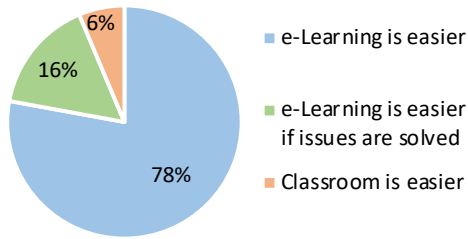


Q2. If your answer in Q1 is Yes, how was the quality of the e-Learning course compared to the classroom training?²⁴

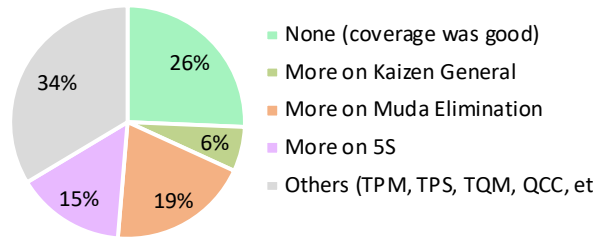


²⁴ Regarding the reason for responding “e-Learning is better”, the results of individual interviews showed almost the same tendency as the answer in Q.9 of the questionnaire result for EKI consultants shown below.

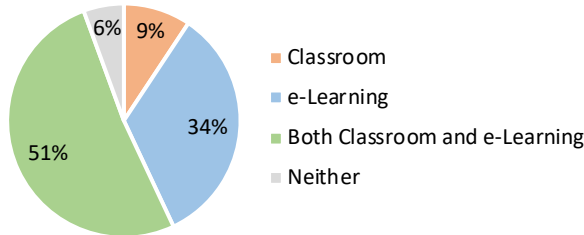
Q3. How was the easiness of e-Learning compared to the classroom training?



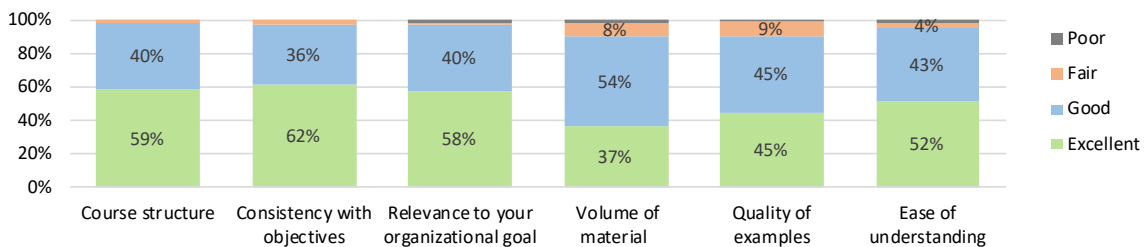
Q4. What topics would you like to see addressed that were not covered?



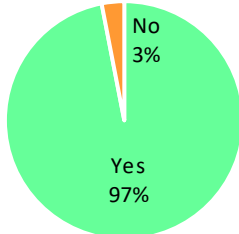
Q5. Which method would you prefer to learn the Kaizen course?



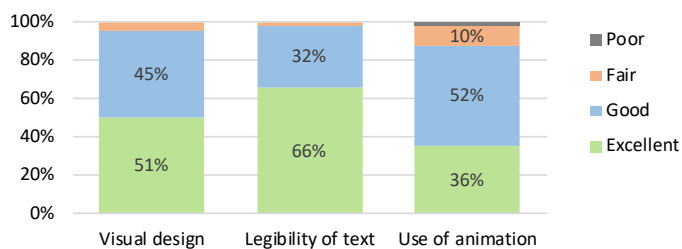
Q6. Please rate the course contents.



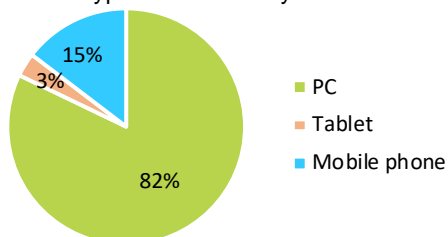
Q7. Was the content arranged in a clear and logical way?



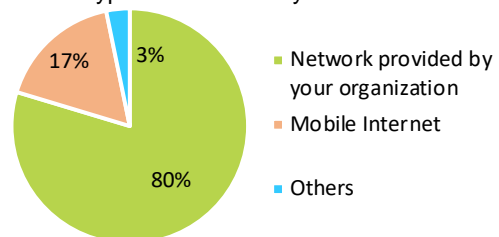
Q8. Please rate the design of course materials.



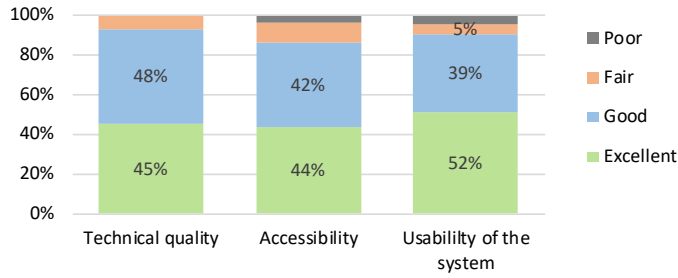
Q9. What type of device did you use for e-Learning?



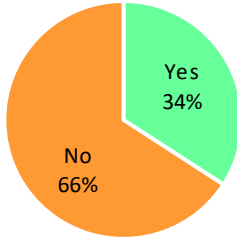
Q10. What type of network did you use for e-Learning?



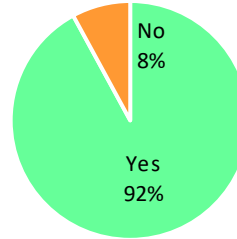
Q11. Please rate the technical aspect of e-Learning system.



Q12. Did you encounter any technical problems during the course?



Q13. Based on this experience, would you take another e-Learning course?

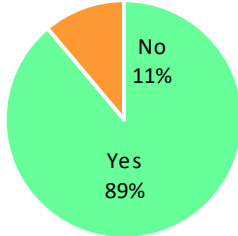


Q14. If you have any comments or suggestions, please let us know. (Major comments only)

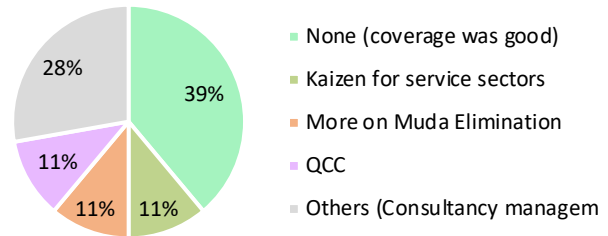
- Add more practical case studies and best practices.
- Improve the system so that it works even in poor network conditions.
- Better to provide a way to download the materials for offline reading and printing.
- Add Amharic language option if possible

(2) Feedback from EKI consultants

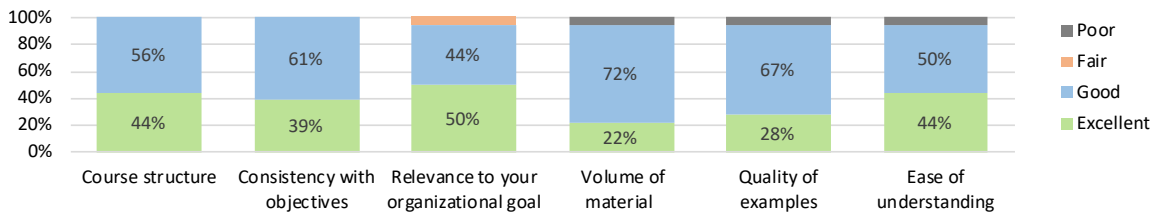
Q1. Did the course cover the content you were expecting?



Q2. What topics would you like to see addressed that were not covered?



Q3. Please rate the course contents.



Q4. What are the strengths and weaknesses of this eLearning course? (Major comments only)

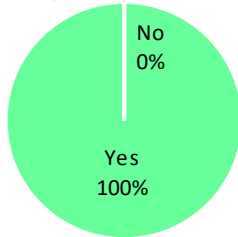
(Strength)

- Enable Kaizen consultants and company employees to improve knowledge and skill
- Easily understandable
- Presents the comparison and differences between Kaizen and other similar methods clearly
- Course content and examples are very good

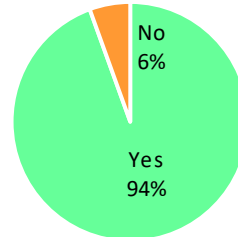
(Weakness)

- Poor internet connection, takes too long to load
- Should be downloadable
- Some questions are not easy to understand
- Some Explanations are short

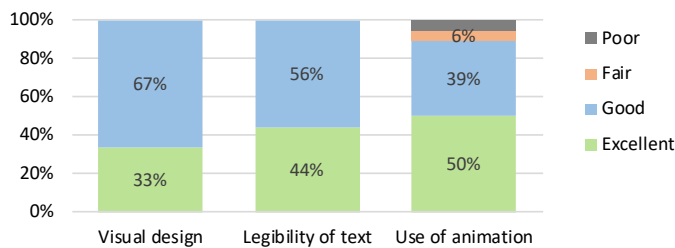
Q5. Was the content arranged in a clear and logical way?



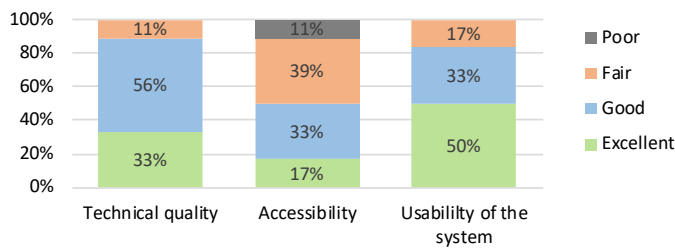
Q6. Did the test cover the material presented in the course?



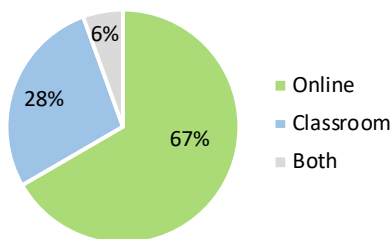
Q7. Please rate the design of course materials.



Q8. Please rate the technical aspect of e-Learning system.



Q9. Would you prefer to take this course online or in the classroom? Why?



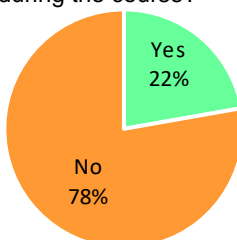
(Online)

- Because learners can advance at their own pace and can control what to learn, when, where and how.
- It reduces stress and increase satisfaction.
- Can review learning topic many times, fast or slow.
- Easily understandable and accessible, time saving.

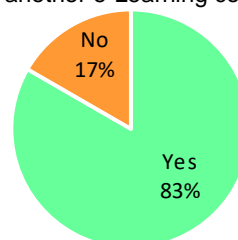
(Classroom)

- Online have their own short coming like network access, no face to face interaction with instructors.

Q10. Did you encounter any technical problems during the course?



Q11. Based on this experience, would you take another e-Learning course?



- Q12. How do you think you could utilize the e-Learning to your client in the future? (Major comments only)
- We have a shortage of consultant so we can use it to solve this shortage.
 - New perception and new knowledge dissemination mechanism may create positive energy to easily learn and implement Kaizen.
 - If they have internet it will be easy but most of my client don't, so it is a better approach to build my skill through the e-Learning then consult them.
 - The platform can be utilized particularly for TOT training in Ethiopia and other parts of Africa. However, for the company wide training the conventional way of training delivery is more appropriate in Ethiopia.
 - As a support material once the implementation has shown better progress to give better understanding for facilitators and Kaizen officers considering their ability of the English language.
 - It helps us to improve individual Kaizen and to recruit candidate consultants.
- Q13. What do you think you could benefit from using e-Learning to your client? (Major comments only)
- Develop skill and knowledge in a short period of time.
 - It will help us to deliver the full package of Kaizen training to company top management members and higher official without interrupting there working hours.
 - It would be easy for client to get understanding on the specific technical issues.
 - Repetition of following up clients can be reduced. They can transform and disseminate Kaizen without the consultants.
- Q14. If you have any comments or suggestions, please let us know. (Major comments only)
- It's easier and better to work without internet (offline).
 - Not only basic Kaizen, advanced Kaizen also needs to be presented in this way having optimum depth considering the target students/clients status.
 - If you can give the presentation slide it is better to upgrade the skills.
 - Can you help us making this e-Learning course in native language?
 - Include examples that suit service industries.

(3) Result of interview survey by individual visit and telephone

Apart from the results of the questionnaire survey, most, if not all, pilot organizations were visited individually to provide user support, and those who did not visit were interviewed by telephone. The table below summarizes the results of asking “why did you not participate in the e-Learning?”

Table-25 Why you did not participate in the e-Learning

EKI	Reason why you did not participate in the e-Learning
EKI	Network, Work overload and Commitment Issues
EKI Client Organization	Reason why you did not participate in the e-Learning
Ethiopian Shipping Lines	Work Overload
CICIDI	Work overload and Network Issues
Federal Transport Authority	Work Overload
Ethiopian Public Health Institute	Work overload and Network Issues
ETIDI	Work overload
ELICO	Work overload
Amahra road works	Reason Unknown
Harari Kaizen Institute	Reason Unknown
Adama University	Reason Unknown
Filwuha Spa Enterprise	Network Issues
SSNPR Science and Technology Institute	Reason Unknown
Addis Ababa Education Bureau	Reason Unknown
Amhara Leadership Academy	Reason Unknown
Trans Ethiopia	Reason Unknown

Pilot Organization	Reason why you did not participate in the e-Learning
Dire dawa Admin Management and Kaizen Institute	2 employees left the organization and the rest trying to complete
Lege Hare Primary and Secondary School	3 employees unwilling to take the courses after registration
Anbessa Shoes Factory	3 employees left the organization and the rest trying to complete
Ministry of Trade and Industry	Network and work overload
NA Metals Industry	Network and Power issues
Ethiopian Red Cross Society	Network issues at branch offices
Civil Service Commission	Network issue and Lack of commitment from the learners
W/ro Sihen PolyTech College	Work overload and Network Issues
Kombolcha Industrial Park	Network issues and lack of commitment from the learners
Leather Industry Development Institute	Follow up of the training manager was really good but lack of commitment from trainees complaining that they are busy
Kombolcha Textile Industry	Work overload and lack network issues
Dire Dawa University	lack of commitment from trainees and peace and security issues at the university
National Cement	Lack of Commitment from learners and network issues especially for the engineers at the factory sites
Ethio-Italy Polytech College	Network issue and work overload
Ethiopian Chamber of Commerce	lack of Commitment and lack of training manager follow-up since learners are from 9 different organizations. Learners from Chamber of commerce faces network issues
Federal TVET Agency	Lack of Commitment from learners and network issues
Wollo University	Learners initial wrong assumption for them to register was after completion they thought they will get scholarship or other incentives(this is their own assumption) when they got cleared that there is no such thing on this project they just got uninterested to take the courses and work overloads
Dil Chora Hospital	They don't have network access for long and health epidemic and different issues also contributed for learners to be highly engaged in other tasks
Kombolcha Polytech College	Since the learners are teachers and they got much work overload they had been requesting text script of the lecture so that they could read the courses at their free time and spent less time online only for exams. Since we didn't provide the additional scripts for them, they couldn't be able to take the courses
Sabyan Hospital	Network access issues and instability in the city distracted them from taking the courses

From this table, it can be seen that the main reasons for not participating in e-Learning are network problems and busy work, but when we actually visited each organization, many employees use PCs and smartphones for SNS and YouTube. It is highly probable that the actual reason was likely to be lack of motivation for learning, and it was a major problem that the commitment of the organization could not be spread to the staff.

6.10 Verification of the hypotheses

The “3.2 Hypotheses for the Use of e-Learning in Africa” created by incorporating the result of the first field survey, was verified by the result of e-Learning pilot program, and it turned out that there are several different results from the hypotheses.

(1) Hypotheses common to all cases

There was found to be a strong possibility that the following hypotheses are erroneous.

- ① Since the penetration rate of mobile phone is high and there are frequent power interruptions, mobile connections are more stable. Moreover, since mobile lines offer sufficient speed, users mainly access e-Learning through mobile phones (smartphones).
- ② To create attractive e-Learning contents, it is better to incorporate video and animation elements, etc. as much as possible.

Concerning ①, as the aforementioned analysis of access logs shows, users accessed not from their own smartphones but rather from workplace PCs. According to the results of individual interviews, etc., the only reason for this was the cost of data access. Unlike Japan, smartphone data charges in Africa are pay-per-use rather than fixed rates, so charges increase the more that users use data. Moreover, as may be gathered from the literature survey, these mobile data charges are not yet sufficiently low. Therefore, hardly any users were willing to pay expensive data charges to access e-Learning that includes videos and other high-volume contents from their own smartphones. The drawbacks of pay-per-use charges were foreseen beforehand to some extent, however, we didn't think that users would be so averse to bearing the expense themselves. This is an important discovery for considering the dissemination of Kaizen in Africa (and other developing countries where data charges are high) in the future.

Concerning ② (video contents), the findings were not as expected. In the separate interviews with agencies that participated in the pilot program, almost all institutions aired negative opinions about the use of videos. The main reasons they gave were as follows.

- Downloading becomes extremely slow if Internet connections are unstable or slow. (The Study Team also envisaged such an opinion).
- Users were unable to properly hear the English narration in videos because it was given in pronunciation close to that of native speakers. Users needed to listen repeated times to understand certain parts.
- Users can somehow understand written English, but they have difficulty hearing it spoken.

On reflection, such opinions are also similarly applicable to Japanese people. It is a fact that users in countries that don't have English as their native language can read English to an extent but have difficulty hearing native English pronunciation. Accordingly, videos and narrations are not very effective for persons who don't use English as their native language. On asking how the video parts should be improved in the interviews, many users gave the following answers.

- (On asking about use of subtitles) Since subtitles are displayed and disappear quickly one after another, it's impossible to keep up and they create stress when playing back contents.

- Videos and narrations are not needed. It is better to use conventional textbooks that provide immobile textual information. Such texts allow users to read and study at their leisure ad repeatedly.
- Course sections are also provided in video format with narration given for each slide, however, because Internet access is required for frequently switching between such short sections, downloading takes a long time and the resultant waiting is very stressful.
- When Internet connection is interrupted during a learning video (a common occurrence in Ethiopia), users cannot do anything, i.e. they cannot move forward or go back, until the connection is restored. If it were made possible to download large volumes of contents as simple text data, users would be able to download substantial quantities of teaching materials by accessing the Internet only once, allowing them to read the contents or transfer them to their smartphones to take home for studying even at times when there is no Internet connection. The users sincerely desire the contents to be provided in PDF format.

(2) Hypotheses for the use of e-Learning according to the KAIZEN training methods

In the pilot program here, in response to the wishes voiced by participating institutions and companies, contents were provided in such a way that users could select from [Hypothesis B1] online individual learning or [Hypothesis B2] individual learning based on CRT format (blended learning) (with possibilities for application to other formats too). However, as a result of actually visiting and discussing with each institution, all the institutions apart from one company (Kombolcha Textile Company) selected [Hypothesis B1], and even Kombolcha Textile Company eventually switched to B1, so it wasn't possible to verify formats other than B1. Having said that, as was described above, since many of the users accessed contents not from their own smartphones but rather from workplace PCs during work hours, while many agencies cited "having no time to study due to being busy at work " as a key impediment to learning, it is possible that the B2 blended learning would actually be more effective in many institutions . This point is discussed in greater detail in 7.3.

7. Recommendations about Kaizen e-Learning

Based on the results of implementing the abovementioned field surveys and pilot program, recommendations for the deployment of Kaizen e-Learning mainly in Africa are given below.

7.1 About Effective Teaching Materials

(1) Contents of effective Kaizen teaching materials

Concerning the contents of teaching materials that should be provided in e-Learning, the most effective approach is to first deal with basic contents centered on classroom learning (CRT) that have little need for practical training (ICT), as in the case of the three contents provided in the pilot program. The reasons are given below.

- Because the contents are basic, there is a broader range of learners and larger numbers of potential learners than for high-level applied contents. Accordingly, it is possible to raise the basic knowledge level of a lot of learners through e-Learning.
- Through introducing e-Learning to such contents, the workload of Kaizen lecturers can be reduced. This will enable the lecturers to focus on lessons devoted to higher level, more practical contents.
- Standardization of learning contents can be anticipated. Because many learners can learn based on the same contents, standardization of the acquired knowledge can be anticipated. Moreover, when it becomes necessary to update the teaching materials, in the case of e-Learning, this can be done on the system and all learners can access the same updated version.

When using e-Learning for more sophisticated contents or ICT assistance, it is necessary to display care regarding the following points.

- Unlike basic subjects, in the case of high-level contents, there is a risk that not all learners will achieve sufficient understanding through independent learning (private study), so it is essential to have mentor support. If applied subjects are covered in e-Learning, it will be necessary to provide an adequate mentor support system for the learners.
- When using e-Learning as an adjunct to ICT, it is preferable to enable use of the teaching materials on smartphones so that they can be used directly in Kaizen settings. Moreover, it is preferable to develop app-based teaching materials, downloadable teaching materials, or offline Web teaching materials that can be used without Internet connection.

In addition, many participating organizations requested that the materials be customized. The requests for customization can be divided into two main categories: “Language customization” and “Material structure customization”. In order to be effective, the material structure and system technology must be able to be customized to meet the needs of the learners (system technology is described later in (2)). In order to make use of Kaizen in a wide range of regions and fields, it is necessary to have a business model and organizational structure that enables customization, since customization of teaching materials to the learner’s objectives and environment is an essential element. Many Japanese B2B e-Learning services have also successfully adopted the material customization approach.

[Language customization]

- A wide range of potential learning targets was identified in this pilot, but it was confirmed that there were many cases where field staffs and local staffs who have the large number could not use English or even Amharic, so the need for language localization was identified as high.

[Material structure customization]

- As with the language needs, there were a number of requests for customization based on learner attributes, such as reduced course content for first-time learners, additional curriculum for administrators, and additional case studies for professionals.

(2) Caution on using existing PowerPoint materials, etc.

For this pilot, we were to create e-Learning materials using existing PowerPoint presentations and other materials. In practice, however, it was rare that existing slides could be used as it is, and most of the slides had to be reconstructed or rewritten from scratch. The reason for this was that most of the slides created for the lecture were based on list of items, but from the perspective of self-study materials for e-Learning, they should have been created according to a “Why-What-How” or “What-Why-How” sequence rather than bullet points, and therefore needed to be reorganized. From this lesson, it should be noted that when utilizing existing slide materials, it may be necessary to reconfigure their content, which will need additional cost and time.

(3) Necessary technology for effective Kaizen teaching materials

Conventionally, photographs, videos, audio, etc. have been utilized to realize effective teaching materials for e-Learning, however, the results of the pilot program show that this is not necessarily the case; in particular, it was found that teaching materials in the form of videos, animations, narrations and so on, i.e. teaching materials in which the “contents flow one-way on the time axis”, can impart stress to learners who do not share the same native language of the teaching materials. Moreover, it is difficult to adjust the speed, etc. of such teaching materials according to the language level of learners, and often it is difficult to rewind and replay the contents in places that have a poor Internet environment. Furthermore, since there is no way of dealing with situations where contents are interrupted due to interruption of the Internet connection (excluding cases where video data can be downloaded onto a PC, etc.), such teaching materials are not necessarily effective for e-Learning in developing countries. When considering individual learning by private persons, the most important thing is to facilitate personal management of the pace of learning by each learner while limiting the impact on Internet instability to a minimum. From this viewpoint, the technical requirements for effective Kaizen teaching materials are as follows.

[Technical requirements for effective teaching materials]

- Use of videos and animation should be limited to contents that can only be conveyed by such methods. However, a “lecture-style” video in the local language with a lecturer with excellent teaching skills is worth considering because of the cost effectiveness of creating teaching materials.

- When using media data (images, audio, animation, video, 3D graphics, etc.), vector data should be used as far as possible because this generally makes it possible to reduce the size of data.
- In the case of media teaching materials, it is important for learners to be able to resume learning from a free location. If the Internet environment is good, it is possible to access the same teaching materials numerous times without having to save them. However, if the Internet environment is poor, rather than the expressiveness of the teaching materials, freedom from the impacts of unstable connectivity (ability to save locally, etc.) becomes more important.
- Interactive teaching materials are effective. That's because, through responding to the actions taken by learners, it is possible to conduct simulated experiences close to practical learning within the teaching materials.

In addition, as mentioned in (1), customization of the materials according to the group of learners is necessary in order to increase the effectiveness of learning. To enable this customization, the following functional requirements are required for content management system (CMS).

[System functional requirements to create, manage and operate effective teaching materials]

- Function to control versions and access rights of master material and customized materials, and to manage a large amount of contents.
- Function to easily edit, manage and upload multiple patterns of digital teaching materials on the web.
- Function that creates a curriculum as a collection of small units of teaching materials and enables the creation of a variety of learning courses while using the same teaching materials.
- Function for multilingual support of the system as well material internationalization support such as subtitles to enable multilingual support from master teaching materials.

7.2 Method for Delivering Teaching Materials

Africa covers a vast area, and the coverage of fixed Internet connections there is limited to major urban centers. Moreover, in line with the rapid spread of mobile phones, the area covered by mobile Internet is far larger than that covered by fixed lines. Therefore, people tend to think that it is better to directly deliver teaching materials to learners' smartphones, etc. via mobile Internet connections, however, the findings of the Study pilot program were totally the opposite. Since mobile Internet lines are expensive pay-per-use schemes, hardly any of the learners wanted to bear the costs themselves. Moreover, almost all of the learners participated in the pilot e-Learning from a workplace Internet-connected PC during working hours. Therefore, in realistic terms, the most acceptable method for delivering teaching materials will be one of the following.

- If delivery of teaching materials is conducted through the Internet, the only option for learners is to receive them using their organization's or company's Internet environment (normally a fixed line with the line cost paid by the organization or company).
- If delivery of teaching materials is conducted through a method other than the Internet (CD-ROM, etc.), the above doesn't apply. However, in this case, the physical costs of updating, managing and delivering teaching materials became a problem. In the final analysis, to exploit the inherent merits of e-Learning, delivery by Internet should be adopted.

Moreover, from the viewpoint of protecting the copyrights of distributed teaching materials, when delivering teaching materials through the Internet, the issue of whether or not to permit their downloading is a difficult question. The pilot program in the Study revealed that a delivery method that is based on a constantly connected Internet environment hardly functions at all in places where the Internet is unstable, however, almost all of the copyright protection technology that is commonly used for e-Learning in the world today assumes constant connection to the Internet. To consider the convenience of learners, instead of using rigid copyright protection technology, it is necessary to permit the downloading of teaching materials (even if it be limited) and make it possible for learners to proceed with learning even when they are not connected to the Internet. Specifically, use of the following technologies is recommended:

- Through partially storing teaching materials in a Web browser cache, etc., make it possible to access teaching materials (the parts stored in the cache) even when learners are offline. Such offline access technology is recently becoming popular in Web services; moreover, in addition to simple data caches, functional caches are also becoming possible (through use of Web browser local databases and JavaScript, etc.) (a representative example of this is Google's GSuite app).

However, not all Web browsers support such functions; moreover, in technical terms, since it is possible to make copies, etc. of teaching materials by removing data from caches and so on, it should be noted that copyright is not entirely protected. Alternatively, it is also possible to protect the copyright of downloaded content without a constant connection to the Internet by having the user install some kind of application. (A prime example is an e-book reader like the Amazon Kindle.)

7.3 How to Use e-Learning

As has been described so far, learning by individual learners based on use of pay-per-use mobile Internet lines is not a realistic option in Ethiopia. However, when it is considered that almost all the learners accessed the e-Learning contents from their workplaces during working hours, the most practical method for effective e-Learning in African countries is individual learning based on [hypothesis B2] CRT system (blended learning). Specifically, and this may sound repetitive, the implementation method is as described below.

- The learners assemble in the classroom at a pre-determined time and jointly learn from teaching materials that are projected onto the classroom screen via the organization's or company's Internet connection. These teaching materials are distributed via the Internet in the same way as conventional e-Learning.
- Concerning parts that require individual assessment by learners, for example, quizzes and tests, each learner access the Internet with their own smartphone, etc. (via the Wi-Fi line, etc. provided by the organization or company).

This approach is also effective for resolving the following kinds of problems that became apparent in the hearing survey during the pilot implementation.

- Because it is necessary for the organization to explicitly provide a time and place for learners to learn about Kaizen, it is possible to overcome the issues that many learners gave as reasons for being unable to participate in e-Learning, i.e. "I didn't have time" or "I was too busy at work", and thereby also address the issue of lack of motivation on the side of learners.
- Since it is possible to clearly record the attendance of learners (in the same way as with conventional classroom learning), it becomes more difficult for learners to be absent from lessons, thus resulting in higher attendance rates (learning rates).
- Since videos and other teaching materials comprising large data volume can be viewed by all learners at once, it becomes possible to secure stable access without placing too heavy a burden on the Internet connection.

Moreover, as was also the case in the pilot program here, some learners received the e-Learning contents via mobile Internet connections using their own smartphone or PC. If learners are wealthy enough to afford pay-per-use charges (managers of companies and organizations, etc.), it is possible for them to receive individual learning based on [hypothesis B1] online e-Learning. Since this is the approach to learning that allows the merits of e-Learning to be utilized the most, the option of [hypothesis B1] should also be retained in anticipation of pay-per-use rates coming down in the future.

Furthermore, the pilot has also revealed that motivating learners is a challenge, especially when the organization takes the initiative to have staff learn. Therefore, it is important to provide some kind of incentive to learners in the implementation of e-Learning such as the followings.

- Provides some kind of financial and / or job evaluation incentive for learners as an organization.
- Issues a certificate upon completion of the course. This certificate can also be a digital certificate that is automatically issued by the LMS. It is also clear from the pilot implementation that the certificate does not necessarily have any official effect and that even a superficial certificate is effective in motivating learners. (At the request of the user, the pilot issued a digital certificate with no real effect.)

7.4 Charge Structure

Here, too, the pay-per-use charge structure of mobile lines is an extremely important issue. Even if contents can be used for free of charge, if it is necessary for learners to pay for access each time they want to look at the same contents, the financial burden will become a major issue. As was stated above, if it is assumed that the most effective method for e-Learning in Africa is for learners to gather in classrooms and participate in CRT-based individual learning, the most rational and realistic approach to collecting charges is not to levy from individual users but rather to levy blanket charges from their organizations. Moreover, in order to administer e-Learning on a sustained basis in the future, it will be important to secure such organizations as large-scale users. In general, compared to levying charges from individuals, levying blanket charges from organizations is better for setting charges at a level suited to sustained operation. When charges are levied from individuals, if the charges are set too high, it is possible that people will not want to participate in e-Learning, making it necessary to implement various sales promotions, such as free demonstrations and so on. Judging from the results of the pilot program here, even though the contents were free of charge, the participation rate of learners was still less than 50%. Accordingly, to disseminate e-Learning in the Kaizen field, the unearthing and securing of organizational users is deemed to be the most important factor. Case studies in e-Learning business in advanced countries including Japan, the success of online services for individuals is rare, but there are many successful examples of B2B business models targeting organizations and B2B2C business models mediated by intermediary organizations that are responsible for sales and services. In Japan in particular, the CRT e-Learning business model is gaining traction from primary and secondary education to adult education.

Finding and securing organizational users is also important from the perspective of maintaining educational quality as well as ensuring sustainability through the introduction of paid services. In order to realize the “customization of learning materials for learners” mentioned in 7.2, it is essential to have an organization that can localize the language of the materials and customize them according to the educational purpose. For example, it is said that there are nearly 100 languages in Ethiopia alone, and in order to disseminate Kaizen e-Learning to non-metropolitan areas through primary education, these languages need to be localized, but it is not feasible for a single organization to implement them. How to construct a supply chain management, that consists of organizations and individuals who can gain incentives through educational activities in localizing these materials into each language and to each education areas, is likely to be the key to extending e-Learning in the Kaizen field to the end. The establishment of a supply chain with multiple organizations is discussed in more detail in the section 7.6.

7.5 Possibilities of e-Learning in the Kaizen digitization (e-Kaizen) domain

In recent years, Digital Transformation (DX) is rapidly progressing in all areas of human activity, and the possibility is being discussed in the area of Kaizen. In particular, the manufacturing industry is working on the 4th Industrial Revolution (4IR) that makes full use of advanced technologies on a global scale. These digitalization efforts and Kaizen activities that have been practiced so far are found to be not mutually exclusive, but rather are very important complements with each other.

In the 4IR efforts being carried out in the manufacturing world, three major factors are Digitalization, Networking, and Data-driven manufacturing. Of these, “Data-driven manufacturing” which is acquiring data from the site, performing accumulation / analysis of data, making a judgment, and feeding back the result to the manufacturing process, is a very important and the most difficult factor. If this is not done before introducing FA or digitalization while leaving an environment that creates waste and quality defects, production speed may increase, but the defect rate and cost will not decrease at all. Until now, Kaizen activities have actually performed this “improvement of business based on data” manually (in analog form). Kaizen, especially advanced Kaizen that eliminates waste and improves productivity based on data, is an indispensable factor for digital transformation of operations in all industries, including next-generation smart manufacturing, though now it is time to “digitize” the method. (See the figure below)

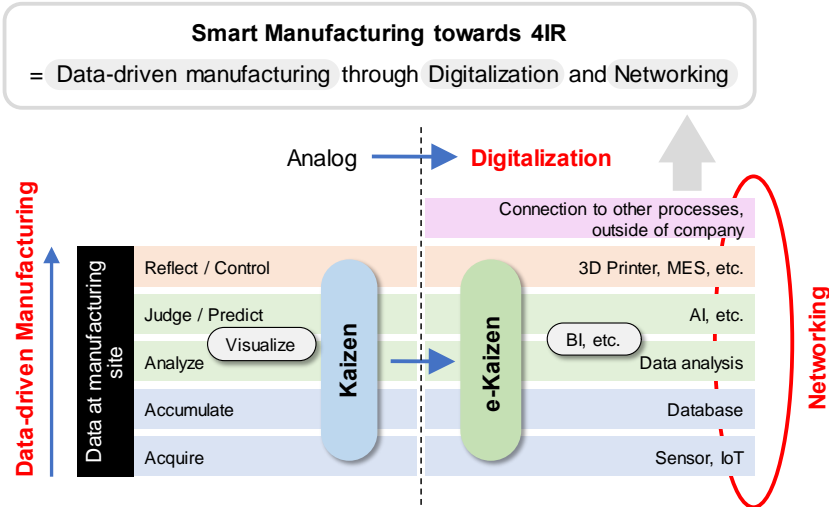


Fig.-17 3 factors of smart manufacturing and the role of Kaizen

In the digitalization of Kaizen (e-Kaizen), not only will the activities that have been done manually be performed more accurately and faster by introducing digital technology, but the information (digital data) acquired in the process will also be accumulated, so the efficiency of Kaizen, which has been performed in analog form, can be dramatically improved by analyzing, displaying, and judging digitally, and ultimately, the results will be fed back to machine tools and other devices in the field to enable achieving intelligent and autonomous business improvement.

Currently, one of the first steps that can be taken in the e-Kaizen domain is to digitize the first step of data-driven operation, the “data acquisition”. Some specific examples are shown below.

- The time spent on or finishing time of each process of the work has been manually recorded on paper by the worker, and was used for improvement of the process. These can be recorded automatically by using sensors.
- The number of parts or products manufactured is counted by hand or by a machine counter. This can be recorded automatically with time stamp by using a sensor.

- By assigning an individual number to each product, it has been manually recorded which process each product has passed. It is now possible to read the barcode or RFID tag attached to the product (or work procedure sheet) to track them automatically. The same method can be applied to inventory management of parts, etc.
- The state of the machine and the working environment (temperature, oil pressure, etc.), which has been recorded manually by humans until now, can be automatically recorded by reading digital sensors or analog meters with AI-enabled cameras.
- By installing a specific app in employee's smartphone, you can keep a record of the approximate location and movement of the employee within the company simply by putting it in the employee's pocket (without looking at the smartphone screen)²⁵. By analyzing the data, the work flow of the employee can be optimized.

Such a shift from “human recording” to “digital automatic recording” not only reduces the burden on humans, but also has the effect of preventing human errors from reading, writing, or intentional false records, etc. Also, once recorded digitally, data can be easily stored in files, databases, etc., and real-time “visualization” of the site can be achieved by analyzing and displaying it digitally, and by statistical processing of data or AI, it can realize the “notice” for advanced points for improvement. In addition, the digitization of “data acquisition” as described above can be implemented with a smartphone in its simplest form²⁶, or if you have some knowledge of electronic circuits, with a sensor (that can be obtained from several hundred yen), an one-board computer²⁷ (a few thousand yen) and a PC. This is an extremely cost-effective and easy-to-start next step of analog Kaizen for small and medium-sized companies who do not have the funds to introduce machine tool or FA.²⁸

As the possibility of e-Learning in the domain of Kaizen digitization (e-Kaizen), it is considered important to take advantage of the fact that it is easy to communicate with each other's data because both use digital technology. Examples of specific possibilities are shown below.

- Utilize an e-Learning system linked to a two-dimensional barcode for Kaizen on-site training or employee education on in-house equipment. Two-dimensional barcodes are pasted on equipment that requires training on the operation method, and when the barcode is read with a smartphone, it opens a learning screen for the operation method of the target equipment.
- By measuring the operation time of each worker, the skill level of each worker is estimated, and a vocational education curriculum customized for each worker is automatically created and provided through e-Learning.

²⁵ It requires to setup equipment called “beacon” withing the company.

²⁶ <https://www.bimms-mieta.com/detail>

²⁷ Raspberry Pi, Arduino, ESP32 etc.

²⁸ <https://www.kouritu-up.net/iot/1-2/>

- Build a knowledge base system to share the progress status and problems of each client company obtained from the work of Kaizen consultant, and use it for consulting to a client company with a similar consultation or if the responsible consultant changes.

7.6 Sample implementation plan

This section describes a specific implementation plan for e-Learning that aims to effectively disseminate Kaizen in Africa.

(1) Infrastructure configuration that is suitable for Kaizen e-Learning

The infrastructure required to provide e-Learning over the Internet is basically a server that can connect to the Internet and various software (OS, database, LMS, etc.) that is installed within the server. Depending on the physical location of these components and where the management entity for each component is to be located, there are a variety of possible infrastructure configuration options, as shown in the figure below.

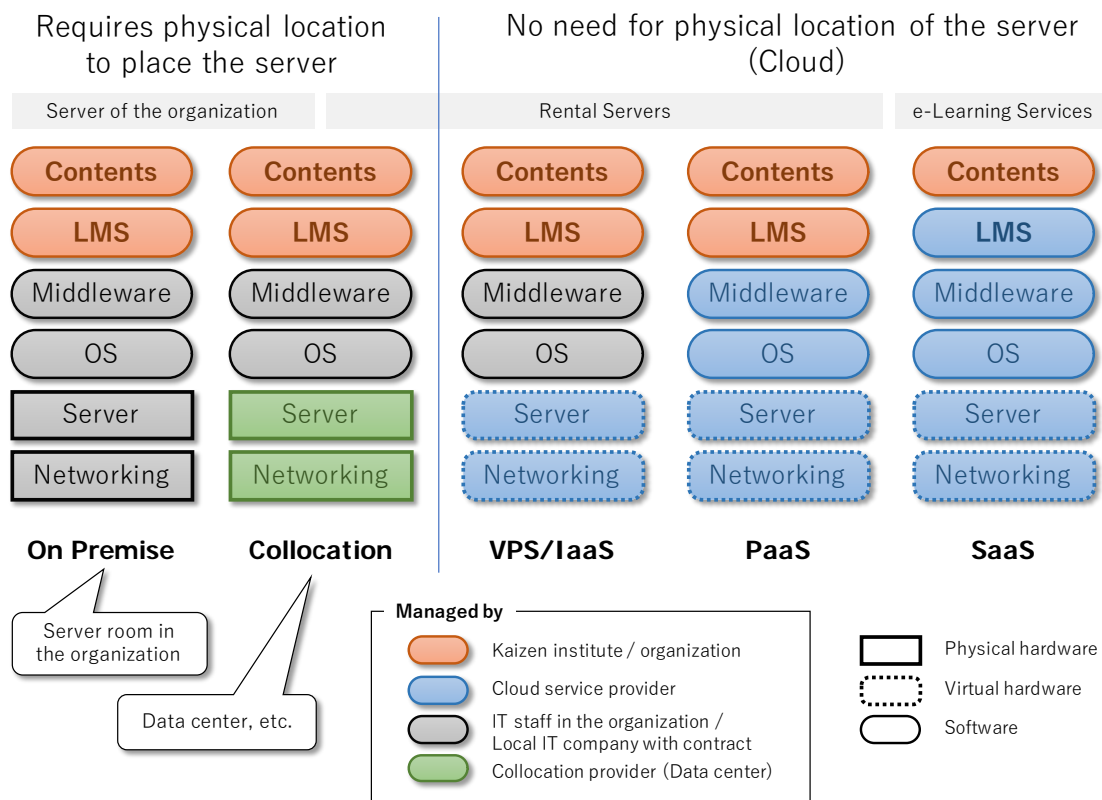


Fig.-18 Possible infrastructure configuration options for e-Learning infrastructure configuration

In this figure, categories of “Server of the organization”, “Rental Servers”, and “e-Learning Services” correspond to implementation methods described in Table-2. Also, “Middleware” in this figure means indispensable basic functions required for LMS implementation such as database management system (DBMS) and Web server software. Brief explanation of each option as well as its advantage / disadvantage are shown in the table on the next page.

Table-26 Comparison of infrastructure configuration for providing e-Learning

Configu-ration	Brief Explanation	Advantage	Disadvantage	Cost		Examples
				Initial Cost	Operational Cost	
On Premise	Place servers within the organization (server room, etc.)	All configuration and management, including hardware and network infrastructure, can be done freely.	Need to provide high-speed, stable internet connection, uninterruptible power supply, and their maintenance/ management systems all by oneself.	Very expensive <ul style="list-style-type: none"> Internet connection infrastructure, server room facilities, all hardware and software. JPY 2~20M 	Expensive <ul style="list-style-type: none"> All equipment maintenance costs (including IT personnel/ maintenance company contract costs) JPY 50K~5M / year 	
Colloca-tion	Place servers at specialized service providers (data center, etc.)	High-speed lines, stable power supply and a resident maintenance management system can be ensured. The server configuration management is also free.	Separate technical personnel are required for maintenance and management of the server internals (OS, middleware, and other software). Reliability is dependent on the data center.	Expensive <ul style="list-style-type: none"> Server hardware and software, Initial cost of using data center Millions JPY 	Expensive <ul style="list-style-type: none"> Rental cost of datacenter, maintenance and management cost of software inside the server JPY 50K~5M / year 	Data centers and hosting services that provide dedicated servers in the world (Bluehost, HostGator, Sakura dedicated server, etc.)
VPS/IaaS	Place and manage virtual servers on the cloud	You can freely (and remotely) configure and manage the software inside the server. Virtualization allows for extremely stable operation (almost no hardware-induced failures). Inexpensive rates.	Separate technical personnel are still needed to maintain and manage the server internals (OS, middleware, and other software).	Inexpensive~ Normal <ul style="list-style-type: none"> Software in the server (in case of paid software) Initial cost of cloud contract (0 for the most of cases) 0~JPY 50K 	Normal <ul style="list-style-type: none"> Cost of using virtual server (Monthly or pay as you go), maintenance and management cost of software inside the server JPY 5K~50K / year 	VPS: Hosting services in the world, Amazon Lightsail, Sakura VPS, etc. IaaS: Amazon EC2, GCP ComputeEngine, Azure Virtual Machines, Sakura cloud, etc.
PaaS	Setup and manage application on top of the provided virtual platform (servers, middleware, etc.)	No need to maintain the server internals (OS, middleware, etc.) and you can focus on application configuration and management.	There is almost no existing LMS applications that match, so you need to develop your own.	Inexpensive~ Expensive <ul style="list-style-type: none"> Development cost of application (or, cost of using readymade application) Initial cost of cloud contract (0 for the most of cases) 0~JPY 5M 	Rather expensive <ul style="list-style-type: none"> Cost of using virtual platform (Monthly or pay as you go), maintenance and management cost of application JPY 5K~1M / year 	AWS Lambda, AWS Elastic Beanstalk, GCP AppEngine, Azure Functions, etc.
SaaS	Use provided (ready-made) application on the cloud	No technical maintenance is required and the provided application can be used immediately.	It is difficult to extend and customize the functionality because you must use readymade application. The higher the number of users, the higher the cost.	Inexpensive <ul style="list-style-type: none"> Initial cost of service contract (0 for the most of cases) 0~JPY 50K 	Normal~ Expensive <ul style="list-style-type: none"> Cost of using application (pay as you go for the most of cases) JPY 5K~5M / year 	Canvas, Moodle Cloud, TalentLMS, etc.

Among these options, VPS / IaaS or SaaS is the infrastructure configuration that is considered suitable for e-Learning to promote Kaizen in Africa.

- VPS / IaaS is highly feasible when considering the e-Learning operation costs that can be sustained by paying for contents, because the flexibility of configuration and the cost are low. Technically, it is more desirable to use IaaS that can flexibly change the server capacity and data capacity in response to increasing number of users, etc., instead of VPS in which the server capacity and data capacity are fixed. However, in VPS / IaaS, it is necessary to perform technical maintenance and management of the server, and for that purpose, it is necessary to assign a technical staff specifically, or to outsource to an external company.
- The greatest advantage of SaaS is that there is no need to perform the technical maintenance and management described above (it is performed by the service provider side), and it is possible to concentrate on the operation of e-Learning services. However, since the cost of provided service plan often increases in proportion to the number of users and the number of contents, it is required to have strategies such as using only in the early period when the number of users is small and moving to IaaS in the future. For example, first, as in the case of the pilot in this study, it is possible to limit the number of users and try as a pilot for multiple countries using SaaS, and then switch to IaaS and start sustainable operation by paid service.

As for the new “server room” planned in the new EKI building currently being constructed in Ethiopia, in which one server and one PC will be provided, it is not recommended to setup a Kaizen e-Learning system on-premises in the server room for the following reasons.

- Our review of the construction plan documents indicates that the server room is intended to serve EKI’s internal network and is not designed to “provide e-Learning to the outside world”.
- In order to receive access from a large number of external users, it is necessary to have a very high-capacity backbone (connection bandwidth to the outside world) and a fixed global IP address, which is different from a normal Internet connection, but it is difficult for an organization such as EKI to bear its high cost on a sustainable basis.
- In order to manage and operate organization’s own server and network infrastructure, it is necessary to assign a dedicated system administrator, and the server room needs to be equipped with uninterruptible power supplies, generators, server air conditioning, etc. However, it is difficult to cover these investment cost and the operating cost by paid service, etc.
- Considering that the price of the cloud service includes the management and operation costs of the backbone and infrastructure, the price is extremely low as compared to the case of having organization’s own server, and the stability is also incomparably high.

- In case it is absolutely necessary to physically setup a server in Ethiopia for reasons such as national policy, a domestic colocation service or rental server should be used instead of on-premises. Specifically, there are the Ethiopian National Data Center (ENDC)²⁹ constructed by the Ministry of Innovation and Technology and the hosting service provided by Ethio Telecom³⁰.

(2) Kaizen e-Learning supply chain construction

Sustainable operation of e-Learning services in the Kaizen sector in African countries requires a fee-paying strategy that can sustain these operating costs. There are two options for this. One is the case where the international Internet connection in each country has sufficient bandwidth compared to the expected number of users and provides most of e-Learning contents common to all countries. The easiest way is to provide the same e-Learning service to all countries with single LMS. However, in this case, it is not easy how multiple countries jointly operate and manage a single LMS. There are many difficult issues, such as how to absorb the differences in the content that each country expects from e-Learning and how to share the burden of LMS operation costs with the number of users in each country, etc. In case a country would withdraw from the operation, it would increase the burden on the rest of the countries, raising questions about sustainability.

Another method, which is effective when it is assumed that there will be a lot of localized content and original content for domestic use in different countries, is to build a hierarchical supply chain with a central content/service provider at the top, which makes it easier to provide services that are adapted to each country's situation. An example of a supply chain for systematic distribution of Kaizen e-Learning is shown in the figure below.

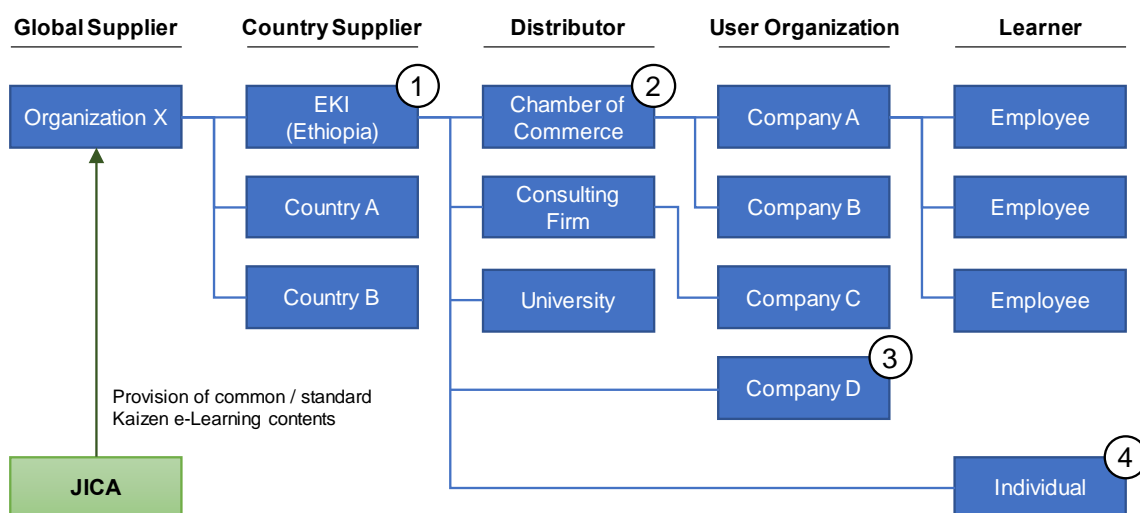


Fig.-19 An example of supply chain for Kaizen e-Learning

²⁹ <http://www.mcit.gov.et/web/guest/infrastructure>

³⁰ <https://www.ethiotelecom.et/product/web-hosting/>

The ① to ④ in the figure indicates examples of the paying options. In the case of ①, the Country Supplier issues an operation license to the distributor and collects a user fee. In ②, a company or individual distributor with a license to operate provides customized e-Learning services to user organizations for a fee. ③ User organizations use e-Learning without distributor for a fee, or provide it to individuals for a fee. In Japanese corporate training, the company mediates and subsidizes the training program in this area ③, but the selection and payment of fees are made by the employees of the company. ④ is the provision of fee-based qualification courses and exams for individuals. The composition and role of each of these organizations is shown in the table below.

Table-27 Composition of each organization in the Kaizen e-Learning supply chain

Composition	Role	Key to success
JICA	<ul style="list-style-type: none"> • Provision of basic Kaizen contents 	Could the list of contents be enriched?
Global Supplier (Global Management Body: GMB)	<ul style="list-style-type: none"> • License management (issuing qualifications, etc.) • System management • Basic contents management • Service management 	Could the course customization according to language / purpose be realized?
Country Supplier (Country Management Body: CMB)	<ul style="list-style-type: none"> • Service operation • Course (contents) customization and localization (translation) • Domestic fee collection management 	Could we secure the Country Supplier for each country?
Distributor	<ul style="list-style-type: none"> • Proposal / introduction to user organizations • Proposal of customization to each organization • Consulting to each organization 	Could we provide incentives for the distributor?
User Organization	<ul style="list-style-type: none"> • Setting up learning objectives • Learner management • Learner evaluation 	Motivating learners to match the educational objectives of the organization

Some countries may not yet have reached the stage of building a supply chain as shown above. For example, countries that do not yet have appropriate CMB (such as Kenya, where the private sector is stronger than the public sector), countries that have CMB but do not have distributors (strong public sector, weak private sector), countries that have no CMB or distributor in their own country but can be replaced by the CMB of closely related neighboring country (such as Djibouti), and countries where neither their own country nor neighboring country's CMB or distributor can be secured. The points to be aware of and the keys to success in these cases are summarized in the table below.

Table-28 For countries where a complete supply chain cannot be built

Case	Points to be aware of in the composition	Key to success
Countries that have no appropriate CMB (private sector is stronger than the public sector, etc.)	<ul style="list-style-type: none"> The GMB will enter into contracts with distributors and user companies in place of the CMB, but since there is no intermediate organization to localize the content, users can use the original content (English, etc.) as it is. In the case of paid service, it is necessary for the distributor to directly collect the usage fee and pay the license fee to the GMB. 	<ul style="list-style-type: none"> Limit to countries where learning in English is no problem. Alternatively, localization into a local language is done by a distributor or JICA. Is it possible to manage licenses for distributors in each country by the GMB?
Countries that have CMB but do not have distributors (strong public sector, weak private sector)	<ul style="list-style-type: none"> The role of distributor will be taken over by the CMB. 	<ul style="list-style-type: none"> Strengthen marketing and consulting capabilities of CMB. Utilize local branch offices of CMB for the bases for introduction to user companies.
Countries that have no CMB or distributor in their own country but can be replaced by CMB of closely related neighboring country	<ul style="list-style-type: none"> Localization is difficult for countries with different local languages than neighboring countries. Neighboring countries need to collect usage fees for the target country. 	<ul style="list-style-type: none"> Limit to countries where learning in English is no problem. Alternatively, localization into a local language is done by a distributor or JICA. Can the charge collection business in the target country be carried out by a CMB or distributor in neighboring countries? Is it possible to collect usage fees across borders?
Countries where neither their own country nor neighboring country can secure CMB or distributor	<ul style="list-style-type: none"> The e-Learning system (LMS) must also be set up at the GMB, since user companies and individual learners in the country will receive services directly from the GMB. 	<ul style="list-style-type: none"> Can GMB operate LMS? Will the LMS in GMB compete with LMSs in countries with CMB? (If the content is customized or localize, it can be differentiated.) Is there a mechanism to complete online cross-border collection of charges (limit to credit cards, etc.)?

(3) Role of JICA

In order to promote e-Learning in the field of Kaizen throughout Africa in the future, it would be effective to provide the following two levels of support by JICA.

First, the implementation of a pilot program aimed at building a supply chain for Kaizen e-Learning as described in the previous section. In this program, JICA will target 11 African countries where Kaizen-related activities are carried out, designate Kaizen promotion organization in each country as a Country Management Body, and implement e-Learning through common and standardized content using SaaS (such as Moodle Cloud) on a trial basis. It is desirable to designate an organization that promotes and coordinates Kaizen activities internationally such as AUDA-NEPAD, or an organization such as Japan's Productivity Center as the Global Management Body. In this pilot program, the three courses developed in this survey program will be used for trial

localization into local languages in each country, with the aim of establishing a coordinated system from upstream to downstream in the supply chain, and to try collecting fees.

Next, once the supply chain of the above pilot is established, the development and delivery of e-Learning content of the basic free Kaizen standard curriculum, which can be used not only in Africa but also worldwide, will be undertaken for a certain period of time. The content can be provided off-line depending on the target country, and since it is basically free of charge, there will be no usage fees between JICA and the Kaizen Management Organization. However, even if it is free of charge, the copyright should belong to JICA, and whether or not to allow free redistribution should be carefully considered. This is because it may overlap with the content of the paid Kaizen trainings offered by each Kaizen organization, which may undermine the profitability of those existing paid courses. Basically, the most desirable method is to make the content available only to organizations that have entered into an agreement with JICA or the Global Management Body, and then to customize and localize the content by the Country Management Body and provide it for a fee.

(End)

APPENDIX

Appendix-1: Major e-Learning providers in the target countries

Country	Provider	Type of Business	Outline of the Service
Burkina Faso	Peace Operations Training Institute	Provision of courses	(Refer to the last column of this table.)
Cameroon	e-Learning Cameroon ³¹	Provision of courses	Courses for school age children and higher education
	African Institute for Mathematical Sciences ³²	Provision of courses	Course for mathematics teachers
Egypt	Innovera ³³	Provision of courses	Partnership agreement with 6 organizations; provision of contents for vocational training, including one for teachers, and K12; also operating in Sudan
	RRC International ³⁴	Provision of courses	An independent test organization in the UK; course specialized in NEBOSH to issue vocational qualifications regarding health, safety, environment and management; also operating in Tunisia
Ethiopia	Ethiopian Red Cross Society ³⁵	Provision of contents	Free contents for Red Cross staff and general public in Ethiopia
	Ethiopian Distance Learning Association ³⁶	Provision of information	Information on distance education for youth in Ethiopia jointly with grassroots organizations
	Ethiopia Aviation Academy ³⁷	Provision of courses	Use of e-Learning at a school run by Ethiopian Airlines
Ghana	A-Plus E-Learning ³⁸	Development of contents	Provision of a system capable of dealing with all contents of K12 and vocational training
	Eneza ³⁹	Provision of courses	Course specialized in K12 with the use of smart phones; also operating in Kenya and Ivory Coast
	Wolo ⁴⁰	Provision of courses	Contents corresponding to individual subjects of each grade of higher secondary education
Kenya	e-Learning Solutions ⁴¹	Provision of courses	15 courses for various business fields
	Eneza	Provision of courses	Course specializing in K12 with the use of smart phones; also operating in Ghana and Ivory Coast
	sQuid ⁴²	Provision of courses	Digital recording of attendance, cashless system on university campuses, etc. in addition to e-Learning courses

³¹ <http://elearningcameroon.xyz/>

³² <https://aimstp.org/elearning/>

³³ <http://www.innovera.me/>

³⁴ <https://www.rrc.co.uk/international/egypt.aspx>

³⁵ <http://www.redcrosseth.org/resource/e-learning>

³⁶ <http://www.physics.ncat.edu/~michael/edla/>

³⁷ <https://www.ethiopianairlines.com/EAA>

³⁸ <http://apluselearning.com/>

³⁹ <https://enezaeducation.com/>

⁴⁰ <https://www.woloafric.com/>

⁴¹ <https://wlearningsolutions.co.ke/>

⁴² <https://squidkenya.co.ke/>

Country	Provider	Type of Business	Outline of the Service
South Africa	Ceed Learning ⁴³	Development of contents	Development of a system to match customer needs, such as school education, practical training, coaching, etc.
	Net Learn ⁴⁴	Provision of courses	Courses to match the needs of schools, vocational training schools, universities and enterprises
	Web anywhere ⁴⁵	Development of contents	Development of contents for both education and business operations using Moodle; global operation
	LRMG ⁴⁶	Development of system	Development of an e-Learning course for the University of Witwatersrand
Sudan	Innovera	Provision of courses	Partnership agreement with 6 organizations; provision of contents for vocational training, including one for teachers, and K12; also operating in Egypt
	War child ⁴⁷	Provision of courses	Courses in line with the primary school curriculum, mainly targeting school age children affected by conflict; also operating in Uganda, Sudan and Jordan
Tanzania	The Launch Pad ⁴⁸	Provision of courses	Adult courses on efficiency, leadership, team activities, etc.
Tunisia	RRC International	Provision of courses	An independent test organization in the UK; course specializing in NEBOSH to issue vocational qualifications regarding health, safety, environment and management; also operating in Egypt
Zambia	mwabu ⁴⁹	Provision of courses	Courses for teachers in primary school Year 1 through Year 7; courses on all subjects for primary school pupils
(Entire Africa)	Peace Operations Training Institute ⁵⁰	Provision of courses	Free courses in English, French, Spanish, Dutch and Arabic for those engaged in UN peacekeeping activities; funded by the Canadian government; also courses for Burkina Faso, Egypt and Cameroon

⁴³ <http://ceedlearning.com/>

⁴⁴ <http://www.netlearn.co.za/>

⁴⁵ <https://www.webanywhere.org/>

⁴⁶ <https://lrmg.co.za/>

⁴⁷ <https://www.warchildholland.org/projects/cant-wait-to-learn/>

⁴⁸ <http://thelaunchpad.or/tz/e-learning/>

⁴⁹ <https://mwabu.com/zambia>

⁵⁰ <https://www.peaceopstraining.org/programs/ntcelp/africa/burkina-faso/>

Appendix-2: Main educational institutions providing e-Learning in the target countries

Country	Educational Institution	Outline of e-Learning
Burkina Faso	EDE Enseignement a Distance ⁵¹	BA and MA courses
Cameroon	University of Yaounde ⁵²	e-Learning course in projects of the UN University
Egypt	Egyptian E-Learning University ⁵³	Introduction of an e-Learning system for 3 to 19 hours a year; an e-Learning course can be taken in the autumn semester and optional spring semester
Ethiopia	Jimma University ⁵⁴	Online lectures, tests and tasks for students; enrolment can last up to discussions on the forum and final test
	Ethiopian Online Science and Technology University ⁵⁵	e-Learning course for institutions for higher education using Moodle
	Mekelle University ⁵⁶	(details unknown)
Ghana	University of Ghana ⁵⁷	(details unknown)
Kenya	Kenyatta University's Digital School of Virtual and Open Learning ⁵⁸	Qualification, graduate and post-graduate level e-Learning for people finding it difficult to attend a school due to work or other reasons
	Centre for Open and Distance Learning, University of Nairobi ⁵⁹	Courses for 51 graduate schools of 12 faculties and for 20 other faculties
South Africa	University of Witwatersrand ⁶⁰	Short courses for businesses
	University of Cape Town ⁶¹	Promotion of online teaching and enhancement of IT literacy among teachers and students
	Cape Peninsula University of Technology ⁶²	Introduction of LMS from Year 2000
Sudan	University of Juba ⁶³	Establishment of an open distance and e-Learning center with the assistance of the AfDB; details of the use of media for distance education using the Internet are unknown
Tanzania	University of Dar es Salaam ⁶⁴	Commencement of distance education funded by Carnegie Foundation of the USA to deal with an increasing number of students
Tunisia	Tunisia Vertical University ⁶⁵	(details unknown)
Zambia	Institute of Distance Education, University of Zambia ⁶⁶	Many courses for graduate and post-graduate students using Moodle
(Entire Africa)	African Virtual University ⁶⁷	Started in 1997 as a World Bank Project; provision of e-Learning in 2003 as an inter-governmental facility; 19 African member countries at present

⁵¹ <http://www.ecolendirect.fr/>

⁵² <https://universityofyaounde.com/#/videos2>

⁵³ <http://www.eelu.edu.eg/>

⁵⁴ <https://www.lucyacademy.com/ju/>

⁵⁵ <http://ethiopianostu.com/>

⁵⁶ <http://213.55.94.36/cncs/index.php/cncs-site-map/129-e-learning/264-e-learning>

⁵⁷ <http://ugcs.ug.edu.gh/service-catalogue/e-learning>

⁵⁸ <http://www.ku.ac.ke/dsvol/>

⁵⁹ <http://codl.uonbi.ac.ke/>

⁶⁰ <https://www.wits.ac.za/part-time/online-learning/>

⁶¹ <http://www.healthedu.uct.ac.za/e-learning>

⁶² <http://www.cput.ac.za/services/ciet?id=6225>

⁶³ <http://jubauni.net/colleges-centers-for-distance-education/>

⁶⁴ <http://ela-newsportal.com/elearning-at-the-university-of-dar-es-salaam/>

⁶⁵ <https://www.uninettunouniversity.net/en/ftntunisia.aspx>

⁶⁶ <https://www.unza.zm/institutes/ide/>

⁶⁷ <http://www.avu.org/avuwweb/en/avu-at-a-glance/>

Appendix-3: Example courses conducted by e-Learning providers

RRC International

Egypt <https://www.rrc.co.uk/international/egypt.aspx>

Tunisia <http://rrc.tn/>

A-4

① NEBOSH National Diploma in Occupational Health and Safety				
<Time>	For 468 hours			
<Contents>	Unit A: Health/ Safety Management <ul style="list-style-type: none"> ● Basics of Health and Safety Management ● Basic Health and Safety Law ● Penal code ● Civil code ● Causal Relationship and Accident Investigation of Loss ● Measurement and Reexamination of Health and Safety ● Prediction and evaluation of hazards ● Risk Management ● Organizational component ● Human factor ● The Role of Health and Safety Workers. (A Three-Hour Written Examination.)	Unit B: Hazardous Substances/ Methods <ul style="list-style-type: none"> ● Occupational health management ● Identification, prediction, and evaluation of hazardous substances ● Supervision of hazardous substances ● Monitoring and measurement of hazardous substances ● Biological means ● Noises and vibration ● Radioactivity. ● Psychiatric Disorders 3- Handling of Violence and Aggression in Health, Work. ● Musculoskeletal Hazards and Supervision ● Operating environment hazard (A Three-Hour Written Examination.)	Unit C: Safety of Workplace and Operating Devices <ul style="list-style-type: none"> ● Workplace well-being requirements and specific workplace challenges. ● Fires and explosions ● Predicting workplace fire hazards ● Storage, operation and treatment of hazardous substances ● Operational equipment ● Workplace equipment ● Mobility, lifting and approach methods for high electrical device safety ● Safety of the electrical system ● Construction and Operation of Temporary Nature-Hazards and Supervision. ● Workplace transport and road hazard management (A Three-Hour Written Examination.)	Unit DNI: Theories and Practices of Health/Safety Utilization Practical workplace evaluation Papers based on a business with 8,000 characters
<Targeting>	Practitioners who wish to work as health and safety professionals in the long term			
<Fee>	Full course : £1,946.00 Unit A : £623.00 Unit B : £563.00 Unit C : £563.00 Unit D : £257.00			

② NEBOSH International Diploma in Occupational Health and Safety				
<Time>	For 468 hours			
<Contents>	Unit IA: Health/ Safety Management <ul style="list-style-type: none"> ● Basics of Health and Safety Management ● Health and safety regulations ● Causal Relationship and Accident Investigation of Loss ● Measurement and Reexamination of Health and Safety ● Prediction and evaluation of hazards ● Risk Management ● Organizational component ● Human factor ● The Role of Health and Safety Workers. (A Three-Hour Written Examination.)	Unit IB: Hazardous Substances/ Methods <ul style="list-style-type: none"> ● Occupational health management ● Identification, prediction, and evaluation of hazardous substances ● Supervision of hazardous substances ● Monitoring and measurement of hazardous substances ● Biological means ● Noises and vibration ● Radioactivity. ● Psychiatric Disorders 3- Handling of Violence and Aggression in Health, Work. ● Musculoskeletal Hazards and Supervision ● Operating environment hazards and supervision (A Three-Hour Written Examination.)	Unit IC: Safety of Workplace and Operating Devices <ul style="list-style-type: none"> ● Workplace well-being requirements and specific workplace challenges. ● Fires and explosions ● Predicting workplace fire hazards ● Storage, operation and treatment of hazardous substances ● Operational equipment ● Workplace equipment ● Mobility, lifting and approach methods for high electrical device safety ● Safety of the electrical system ● Construction and Operation of Temporary Nature-Hazards and Supervision. ● Workplace transport and road hazard management (A Three-Hour Written Examination.)	Unit DNI: Theories and Practices of Health/ Safety Utilization Practical workplace evaluation Papers based on a business with 8,000 characters
<Targeting>	Practitioners who wish to work as health and safety professionals in the long term			
<Fee>	Full course : £1,946.00 Unit A : £623.00 Unit B : £563.00 Unit C : £563.00 Unit D : £257.00			

③ NEBOSH National Diploma in Environmental Management	
<Time>	For 235 hours
<Contents>	<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>Unit ED1: Supervising Environmental Protective Aspects</p> <ul style="list-style-type: none"> ● Importance of the cycle of environmental protection and the impact of human activities in the environment ● Guidance on environmental protection ● Environmental protection management system and emergency planning ● Hazard assessment and supervision for environmental protection ● Evaluation of Environmental Protection Outcomes ● Sustainability ● Waste management ● Air pollution management ● Water pollution management ● Supervision of environmental noise ● Hazardous substances and soil pollution ● Energy use </div> <div style="width: 48%;"> <p>Unit NDEMD2: Environmental Preservation Restrictions</p> <p>Three-component structure</p> <ul style="list-style-type: none"> ● Enforcement of environmental protection regulations ● State responsibility ● Pollution prevention and supervision regulations <p>Review of your organization's environmental protection and management system and evaluation based on analytical issues</p> </div> </div>
<Targeting>	Practitioners seeking high specialty in environmental protection management and safety
<Fee>	Full course : £1,018.00
④ NEBOSH International Diploma in Environmental Management	
<Time>	For 235 hours
<Contents>	<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>Unit ED1: Supervising Environmental Protective Aspects</p> <ul style="list-style-type: none"> ● Importance of the cycle of environmental protection and the impact of human activities in the environment ● Guidance on environmental protection ● Environmental protection management system and emergency planning ● Hazard assessment and supervision for environmental protection ● Evaluation of Environmental Protection Outcomes ● Sustainability ● Waste management ● Air pollution management ● Water pollution management ● Supervision of environmental noise ● Hazardous substances and soil pollution ● Energy use </div> <div style="width: 48%;"> <p>Unit IDEMD2: Environmental Preservation Restrictions</p> <p>Two-component structure</p> <ul style="list-style-type: none"> ● Enforcement of environmental protection regulations ● Pollution prevention and supervision regulations <p>Review of your organization's environmental protection and management system and evaluation based on analytical issues</p> </div> </div>
<Targeting>	Practitioners seeking high specialty in environmental protection management and safety
<Fee>	Full course : £1,018.00

⑤ NEBOSH National General Certificate in Occupational Health and Safety			
<Time>	For 133 hours		
<Contents>	Unit NGC1: Health/ Safety Management <ul style="list-style-type: none"> ● Basis for health and safety ● Plan ● Implementation ● Confirmation ● Law (A Two-Hour Written Examination.)	Unit GC2: Supervision of Workplace Hazard Elements in Japan <ul style="list-style-type: none"> ● Workplace hazard factors and hazard supervision ● Hazardous elements of transport, supervision of hazards ● Musculoskeletal hazard factors and hazard supervision ● Supervision of hazardous elements and hazards of operational equipment ● Safety of the electrical system ● Fire safety ● Chemistry, biological health hazards, and hazard supervision ● Physical and mental health hazards and supervision of hazards (A Two-Hour Written Examination.)	Unit GC3: Practical Use of Health/ Safety Practical workplace evaluation
<Targeting>	Representatives of administrators, supervisors, and personnel/ Practitioners starting to engage in health and safety		
<Fee>	Full course : £593.80 Unit NGC1 : £316.00 Unit GC2/3 : £ 339.00		
⑥ NEBOSH International General Certificate in Occupational Health and Safety			
<Time>	For 133 hours		
<Contents>	Unit IGC1: Global Health/ Safety Management <ul style="list-style-type: none"> ● Basics in Health and Safety ● Health and Safety Management Systems: Planning ● Health and Safety Management Systems: ● Health and Safety Management System: Confirmation ● Health and Safety Management Systems; Law (A Two-Hour Written Examination.)	Unit GC2: Oversight of International Workplace Hazard Factors <ul style="list-style-type: none"> ● Workplace hazard factors and hazard supervision ● Hazardous elements of transport, supervision of hazards ● Musculoskeletal hazard factors and hazard supervision ● Supervision of hazardous elements and hazards of operational equipment ● Safety of the electrical system ● Fire safety ● Chemistry, biological health hazards, and hazard supervision ● Physical and mental health hazards and supervision of hazards (A Two-Hour Written Examination.)	Unit GC3: Practical Use of Health/ Safety Practical workplace evaluation
<Targeting>	Representatives of administrators, supervisors, and personnel/ Practitioners starting to engage in health and safety		
<Fee>	Full course : £593.80 Unit IGC1 : £316.00 Unit GC2/ 3 : £339.00		

⑦ NEBOSH National General Certificate in Occupational Health and Safety			
<Time>	For 133 hours		
<Contents>	Unit NGC1: Health/ Safety Management <ul style="list-style-type: none"> ● Basics in Health and Safety ● Plan ● Implementation ● Confirmation ● Law (A Two-Hour Written Examination.)	Unit GC2: Supervision of Workplace Hazard Elements in Japan <ul style="list-style-type: none"> ● Workplace hazard factors and hazard supervision ● Hazardous elements of transport, supervision of hazards ● Musculoskeletal hazard factors and hazard supervision ● Supervision of hazardous elements and hazards of operational equipment ● Safety of the electrical system ● Fire safety ● Chemistry, biological health hazards, and hazard supervision ● Physical and mental health hazards and supervision of hazards (A Two-Hour Written Examination.)	Unit GC3: Practical Use of Health/ Safety Practical workplace evaluation
<Targeting>	Representatives of administrators, supervisors, and personnel/ Practitioners starting to engage in health and safety		
<Fee>	Full course : £593.80 Unit IGC1 : £316.00 Unit GC2/ 3 : £339.00		
⑧ NEBOSH Health and Safety Executive Certificate in Health and Safety Leadership Excellence			
<Time>	10 hours + evaluation		
<Contents>	Unit 1: Health/safety guidance <ul style="list-style-type: none"> ● Basis for health and safety guidance ● Human Failure and Decision Making ● Instruction 		
<Targeting>	Representatives of administrators, supervisors, and personnel/ Newly assigned and motivated managers		
<Fee>	£189.00		

⑨ NEBOSH International Certificate in Fire Safety and Risk Management			
<Time>	For 120 hours + test		
<Contents>	Unit IGC1: Global Health/ Safety Management <ul style="list-style-type: none"> ● Basics in Health and Safety ● Health and Safety Management Systems: Planning ● Health and Safety Management Systems: ● Health and Safety Management System: Confirmation ● Health and Safety Management Systems; Law (A Two-Hour Written Examination.)	Unit IFC1: Safety and Hazard Control for Fires <ul style="list-style-type: none"> ● Safety management for fires ● Basics of Fire and Explosion ● Causes and prevention of fire ● Fire prevention in buildings ● Safety of people during fires ● Safety hazard assessment for fires (A Two-Hour Written Examination.)	Unit IFC2: Application of Safety to Fires Evaluation of the Practices Occurring in Your Workplace.
<Targeting>	Representatives of administrators, supervisors, and personnel/ Fire safety manager/ Advisor to fire safety		
<Fee>	Full course : £593.80 Unit IGC1 : £316.00 Unit GC2/ 3 : £339.00		
⑩ NEBOSH National Certificate in Fire Safety and Risk Management			
<Time>	For 120 hours + test		
<Contents>	Unit IGC1: Health/ Safety Management <ul style="list-style-type: none"> ● Basics in Health and Safety ● Plan ● Implementation ● Confirmation ● Law (A Two-Hour Written Examination.)	Unit FC1: Safety and Hazard Control for Fires <ul style="list-style-type: none"> ● Safety management for fires ● Basics of Fire and Explosion ● Causes and prevention of fires and explosions ● Fire prevention in buildings ● Safety of people during fires ● Safety hazard assessment for fires (A Two-Hour Written Examination.)	Unit FC2: Application of safety to fires Practical workplace evaluation
<Targeting>	Representatives of administrators, supervisors, and personnel/ Fire safety manager/ Advisor to fire safety		
<Fee>	Full course : £593.80 Unit IGC1 : £316.00 Unit GC2/ 3 : £339.00		

Appendix-4: Field survey schedule

(1) First Field Survey (April 28~May 17, 2019)

Date	City	Visited Destination	Survey Contents
4/29	Addis Ababa	EKI	Courtesy call / Explanation of survey contents / Meeting with EKI officials
4/30		EKI	Securing of appointments with visit destinations / Survey of EKI information infrastructure
5/1		Lucy Academy	Survey of e-Learning service provided contents / Inquiry about pilot cooperation
		Ministry of Trade and Industry	Explanation of the survey contents and request for cooperation
5/2		Federal TVET Agency	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Addis Ababa University	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
5/3		EKI	Securing of appointments with visit destinations in regional cities
		(Local Market / ICT Shop)	Local ICT market survey (mobile phones, PCs, etc.)
5/4			Sorting of materials
5/5		Transit (Addis Ababa → Kombolcha)	
5/6	Kombolcha	Kombolcha Polytech college	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Kombolcha Textile	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		(Local Market / ICT Shop)	Local ICT market survey (mobile phones, PCs, etc.)
5/7	Kombolcha	Kombolcha Industrial Park	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Carvico Ethiopia PLC (Italian)	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Saytex spinning (Chinese)	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
	Dessie	Wro Sihen TVET	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
5/8	Kombolcha	Wollo University	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Transit (Kombolcha → Dire Dawa)	
5/9	Dire Dawa	DDMKI	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Dire Dawa University	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Legehare Primary and Secondary School	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Ethio-Italy Polytech College	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
5/10	Dire Dawa	Sabyan General Hospital	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		National Cement	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Dile Chora Referral Hospital	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
5/11	Dire Dawa	(Local Market / ICT Shop)	Local ICT market survey (mobile phones, PCs, etc.)
		Transit (Dire Dawa → Addis Ababa)	

Date	City	Visited Destination	Survey Contents
5/12	Addis Ababa		Sorting of materials
5/13		Chamber Academy	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Intercom (IT company)	Domestic ICT environment and market survey
		PRIME (IT company)	Domestic ICT environment and market survey
5/14		EKI	Sorting of survey findings
		JICA Ethiopia Office	Reporting of survey findings
5/15		NA Metal Engineering	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
		Red Cross Society	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program
5/16		iDF (IT company)	Domestic ICT environment and market survey

(2) Second Field Survey (June 30~July 18, 2019)

Date	City	Visited Destination	Survey Contents	
7/1	Addis Ababa	EKI	Team meeting / Securing of appointments with visit destinations	
7/2		EKI	Securing of appointments with visit destinations	
		Red Cross Society	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
7/3		Leather Industry Development Institute	Survey of e-Learning needs, user environment and intentions regarding participation in the pilot program, and explanation of the pilot implementation contents and participation procedures, etc.	
		NA Metal	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
7/4		Federal TVET Agency	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
		Chamber Academy	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
7/5		EKI	Meeting with vice-director of EKI	
7/5		Addis Ababa	Anbessa Shoes Factory	
7/6				Sorting of materials
7/7			Sorting of materials	
7/8	EKI		Team meeting / Securing of appointments with visit destinations	
	Federal TVET Agency		Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
	Chamber Academy		Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
7/9	Civil Service Commission		Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
	Ministry of Trade and Industry		Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
7/10	Addis Ababa University		Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
	Transit (Addis Ababa → Dire Dawa)			
7/11	Dire Dawa	DDMKI	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
		Dire Dawa University	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
		Legehare Primary and Secondary School	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
		National Cement	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
		Ethio-Italy Polytech College	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
7/12	Dire Dawa	Dile Chora Referral Hospital	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
		Sabyan General Hospital	Explanation of the pilot implementation contents and discussion of participation procedures, etc.	
7/13	Transit (Dire Dawa → Addis Ababa)			
7/14	Addis Ababa		Sorting of materials	
	Transit (Addis Ababa → Kombolcha)			

Date	City	Visited Destination	Survey Contents
7/15	Kombolcha	Kombolcha Polytech college	Explanation of the pilot implementation contents and discussion of participation procedures, etc.
		Kombolcha Textile	Explanation of the pilot implementation contents and discussion of participation procedures, etc.
		Wollo University	Explanation of the pilot implementation contents and discussion of participation procedures, etc.
		Kombolcha Industrial Park	Explanation of the pilot implementation contents and discussion of participation procedures, etc.
		Carvico Ethiopia PLC (Italian)	Explanation of the pilot implementation contents and discussion of participation procedures, etc.
		Saytex spinning (Chinese)	Explanation of the pilot implementation contents and discussion of participation procedures, etc.
7/16	Dessie	Wro Sihen TVET	Explanation of the pilot implementation contents and discussion of participation procedures, etc.
	Transit (Kombolcha → Addis Ababa)		
7/17	Addis Ababa	EKI	Reporting of survey findings to the director of EKI / Creation of report

Appendix-5: Curriculum of pilot teaching materials

(1) Kaizen general

No.	Chap.	Section	No.	Topic			
1	I.	Contents of Kaizen general					
2	II.	What is Kaizen?	1	Origin of Kaizen			
3			2	Definition of Kaizen			
4			3	Important terms			
5				(1) Standard situation			
6				(2) Gap			
7				(3) Problem solving type Kaizen			
8				(4) Task achieving type Kaizen			
9				(5) Kaizen target			
10				(6) Kaizen theme			
11				(7) Kaizen objective			
12				(8) Bottleneck			
13				(9) Possible cause			
14				(10) Root cause			
15			(11) Countermeasure				
16			4	Typical situation after implementing a countermeasure			
17				(1) Appearance of Kaizen results immediately after Kaizen			
18				(2) Temporarily worse Kaizen results after Kaizen			
19			5	Similar management and control methods	(3) Continuously worse Kaizen results after Kaizen		
20					(1) Innovation		
21					(2) ISO		
22					ISO		
23					(3) TOC (Theory of Constrains)		
24					(4) Lean Production System		
25					(5) Six Sigma		
26			6	Features of Kaizen	(6) Balanced Scorecard		
27					(7) Restructuring		
28			7	Kaizen indicators	(8) Participatory		
29					(1) KPIs (Key Performance Indicators)		
30					(2) KPIs of EKI (Ethiopian Kaizen Institute)		
31					Why is Kaizen?	Why is Kaizen?	
32						1	Kaizen and high growth economy of Japan
33						2	Background for Kaizen
34						3	Reasons of Kaizen
35	IV.	Where is Kaizen?				Where is Kaizen?	
36			V.	When is Kaizen?		When is Kaizen?	
37						1	Start of the division of labor
38						2	Interchangeability of parts
39					3	History of quality control	
40	4	History of productivity					
41			5	Kaizen spreading throughout the world and the situation in Africa			

No.	Chap.	Section	No.	Topic	
52	VI.	Who does Kaizen?		Who does Kaizen?	
53			1	Who are stakeholders of Kaizen?	
54				(1) Consultants	
55				① Type of consultants	
56				② Consultant competency	
57				③ Points to Note	
58				④ Consultant Evaluation	
59				⑤ Consultant ethics	
60				(2) CFT	
61				(3) Organization to promote	
62				2	Human side of Kaizen
63					(1) Law of action-reaction in Kaizen
64					(2) Kaizen mind
65					(3) Roles of 5S in Kaizen
66	(4) Kaizen myopia				
67	(5) Changing from negative to positive				
68	VII.	How is Kaizen?		How is Kaizen?	
69			1	Product technologies	
70			2	Processing technologies	
71			3	Total Quality Management (TQM)	
72				(1) TQM	
73				(2) System of TQM	
74				(3) Policy Management	
75			(4) Cross-functional Management		
76			4	Industrial Engineering (IE)	
77			5	Total Productive Maintenance (TPM)	

(2) Muda Elimination

No.	Section	No.	Topic	Learning objective	M	
1	Introduction	1	Muda elimination		1	Movie
		2	Introduction		2	Movie
		3	Road map to Muda elimination		3	PPT
		4	Road map to Muda elimination		3	PPT
	Test	Test	20 questions			
2	Background of Muda elimination	5	Distant view		3	PPT
		6	Close view		1	PPT
	Test	Test	2 questions			
3	Definition of Muda	7	Definition of Muda		1	PPT
		8	First Definition of Muda (1)		1	PPT
		9	First Definition of Muda (2)		2	PPT
		10	Second Definition of Muda		3	PPT
		11	Definition of Muda through time	Muda, Mura, Muri	3	PPT
	12	Conclusion		1	PPT	
Test	Test	1 question				
4	Muda elimination and Improvement of value	13	Value Engineering		4	PPT
		14	Value of Products from the Standpoint of Manufacturers		3	PPT
		15	Relationship between Product Value and Muda Elimination		3	PPT
	16	Productivity and Value Productivity		1	PPT	
Test	Test	2 questions				
5	Muda elimination and problem solving type Kaizen	17	Muda elimination and problem solving type Kaizen		4	PPT
6	Visualization	18	Visualization		2	PPT
		19	Human perception regarding Muda		1	PPT
		20	Muda is visible, but it is not perceived as Muda.		3	PPT
		21	Muda is visible, but it is not perceived as Muda.		1	PPT
	22	Example of Andon		1	PPT	
Test	Test	2 questions				
7	Approaches to Muda Elimination	23	Approaches to Muda Elimination		3	PPT
		24	Accounting approach		3	PPT
		25	Engineering approach		2	PPT
	26	Phenomena approach		2	PPT	
Test	Test	2 questions				
8	Toyota's Muda	27	7 Muda of Toyota		3	PPT
9	Muda in Overproduction	28	What is Muda Overproduction?		2	PPT
		29	Muda that arises from Muda in Overproduction		2	PPT
		30	Why does Overproduction occur?		1	PPT
		31	Why does Overproduction occur?		1	PPT
	32	How to eliminate MUDA in Overproduction.		4	PPT	
Test	Test	2 questions				
10	Muda in Waiting	33	What is MUDA in Waiting?		1	PPT
		34	Why does MUDA in Waiting occur?		1	PPT
	35	How to eliminate MUDA in Waiting.		1	PPT	
Test	Test	2 questions				
11	Muda in Transportation	36	What is MUDA in Transportation?		2	PPT
		37	Check Points		2	PPT
		38	How to eliminate MUDA in Transportation.		1	PPT
	39	How to eliminate MUDA in Transportation.		3	PPT	
Test	Test	2 questions				
12	Muda in Processing	40	What is Muda in processing?		1	PPT
		41	Check Points		2	PPT
	42	How to eliminate MUDA in Processing.		2	PPT	
Test	Test	2 questions				

No.	Section	No.	Topic	Learning objective	M	
13	Muda in Inventory	43	What is MUDA in Inventory?		2	PPT
		44	Why does MUDA in Inventory occur?		1	PPT
		45	Why does MUDA in Inventory occur?		3	PPT
		46	How to eliminate MUDA in Inventory.		1	PPT
	Test		Test	2 questions		
14	Muda in Motion	47	What is Muda in Motion?		1	PPT
		48	Eliminating Muda in motions of workers		2	PPT
		49	How to eliminate MUDA in Motion.		2	PPT
	Test		Test	2 questions		
15	Muda in Defective	50	What is MUDA in Defect?		1	PPT
		51	Why does MUDA in defect occur?		2	PPT
		52	How to eliminate MUDA in Defect.		3	PPT
	Test		Test	2 questions		
16	How to proceed Muda elimination on site	53	How to proceed Muda elimination on site		2	PPT
17	Conclusions	54	Conclusions		4	PPT
	Test		Test			

(3) 5S

No.	Section	No.	Topic	Learning objective
		1	Introduction	
		2	Why 5S is necessary?	
		3	Contents	
1	Preface	4	Preface	
		5	Application of 5S to some companies	
2	Outline of 5S	6	What is 5S?	
		7	5S contributes to Muda elimination	
		8	Sort and Set in Order	
		9	Shine, Standardization and Sustain	
3	Effect of 5S	10	Effect of 5S	
4	Process of 5S	11	Process of 5S	
		12	Why Sort is necessary?	
		13	How to practice Sort	6 Steps for Sort
		14	Preparation of Red Tag	
		15	Five Points to Paste Red Tags	
		16	Example of 5S	
		17	Case study	
		18	Case study	
		19	Why Set in order is necessary?	
		20	3 Points to Set in Order	
		21	Exercise of Set in Order	Which is Easy to Use?
		22	Indication	Points to Indicate Items
		23	Location Plate and Number Plate	
		24	Display sample	
		25	Separation of Location	Paint Operation
		26	Why Shine is necessary?	
		27	3 Levels of Shine	
		28	Processes for Daily Cleaning	
		29	Check point for Machines	
		30	Why Standardization is necessary?	
		31	How to practice Standardization	Standardization and Sustain
		32	Why Sustain is necessary?	
		33	How to practice Sustain	Relationship between 5S
5	Implementation plan of 5S	34	Schedule for Introduction of 5S	
		35	Case study	
		36	Case study	
6	Frequent questions and answers on 5S	37	Why should we do 5S?	
		38	Our factory is very untidy. Where do we begin?	
		39	Though we want to practice in 5S, we have no time and no place for 5S.	
		40	When there is no time to get across 5S, how do we do it?	
		41	After SEIRI, things soon become untidy again. How should we continue 5S?	
		42	After Sort, things soon become untidy. How to continue 5S?	
		43	In the case where it is difficult to distinguish from the necessary things because several workers use them, how should we select the unnecessary things?	
		44	The supervisor and the manager know 5S in their mind but do not intend to do 5S.	
		45	How to measure the economic effect of 5S?	

Appendix-6: Presentation materials at the Africa Kaizen Annual Conference 2019

Information Gathering and Confirmation Study Concerning Global Kaizen E-learning

Japan International Cooperation Agency
Japan Development Service Co., Ltd.
Digital Knowledge Co., Ltd.



1

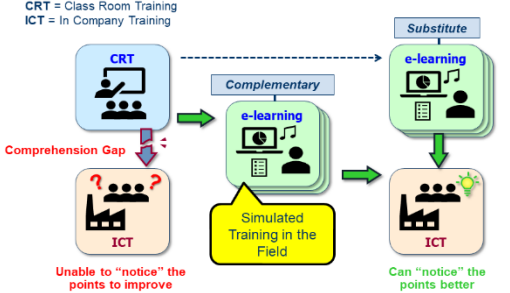
Purpose of the Study

- Gather information on e-Learning utilization in developing countries
 - And examine its possible applications in Kaizen field
- Assess recommendations
 - On effective e-Learning utilization for Kaizen dissemination and expansion

2

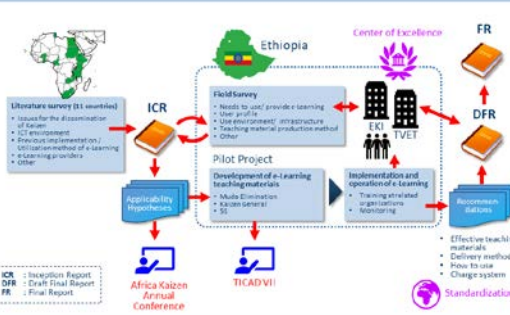
Why e-Learning in Kaizen?

CRT = Class Room Training
ICT = In Company Training



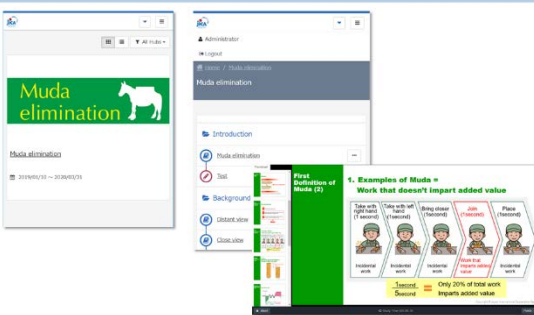
3

Overview of the Study and Reports



4


e-Learning content under development



5

Result of Literature Survey on the Internet Environment

Countries covered:
Burkina Faso, Cameroon, Egypt, Ethiopia, Ghana, Kenya, South Africa, Sudan, Tanzania, Tunisia, Zambia



6

Situation of international Internet connection

Country	International Connection Bandwidth (Gbps)	Main Country of Connection
Burkina Faso	~10	Ghana
Cameroon	~10	Nigeria
Egypt, Arab Rep.	~1250	France, Italy, UK
Ethiopia	~50	Djibouti, Kenya
Ghana	~300	UK, Nigeria
Kenya	~700	UK, France, South Africa
South Africa	~1800	UK, France, Kenya
Sudan	~100	Ethiopia
Tanzania	~200	Kenya, Mozambique
Tunisia	~400	France, Italy
Zambia	~100	Zimbabwe, South Africa

Source: TeleGeography, ITU

7

Penetration rate of mobile Internet connection and cost

Country	Penetration Rate	Data Download Charge per 1GB (Pre-Paid)		Pre-Paid Ratio	Ratio of 3G Connection or Higher
		Ratio to Average Monthly Income	Cost (US\$)		
Burkina Faso	11.4%	19.0%	27.1	100%	10%
Cameroon	20.7%	6.1%	16.7	99%	7%
Egypt, Arab Rep.	37.1%	1.4%	16.4	89%	50%
Ethiopia	11.6%	17.2%	21.0	98%	67%
Ghana	28.1%	8.9%	32.4	97%	41%
Kenya	66.8%	8.8%	22.6	96%	23%
South Africa	51.9%	2.7%	33.2	87%	51%
Sudan	26.6%	2.6%	6.9	97%	40%
Tanzania	13.5%	6.0%	12.8	98%	39%
Tunisia	56.0%	2.8%	24.7	94%	44%
Zambia	21.0%	15.6%	62.2	96%	22%
Japan (Reference)	93.3%	3.0%	96.7	0%	98%
USA (Reference)	88.2%	2.3%	108.9	26%	90%

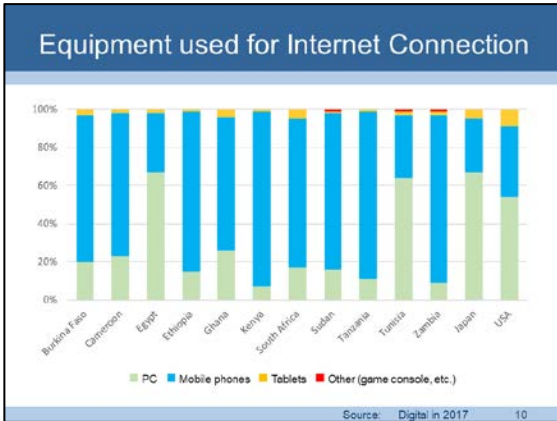
Source: Converted from Digital in 2017, ICT Prices (2017 - ITU)

8

Penetration rate of fixed line Internet connection plan and cost

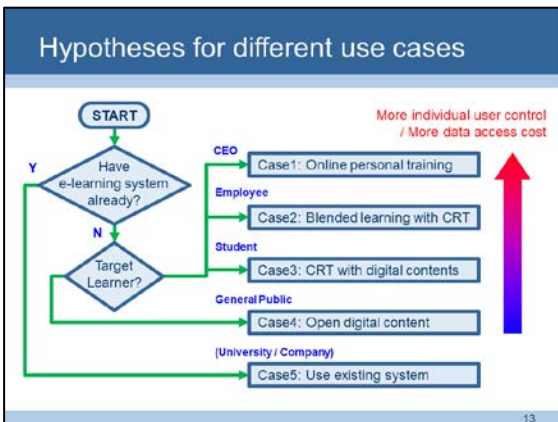
Country	Penetration Rate	Cheapest Fixed Price Plan (With Ad)			
		Ratio to Average Monthly Income	Cost (US\$)	Speed (Mbps)	Data Download Limit (GB)
Burkina Faso	0.1%	69.6%	37.1	0.3	Unlimited
Cameroon	0.2%	22.8%	62.0	2.0	Unlimited
Egypt, Arab Rep.	5.4%	1.8%	5.0	1.0	10.0
Ethiopia	0.6%	25.2%	12.4	0.5	2.0
Ghana	0.2%	19.0%	23.4	4.0	20.0
Kenya	0.6%	39.7%	44.3	15.0	Unlimited
South Africa	3.0%	3.6%	18.3	1.0	1.0
Sudan	0.1%	7.2%	11.6	0.5	15.0
Tanzania	3.2%	36.0%	27.6	1.0	Unlimited
Tunisia	7.0%	1.4%	4.6	4.0	Unlimited
Zambia	0.2%	19.5%	24.2	2.0	10.0
Japan (Reference)	31.7%	0.6%	20.1	12.0	900.0
USA (Reference)	33.9%	0.8%	38.1	15.0	Unlimited

Source: ICT Prices (2017 - ITU), World Bank, TeleGeography

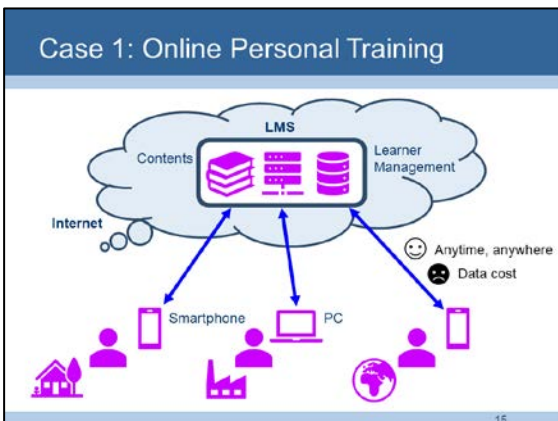


Hypotheses of e-Learning utilization for KAIZEN in Africa

- ### Considerations from the result of field survey
- Target device for e-Learning
 - Smartphones in most cases
 - PCs in some cases (e.g. classrooms)
 - Internet connection for e-Learning
 - Mobile connection for business learners
 - Shared fixed line (via Wi-Fi) for classrooms
 - Minimizing data cost is very important
 - Even for free offering of e-learning contents

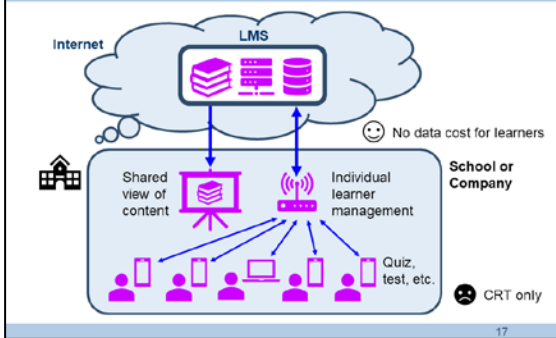


- ### Case 1: Online Personal Training
- The most common e-learning method
 - Each user has independent account
 - Learn any time at any place
 - Suitable for learners who:
 - Can afford data cost by themselves
 - Prefers maximum flexibility of learning
 - Ex. CEOs, Consultants, etc.
 - Caution:
 - Data access cost is borne by learner



- ### Case 2: Blended Learning with CRT
- Learn in classroom with shared screen for e-Learning content
 - Pre-study, review, exam will be done by individual user account
 - Suitable for learners who:
 - Are not willing to / cannot pay data cost
 - Don't care learning in classroom
 - Ex. Employees, University students, etc.
 - Caution:
 - Need to gather in classroom

Case 2: Blended Learning with CRT

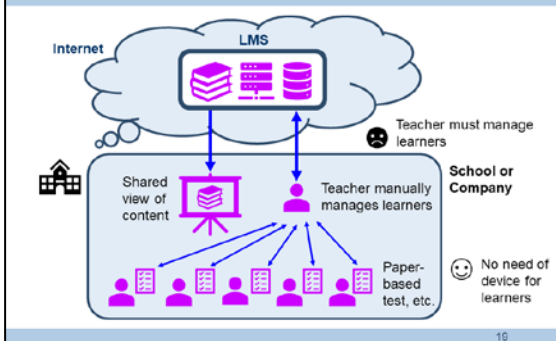


Case 3: CRT with digital contents

- Basically traditional classroom training
- Just using online digital content
 - Easy distribution of the latest content
- Suitable for schools / companies with:
 - Limited internet connection, and/or
 - Learners who don't have any device
- Cautions:
 - No individual management by system
 - Difficult IP protection / monetization

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Case 3: CRT with digital contents

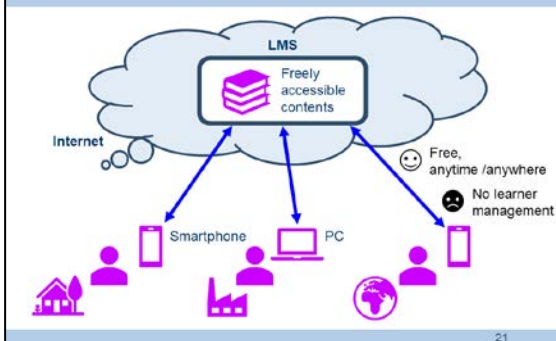


Case 4: Open digital content

- Provide digital learning contents publicly for free
- Suitable for:
 - Publicizing the basic idea of KAIZEN for free
- Cautions:
 - For promotional purpose only
 - No control on learners at all

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Case 4: Open digital content

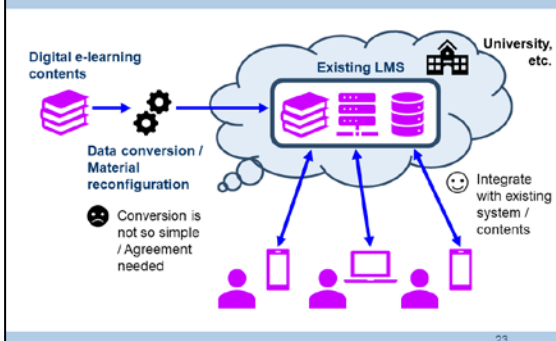


Case 5: Use existing system

- Provide learning contents to existing e-learning system
- Suitable for organizations who already have their e-learning system
 - Universities
 - Big companies
- Cautions:
 - Need to reconfigure materials for the system
 - Require legal agreement between both parties

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Case 5: Use existing system



Other ways to use digital technology for Kaizen



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e-Kaizen

- **e-Kaizen training**
 - Employ digital technologies in Kaizen training
 - For consultants, CEOs, QCC members
- **e-Genba-kaizen**
 - Application of "Industry 4.0" as an extension to Kaizen activities
- **e-Kaizen consulting**
 - Improvement through continuous digital data acquisition and analysis

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Final Thoughts - Questions

- **Technology is just a tool – Not a goal**
- **Which use case should you choose?**
 - Better technical solution might not be the best (in terms of dissemination and expansion)
 - Or, is there any other use case in your country?
- **Consider collaborating with existing e-learning institutions (such as universities)**
 - Building LMS from the ground up is costly

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Thank you!

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Appendix-7: Field survey photographs

- Adama Science and Technology University) (September 24, 2019)



ICT Center entrance



Constructed under support from KOICA



Classroom for e-Learning



e-Learning classroom control panel



Shooting and broadcasting studio



Studio control equipment

Appendix-8: Summary of user support result

Category	Sub Category	# of incident	Content of Question	
Access Issue	Login Error	2	User ID not active	
		7	How to change the language setting	
		11	Can't access with given access information	
	Login Information	1	How to change the password	
		4	What is my username and password	
		2	Profile Error (name spelling wrong)	
Basic Communication	Followup	4	Haven't received login information	
		7	Follow-up with the question previously sent to general email	
	Kaizen Team	1	Communication with Kaizen eLearning project team member (Fasil)	
	Reminer Error	7	Received "Reminder" email from Kaizen although they have already started	
		2	Notifying all courses are completed	
Certificate Request	Certificate	9	Confirming the receipt of auto generated email	
		1	Can I receive certificate of completion?	
Course Material	Course Material	3	How to obtain certificate	
		1	Where is the soft-copy of material not video	
	Duration of the course	2	How can I take 5S course	
		1	How many days/how much time it will take to finish the course	
eLearning General	Purpose	1	How/when to start the training	
		1	What is the main goal after the training	
		1	What is the benefit of taking eLearning course	
		1	What is this project? Am I a wrong user?	
Manual Related	Manual	1	Not understanding the importance of the eLearning	
		1	Request for training manager guide not received	
		1	Can you send me Kaizen document (assuming user is requesting a manual)	
		1	Requesting Manual	
		1	How to use Kaizen e-Learning	
Registration	Login Error	5	How can I choose a course to study (there are no hubs available for registration)	
		4	List of users not active, request to check and re-register	
	User list	18	Change the info of user list (email address to phone number as not many ppl has email address)	
		1	How to file the format (assuming how to file the user list)	
		1	Want to join the eLearning (assuming when to register for the eLearning)	
		9	Request to update/modify the user list	
Special request	Extension of deadline	26	Sending trainees/user list	
		1	Request to extend the deadline of submitting user list	
	Official letter	1	Requesting official letter for the project	
	Study progress	2	Completed a course but study progress shows 96%	
Technical Issue	Training	2	Request a training for Kaizen	
	Browser Issue	1	"Invalid parameter" message appear (browser issue)	
		Connnection error	1	Connection problem, how to solve it
			1	Content not showing on screen
	Verification	1	Questionnaire has a invalid message	
Total			149	