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DIRECTORATE OF VOCATIONAL EDUCATION AND TRAINING

REPORT

Evaluation on the progress and results of digital transformation, the development of smart TVET college model

Hanoi, November 2021

General Information

This document was developed with the support of the Vietnam-Germany Cooperation Program "Program Reform of Technical Vocational Education and Training in Vietnam". The program is authorized by the German Federal Ministry of Economic Cooperation and Development (BMZ), implemented by the German Corporation for International Cooperation GmbH (GIZ) in collaboration with the Directorate of Vocational Education and Training, under the Ministry of Labour, Invalides and Social Affairs. The program aims at an enhanced, better aligning TVET in Vietnam to the changing world of work, towards a greener and digitized future.

Program Reform of Technical Vocational Education and Training in Vietnam
No. 1, Lane 17 Ta Quang Buu, Hai Ba Trung District, Hanoi
T: +84 24 397 46 571
E: office.tvet@giz.de
W: www.tvet-vietnam.org/ www.giz.de

Coordinating Organization:	**Program Reform of Technical Vocational Education and Training in Vietnam** MSc. Pham Xuan Hoan Ms. Nguyen Nguyet Linh
Collaborating Organization:	**Directorate of Vocational Education and Training** **11 partner TVET colleges of GIZ**
Group of Compiling:	**GIZ's Consultants** Prof. Dr. Ho Tu Bao Dr. Nguyen Nhat Quang

German Corporation for International Cooperation GmbH, GIZ
Program Reform of TVET in Vietnam

Directorate of Vocational Education and Training

REPORT

Evaluation on the progress and results of digital transformation and the development of smart TVET college model

First version

Hanoi, November 2022

Report on the evaluation of the progress and results of digital transformation and the development of smart TVET college model is officially developed

by the Consultants and cooperation partners of the Program Reform of Technical Vocational Education and Training in Vietnam.

Address: No. 1, Lane 17, Ta Quang Buu Street, Bach Khoa Ward, Hai Ba Trung District, Hanoi, Vietnam

***Tel:** +84 (0) 24 39 74 64 71*

***Website:** www.tvet-vietnam.org*

www.giz.de/vietnam

CONTENTS

SUMMARY

This document summarizes two activities on digital transformation in the field of vocational education and training (TVET): (1) Evaluating the process and results of digital transformation activities at GIZ's 11 partner colleges, and (2) Proposing a smart TVET college model for TVET sector.

The evaluation of the digital transformation process and results was carried out by the working group (External consultants, officers of GIZ and colleges), directly at 11 partner colleges, through listening to reports, observations, discussions with leaders and key officials on digital transformation at each college according to the contents and criteria of digital transformation in education which were identified two years ago, as well as sharing and exchanging digital transformation with all staff and lecturers of each college. One of the efforts on digital transformation of 11 partner colleges was on the development of a self-paced learning course on digital transformation in TVET.

The activity of building a smart TVET college model is based on the results of the above assessment activities and the working group's research on the ecosystem model of organizations in the physical-cyber environment.

From the facts and results of the two activities mentioned above, the working group made a number of suggestions and recommendations for Directorate of Vocational Education and Training (DVET), 11 partner colleges, and related agencies in the digital transformation of TVET system. The results achieved can be considered as a premise to expand the digital transformation activities of TVET colleges across the country.

(External consultants, officers of GIZ and colleges)

1. OVERVIEW

1.1. Programme “Reform of TVET in Vietnam”

The joint Vietnamese-German technical cooperation programme “Reform of Technical TVET and Training in Viet Nam” (TVET Programme) is financed by the German Ministry of Economic Cooperation and Development (BMZ) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is commissioned to implement, with counterpart funds from the Vietnamese Government. In Viet Nam, the Directorate of Vocational Education and Training (DVET) under the Ministry of Labour, War Invalids and Social Affairs (MoLISA) is the implementing partner. The general goal of the Programme Reform of TVET in Vietnam is to help “better align TVET in Viet Nam to the changing world of work.” The three detailed outputs are as follows:

- **Output 1:** State actors, TVET staff, TVET institutes and the business sector are interconnected;
- **Output 2:** The regulatory framework of TVET is aligned to the requirements of the changing world of work;
- **Output 3:** The concept of High-Quality TVET institutes is successfully implemented in selected TVET institutes.

1.2. Background, objectives and results of the activities

1.2.1 Awareness raising, evaluation of the process and results of DX at 11 partner colleges

Context

Regarding the evaluation of the process and results of digital tranformation (DX), all 11 partner colleges have been supported to develop a DX strategy suitable for their units. Besides, DVET and the 11 colleges are also supported in terms of digital infrastructure, digital platforms, digital devices and software serving the DX. Apart from activities supported by GIZ, partner colleges also actively make their own efforts to implement DX activities. To ensure continuous and process-based support, the Programme Reform of TVET in Vietnam carried out this activity to evaluate the effectiveness of DX, and at the same time, the partner colleges’ commitment to effectively exploit resources serving DX supported by GIZ such as LMS, OER, e-learning room. On that basis, external consultants provide strategic as well as technical advice to each partner college with the model/criteria to build and develop a smart TVET institute.

Regarding raising awareness about DX, in year 2021, the TVET Programme organized 60 activities and events on digital transformation such as workshops, training courses, group discussions, strategy consulting meetings … for their affiliated TVET partners. The series of activities has brought about change and unified awareness of DX among leaders, staff and core teachers. However, activity statistics show that these activities only reach 15% of the more than 1,700 leaders, staff, and lecturers of DVET and 11 colleges. Therefore, raising awareness ofDX

thoroughly and systematically remains a major challenge. This challenge also poses a need for digital solutions to raise awareness to reach a larger audience, even for the whole TVET system in Vietnam. Digitalising content and building self-learning courses on DX basics through access to open educational resources (OER) are seen as a viable and potential solution. Upon completion of the course, students can receive a certificate for motivation and encouragement.

Objectives

The activity aims to achieve the following three objectives: 1) Evaluation of DX activities at 11 partner colleges in general and effectiveness of the exploitation of GIZ resources in particular, 2) Raising awareness and in-depth advice on building the model of a smart TVET institute suitable for the context of each unit, 3) Learning and analyzing the legal framework related to DX, advising colleges, and proposing recommendations to DVET.

The activity of raising awareness about DX is to build a self-paced learning course focusing on the contents: course introduction, course objectives, expected outcomes, training video clips (5-10 minutes/clip), tests and exercises, questions, and evaluation criteria together with references. The course is hosted on the LMS and is connected to the OER platform for free access for learners.

Results

The activity of evaluation of DX processes and results was implemented from 18/9/2022 to 30/9/2022. It started with a working session at Bac Ninh College of Industry, and after that the group was divided into two consisting of experts and GIZ staff to go and work at colleges in the Central and Southern areas. Each trip to the partner colleges was an opportunity to raise awareness about DX not only for the management and teachers at the partner colleges but also for parent organizations at the province-level such as Department of Labours, War Invalids and Social Affairs, Department of Planning and Investment, Department of Information and Communications, People's Committee, and leader representatives from the nearby colleges. Among the 11 colleges, apart from the common agenda, the following 06 colleges proposed that the expert consultants of GIZ organize one more workshop just for the college's teachers and staff members:

Construction College No. 1

Vietnamese-German Technical College of Hatinh

Hue Industrial College

Ninh Thuan Vocational College

College of Technology II

An Giang Vocational College

Regarding the self-paced learning course, there are eight lessons developed to equip basic knowledge for managers, administrative staff, teachers from the central to grassroots levels to raise and unify awareness of DX in TVET.

1.2.2. Building a smart TVET college

Context

In 2022, the TVET Programme prioritizes consulting to build a model of smart TVET institute for partner TVET colleges. The community of 11 partner colleges of GIZ has been supported to develop strategies, develop human resource capacity as well as digital solutions and platforms since 2020. However, colleges still have difficulty identifying for themselves a specific model of a smart TVET institute. Building this model helps the colleges better shape the picture of the digital transformation roadmap. Thus, this workshop was held as a kick-off activity for the advice to introduce the DX approach, helping the colleges discuss, share expectations as well as perspectives on different aspects of the model of a smart TVET institute. The workshop also serves as a premise for further activities when we come to 11 partner colleges to evaluate the effectiveness of digital transformation activities and consult on smart TVET institute model associated with the context of each institution.

Objective

This actitvity aimed at three objectives: 1) Update new knowledge and the DX approach in TVET, 2) Create a discussion forum for the exchange of ideas about different different aspects/criteria of a smart TVET institute, 3) Develop an initial conceptual framework for smart TVET institutes based on the results of discussions.

Results

The activating workshop was held in one day in Ho Chi Minh City in a hybrid online and offline model (detailed information about the Workshop Agenda is in Appendix 1). Participants include 52 representatives of Directorate of TVET and Training (DVET), leaders and specialists of DVET, representatives of Rector boards and focal points of 11 partner TVET colleges, staff of GIZ and experts. After listening to the presentation of Prof. Ho Tu Bao on basic concepts and ST-235 methodology in DX and the sharing of abstract of model of a smart TVET institute and discussion guidelines, the participants were divided into six groups (four on-site groups, two online groups) to discuss and present the results. Overall, the participants still had difficulty understanding the concept of the model of a smart TVET institute thoroughly. Discussion results could only initially help raise awareness.

The discussion and collection of opinions on the smart TVET college model was further integrated into the trips to evaluate DX processes and results at 11 partner colleges. This content is carefully analyzed in section 3 "Building a smart TVET college".

1.3. Implementation methods

Activities were implemented based on studies of references, reports submitted by the partner colleges, group discussions, in-depth interviews, and field surveys. The workshop is designed in the direction of presentation-oriented, open discussion to gather broad opinions. The course “DX in TVET” is designed following the self-paced learning method and organized on the LMS, using

technological equipment of the e-learning studio and applying features of Moodle open-source software to increase interaction and evaluate learning outcomes for learners.

2. EVALUATION OF DIGITAL TRANSFORMATION PROCESSES AND RESULTS AT 11 PARTNER COLLEGES

2.1. Overall evaluation

The following assessments are based on college reports and survey results, and direct discussions at colleges as of September 9, 2022. Following are some general comments and reviews.

Some remarkable results. In the last two years:

- Raising and unifying awareness of DX among the groups of management and core teachers of 11 partner colleges is a highlight, especially the approach of DX ecosystem in TVET, which consists of six (06) components, consulted by GIZ experts. Colleges have shaped the DX strategy to 2025 and the vision to 2030. In addition, many capacity development activities for core teachers are organized on different topics such as LMS, production of learning materials, Industry 4.0...
- 11 partner colleges have made a breakthrough in building and applying digital solutions and platforms. Specifically, 10/11 colleges have had LMS, 04 colleges have been supported with DMP, 11 colleges are commonly using the OERplatform, 11/11 colleges have had a e-learning studio to produce digital learning materials, 02 colleges exploit 06 cloud server service packages. This is an important premise for DX.
- 11 partner colleges have formed communities of core groups that play a leading role in change and multiplying training, for example: groups of multipliers, groups of digital transformation focal points, LMS, learning material production. GIZ has contributed to connecting, supporting and building communities that bring together core, positive, dynamic, and enthusiastic staff and teachers. The colleges have made certain strides and results as a premise for sharing experiences and practical lessons, discussing challenges encountered and building digital transformation solutions (self-advocacy, self-ownership).

Room for improvements. In addition to some of the above remarkable results, the colleges still have many challenges, difficulties, and shortcomings, namely:

- After the Covid pandemic is under control, colleges are no longer under pressure to work and teach online. Transformation and effectiveness of activities basically only take place in colleges that recognize the role and meaning of DX correctly. These colleges exploit and make effective use of external support resources for DX.
- The general awareness of the inevitability of the digital transformation of TVET by leaders and a part of teachers and staff in all colleges is high. However, the colleges are struggling with how to implement DX, leading to not many concrete actions.

- In the direction of building and developing the model of a smart TVET institute, the colleges currently do not have a full and common understanding of this model, or perceive it in different ways. Mainly, colleges are at the stage of IT applications, contributing to automation in the management and organization of teaching and learning activities, gradually creating, storing, connecting, and exploiting data as a premise for the purpose of smart. The vast majority of colleges have not really experienced to see what the exploitation and analysis of data to support decision-making, support innovation activities in terms of training content, teaching and learning methods, management ... are like. In the short term, colleges are more interested in DX activities to create immediate effects, as well as advice to help with specific roadmaps and plans for each year. It can be imagined that on the scale of level 1 to 5, if the destination of the smart TVET institute is level 5, the status of the colleges is at 1.5 - 2 (for example, digitization, automation). They are interested in levels 3 – 4 (e.g. connecting and mining data, restructuring processes, services, etc.), what specifically needs to be done to be able to become a smart TVET institute - level 5 (e.g. personalized learning...)
- The initiative of colleges in digital transformation is not high, there is no specific action plan but relying on funding activities. Most of the major activities reported by the colleges are implemented activities supported by GIZ.
- Some colleges which have dynamic, active digital transformation teams that have the necessary insights and have the support of the board of rectors have achieved certain results. However, many colleges have not yet created such nuclear groups. In other words, where there are DX focal officers with capacity, eagerness to learn and enthusiasm, there is a clear change in DX performance. In fact, this group of staff is often overwhelmed by multitasking. Colleges also do not have official positions, incentive and recognition mechanisms, and remuneration regimes in a formal and reasonable way. This leads to an "upper hot and lower cold" situation in some colleges.
- Legal corridors, especially internal regulations related to digital transformation, have not been paid attention to be developed and promulgated.
- There has not been much progress in technological infrastructure investment other than GIZ's support. Colleges are still confused and need advice on IT architecture to orient DX becoming a smart TVET institute.
- Most colleges have problems linking data with existing platforms and software, especially connecting with platforms/software of state management agencies.

The main difficulties raised by the colleges are still:

- Lack of investment capital from the state budget due to the general difficult situation of disbursement of public investment capital in general and investment in digital transformation in particular. Although the project of digital transformation in TVET according

to the Decision No. 2222/ QĐ-TTg was issued on 30/12/2021, this has not been implemented in practice, so colleges do not have investment sources.

- There are many entanglements in the legal corridor; The issues raised remain similar to those that were pointed out in the 2020-2021 studies.
- Awareness of how to do digital transformation is still unclear. Although the colleges already have digital transformation strategies, when concretizing those into action plans, they are all confused and need more advice and support at a more detailed level.

2.2. Transformation of training content

The DX strategy of all the partner colleges as well as the national Programme of DX in TVET according to the Decision No. 2222/ QĐ-TTg emphasizes the importance of updating training contents to catch up with the change in job positions in the labour market.

Objectives of updatingtraining contents:

- Immediately update the training program to ensure the fastest possible narrowing of the existing digital skills gap between training and the requirements of the job position, minimizing the need for additional training of businesses after recruitment.
- Improve the ability to grasp and adjust the curriculum continuously based on the development trend of the labour market, including the ability to predict new requirements for job positions in the future as well as industry structure of the labour market to organize enrollment and training in accordance with the needs of the market.

Possible measures:

- Improve the general computer training program to a more advanced level than the minimum program prescribed by DVET to meet the current needs of businesses. To do this:

+ DVET needs to actively research and update the computer training program to suit the new requirements. Currently, GIZ is organizing a study to update the content and methods of the computer training programme, oriented towards digital competency training, with reference to the European, UNESCO and domestic digital competency frameworks, and it is to be completed in December 2022. After piloting at some or all GIZ's 11 partner colleges, DVET can organize an evaluation and issue this program to apply to the whole field.

+ Colleges need to actively develop a general computer training program in a more advanced direction than the current program and actively add appropriate content to specialized computer subjects.

+ Each faculty, each unit needs to add content related to digital technology to all subjects being taught at an appropriate level.

- Digital transformation of the colleges' business cooperation activities, focusing on creating closer connections in the digital environment to collect data on changes in human resource requirements and processing the data obtained to make decisions to adjust training content.

Connecting with businesses in digital environment can be done through business leaders, engineers, technical staff and alumni working at those businesses.

- Digital transformation of enrollment activities, including early career guidance activities, combined with general education system. Through data collection, the admissions system needs to be able to forecast the training needs of the following years, so that colleges can early prepare teachers and other necessary conditions.
- It is necessary to design many short-term, flexible training programs to meet the training and retraining requirements for workers affected by the fourth industrial revolution as well as meet the needs of training new professions, not yet eligible to form training courses at intermediate and college levels.
- Have an information system on human resource needs (connecting job placement centers, businesses). This system should be organized on a nationwide scale, chaired by MOLISA and DOLISA in all localities.

Clearly visible problems at 11 partner colleges in the survey trip:

- All colleges are aware of the inevitability of innovating training content according to digital transformation requirements, but there are no specific activities to realize this awareness. Forms of business cooperationhave not yet been innovated and connections have not been formed in the digital environment. In other words, compared to the results of the assessment through the DX status-quo evaluation at 11 colleges in 2021, the activity of updating training content has not made significant progress.
- The teaching of the IT subject has not changed compared to the previous schoolyear, no college has announced the increase in the number and quality of computer teachers. Now in its 4th year, the common subject Computer training of DVET has not been updated and lacks many training contents that can meet the requirement of changing technology such as digital tools, digital platforms, working in the digital environment, culture of behavior and security of personal data in the digital environment.
- Some colleges have begun experimenting with organizing some short-term training courses on digital-related content. (Building Information Modelling at CTC1 for example), however, the initial results did not meet expectations for many reasons.
- Many colleges are struggling with enrollment. Some majors have a high number of applicants, but the college cannot meet the demand due to insufficient teachers in their respective majors. Meanwhile, many other majors do not meet the enrollment quota, many majors even cannot enroll any candidates. This phenomenon, in addition to the reason that society's perception of TVET is not correct, also has a root cause in the fact that the training program is slow to innovate and does not meet the apprenticeship needs of society. On the other hand, the capacity to collect and process data to forecast the training needs of the partner colleges are not high, there are no necessary tools to implement.

2.3. Innovation in training methods

In order to take advantage of the benefits that digital technology brings and meet new requirements when innovating education and training content, it is necessary to conduct a digital transformation of training methods, that is, innovating the way teaching and learning based on the use of digital technology.

Objectives of digital transformation of training methods:

- Flexible training process, meeting the personalized learning requirements of learners.
- Organize flexible training, make optimal use of existing resources on teachers and facilities to improve the quality and scale of training.
- Use data on the teaching and learning process to analyze and optimize the teaching and learning process, helping to innovate teaching and learning content and methods, student services.
- Implement new, more effective pedagogical methods based on digital technology applications.

Possible measures:

- Use the learning management system (LMS) to organize student learning activities. Each student's entire learning process needs to be documented on the LMS. To do so, all teachers must put their activities and teaching materials on the LMS.
- Use TMS (Teaching Management System) to manage the entire training process of the college. The entire training process, from the curriculum, teaching plan, timetable to detailed lesson plan of each lesson must be digitalized and managed in a unified system. Maximize automation and use of data analysis to continuously optimize training processes flexibly. In particular, it is necessary to quickly digitalize the bookkeeping to reduce the load on the teaching staff.
- Experiment lessons according to new pedagogies by appropriately selected teachers to perfect the process and replicate it throughout the college. It is recommended to build sample lectures for teachers to refer to and multiply.

Problems detected at 11 partner colleges in the survey trip:

- In terms of awareness, all colleges understand that digital transformation of training processes is the backbone of college digital transformation in general. However, the understanding of the content and how to conduct digital transformation is still not correct, so there are many confusions.
- Some colleges have implemented the installation and training of LMS (Moodle) systems with the support of GIZ as well as with their own resources. However, the use of LMS in reality has not been implemented much due to incorrect understanding of LMS. Most colleges consider LMS to be for online teaching, when the Covid 19 pandemic subsided, colleges returned to face-to-face training, LMS was only used to bring the teaching of six common subjects to the online environment. The reality is that LMS is for managing the entire learning process of students,

regardless of face-to-face, online or blended learning. The digital transformation of teaching and learning only really takes place when all teachers change their teaching methods, introduce training content, learning materials and activities of checking attendance, testing, evaluation, delivery of assignments to the LMS platform and all related students can access and study on this platform.

- Some colleges have implemented training management software (TMS); however, the efficiency is not high. Most colleges still do not have TMS, although they are aware of the need.
- Although colleges are aware of the need to implement new pedagogical methods, concrete measures have not been taken. The reason is that colleges are still waiting for training activities on e-pedagogy but do not consider this as an activity that can and needs to be actively tested and conducted.

2.4. Digital transformation of administration - management

The application of IT in administration and management in TVET has been of interest for a long time, but the results achieved are not clear. According to the trend of digital transformation of TVET, the way technology is applied has changed very fundamentally. Digital transformation is considered as the process by which colleges change their own administration and management methods, technology must be designed to support that change, not to automate old operational processes. Along with the change in administration – management model and technology integration, it is necessary to synchronously transform the elements belonging to people and institutions. Digital transformation of administration and management helps the system become smarter, react to changes in the external environment in a more timely and effective manner.

Objectives of digital transformation of administration - management:

- Accurately and promptly grasp the current situation and fluctuating trends of the external operating environment. Specifically, accurately grasp the changing trends in training needs, job positions, scientific and technological advances and socio-economic development trends, the current state of training of the TVET sector.
- Understand the current state of college resources (staff, teachers, facilities...) and issues in the training, administration and management processes of the college to continuously optimize the use of resources.
- Improve the quality of decision-making and planning at all levels, shifting sharply to data-driven decision-making methods.
- Simplify, maximize automation of administrative processes, reduce the load on the entire staff and teachers and students.
- Accumulate and distribute knowledge effectively to each working position.

Possible measures:

- Design a unified, shared data platform. Using digital technology to connect inside and outside the college to improve data collection capacity.

- Invest in improving data processing capacity and distributing data effectively to all working positions.
- Redesign all management processes towards maximum simplification and automation. The renewal of management processes requires synchronous implementation of awareness raising, training skills to work in a new environment, building a culture of innovation, innovating relevant internal regulations and corresponding technology investment.

Clearly visible problems at 11 partner colleges in the survey trip in September, 2022:

- All partner colleges are currently using different management software, but the efficiency is not high due to the lack of data consistency. Compared to the 2021 survey, progress has not been observed.
- 04 colleges have been supported by GIZ to have the DMP, which has been installed and they have been guided on how to use that. However, for many reasons, the process of digital transformation of administration and management activities is only at the beginning stage.

2.5. Teachers and learners in digital transformation

Of the three factors that determine the success and failure of digital transformation, the human factor plays the most important role. Humans are the driving force of digital transformation, but at the same time, humans can also be the main drag on this process. There are three main factors related to teachers (including managers) and learners in digital transformation: awareness, capacity, and culture.

Objectives of digital transformation of humans:

- Awareness (changing environment, inevitability of digital transformation, technology brings opportunities, opportunities to do better, possible challenges).
- Digital capacity and e-pedagogy of teachers and learners (here only refers to digital capacity and e-pedagogy directly related to teaching and learning in particular and the digital transformation of colleges in general. Digital capacity related to the trained profession has already been mentioned in the transformation of training content section).
- Culture (behavior when interacting in a cyber-physical environment, continuous innovation, data sharing, information and knowledge sharing).

Possible measures:

- Organizing internal communication activities and training courses to raise awareness.
- Integrating basic digital literacy training into the content of learning methods training at the beginning of each occupation’s curriculum.
- Organizing large-scale training to improve the digital capacity of teachers, take advantage of the LMS platform that colleges have in order to train their teachers.
- Available and free platforms can be used to spread basic digital skills to both teachers and learners quickly andeconomically.

Clearly visible problems at 11 partner colleges in the survey trip in September, 2022:

– The general awareness of college leaders about the need for digital transformation is high, but not all colleges put this on the list of priorities and consider this as one of the effective ways to develop the college.

– Most teachers of the colleges have been aware of the inevitability of digital transformation, but have not actively participated in general digital transformation activities as well as proposed innovative initiatives related to digital transformation.

– General understanding of the content as well as how to conduct digital transformation activities is not complete. Most colleges still consider investing in technology as decisive and tend to wait for funding to actually proceed.

– All colleges have digital transformation nuclear groups, but the capacity and level of commitment of nuclear groups in different colleges are different. In fact, colleges with strong nuclear groups, supported by college leaders, are more effective in digital transformation activities.

– Some colleges have begun using www.congdanso.edu.vn platforms to provide universal digital skills training to the entire teaching staff and students. This can be a good practice; it is necessary to track the results and draw lessons to disseminate to the rest of the partner colleges.

2.6. Legal corridors and internal regulations

In the process of digital transformation, when technology is integrated to become an integral component of the system, it is necessary to update and expand the legal corridor, regulations, and internal regimes to regulate interactions in the digital environment. On the other hand, promoting digital transformation cannot be based solely on human perception. In fact, reaching an absolute consensus on digital transformation in colleges is very difficult and the development, amendment and supplementation of regulations play a very important role in the digital transformation process.

Objectives of establishing regulatory frameworks for digital transformation:

– Establish a system of processes and regulations in accordance with the operating model of a digital transformation college, especially towards data-based operation and management instead of documents.

– Remove institutional barriers previously set by the college itself but now hindering digital transformation efforts.

– Develop regulations and regimes to promote innovation in general and digital transformation in particular.

Possible measures:

– Carefully study and make the most of the latest government documents, especially from DVET in the direction of digital transformation and apply them in practice.

– Review all current internal regulations, forms, reports and economic and technical norms to adapt them to the new mode of operation.

– Develop and promulgate mechanisms and policies to encourage and honor staff, teachers and students who propose innovative initiatives related to digital transformation.

Clearly visible problems at 11 partner colleges in the survey trip in September, 2022:

– Circular No. 23/2018/TT-BLĐTBXH REGULATIONS ON RECORDS AND DOCUMENTATIONS IN INTERMEDIATE AND COLLEGE-LEVEL TRAINING has allowed college rectors to approve the form system themselves and specifically encouraged colleges to use electronic documents. However, the colleges have not yet implemented that. Thus, it can be seen that colleges have not actively amended internal regulations to suit digital transformation.

– Except for a few colleges that have regulations that encourage the application of digital technology in teaching, the rest of the colleges do not have any regulations in such a direction.

2.7. Digital infrastructure, platforms and learning materials

Investment in digital infrastructure plays an important role in the digital transformation of vocational colleges. Although digital transformation is not just a technology story, without technology infrastructure, there can be no digital transformation.

Objectives of investment in technology infrastructure, production of digital learning materials in digital transformation:

– Technology infrastructure, teaching and learning platforms, administration and management platforms, data platforms and connections together with digital learning resources repositories must be invested in sync with digital transformation activities.

– When the infrastructure is invested, they must be effectively exploited. To do so investment in technology must be concurrent with addressing human and institutional factors.

– Digital learning production is carried out methodically, reviewed and planned according to the roadmap to prioritize the contents, programs and subjects that need to be digitized, or piloted before gradually multiplying.

Components to invest in:

– Hardware infrastructure includes computer and other digital equipment, computer network and internet infrastructure. Hardware infrastructure needs to be invested in sync with other components, the general trend is to make the most of cloud services instead of investing in large server systems themselves.

– Software infrastructure, platforms, applications

+ Learning Management System (LMS)
+ Teaching Management System (TMS)
+ Student Management System
+ Admission system
+ Digital learning resources management system can be integrated into LMS to become LCMS, shared Open Educational Resources (OER)

+ College administration and management system (enrollment, facilities, supplies, equipment for training, personnel - salary ...)

+ A platform to connect all staff and teachers of the college

+ A unified data governance platform

+ Student applications

– The college's data infrastructure needs to be a unified data infrastructure. All software systems need to share a data infrastructure managed by the appropriate database management software.

– Human resources who are to operate and develop the college's digital technology infrastructure need to have corresponding capacity.

– The institution that operates the system is an important component and should be built in sync with the investment of the system.

– A digital learning repository is a collection of all types of digital data that the college has and can use in training activities.

Visible problems at 11 partner colleges in the survey trip in September, 2022:

– The survey showed that none of the 11 partner colleges have a technology infrastructure that meets the requirements of digital transformation.

– All colleges have been supported by GIZ to have e-learning rooms and teachers trained to use related equipment and software. These studios played an important role in the formation of the capacity to produce digital learning materials. All colleges have begun to exploit these studios, but the results vary widely. Colleges with good nuclear teams were able to produce quality learning materials that met the requirements. The majority of the remaining colleges stopped at the experimental level and exploited the studio mainly for media and admissions purposes.

– In terms of perception, collegels have an incorrect notion that the learning material must be video lectures (usually 45' for a lesson). Such a way of thinking makes it very difficult to produce video lectures and teachers are afraid to shoot videos for various reasons. In fact, digital learning materials can be very diverse, with ppt presentations currently in common use accounting for the largest proportion. These slideshow files need to be continuously improved, with short videos inserted to improve the quality so that they can be put into LMS for teaching.

– Some colleges are supported by GIZ to deploy Moodle software such as LMS platform and have been trained and guided to use it. The remaining colleges also mostly invest in building their own LMS platform. This is an essential foundation in the digital transformation of student learning activities.

– Some colleges are currently using teaching management system (TMS) and managing other aspects of operations. The general situation is that these softwares have been invested for a relatively long time, the technology is outdated and especially not connected to each other.

- Apart from the investments supported by GIZ for colleges over the past year, no significant investments by the colleges have been recorded in infrastructure and technology platforms as well as digital learning materials. This situation has a common reason that the digital transformation projects of the industry as well as of colleges have not been funded. In the near future, some colleges in the group of high-quality colleges can be invested from the state budget, but they do not have a clear picture of the systems that need to be equipped to ensure a digital technology infrastructure that meets the requirements of digital transformation.

2.8. Raising awareness through developing a self-paced learning course about DX in TVET

The course content includes the eight lessons below which are digitalised, designed and organised on the LMS platform, including:

Introduction: Objective, contents, methods, and the lecturer of the course

Overview lesson: a video clip introducing the course and guidance

Lesson 1: Why TVET needs digital transformation

- Objectives of the lesson
- Context of the 4.0 Industry revolution
- Cyber-physical environment and digital transformation
- National digital transformation on the three pillars and the needs for human resources
- The 2222 scheme

Lesson 2: The essence of digital transformation in TVET

- Objectives of the lesson
- Digital transformation is a systematic self-changing process
- Digital transformation is an innovation process with data and connection

Lesson 3: Principles for successful digital transformation

- Objectives of the lesson
- The principle of being overall and throughout
- The principle of breakthrough and synchronisation
- The principle of ownership and leadership

Lesson 4: Concurrent implementation of key DX components

- Objectives of the lesson
- Human component
- Regulatory frameworks component
- Technology component
- Transformation roadmap
- Management of implementation in digital transformation

Lesson 5: Summary of the ST-235 methodology

- Objectives of the lesson

- ST – Cyber-physical ecosystem model
- 235 – Implementation methods

Lesson 6: TVET ecosystem in the cyber-physical environment

- Objectives of the lesson
- Training contents
- Training methods
- Administration and management
- Digital data and connection
- Security and safety in cyber-physical environment
- Teachers and learners in digital transformation
- Reforming and finalizing regulations to change the working methods
- Technology infrastructure for TVET

Lesson 7: The role of each person in the digital transformation of TVET

- Objectives of the lesson
- DVET
- DoLISA
- Management boards of TVET institutes
- DX taskforce
- Management staff of the college
- Teachers of the college
- Students of the college

Lesson 8: Model of a smart TVET institute

- Objectives of the lesson
- Criteria of a smart TVET institute
- Connectivities in a smart TVET institute
- Data capacity
- Innovation capacity with data and connection
- Components of a smart TVET institute

Discussion: Forum for learners to exchange opinions and give feedback

End-of-course result evaluation

- Guidance on how to complete
- Learners have to complete 100% required content
- Take the end-of-course test to receive the completion confirmation

Comments about the course

In addition to the content of the above eight lessons, the course provides orientating information about the purpose, content, methods and teachers. Learners are provided with information about learning results evaluation. The course has a total of 8 lessons with study

duration of 186 minutes, and it is expected to take 240 minutes for learners to complete the entire course. A set of multiple-choice questions for each lesson and the whole course is designed and integrated into clips using LMS's H5P technology. The course website allows learners to discuss, exchange ideas... on the common online forum for the whole course as well as each lesson to create an academic environment for sharing experiences. The experts are in charge of building content and recording video clips for the lessons in the studio. In addition, GIZ cooperates with the technical team to support scripting, videoclip recording, post technical processing and course design on the LMS platform.

Some illustrations of system use

Figure 5. The eight lessons needs to be completed in order, completing the previous lesson is required to take the next lesson

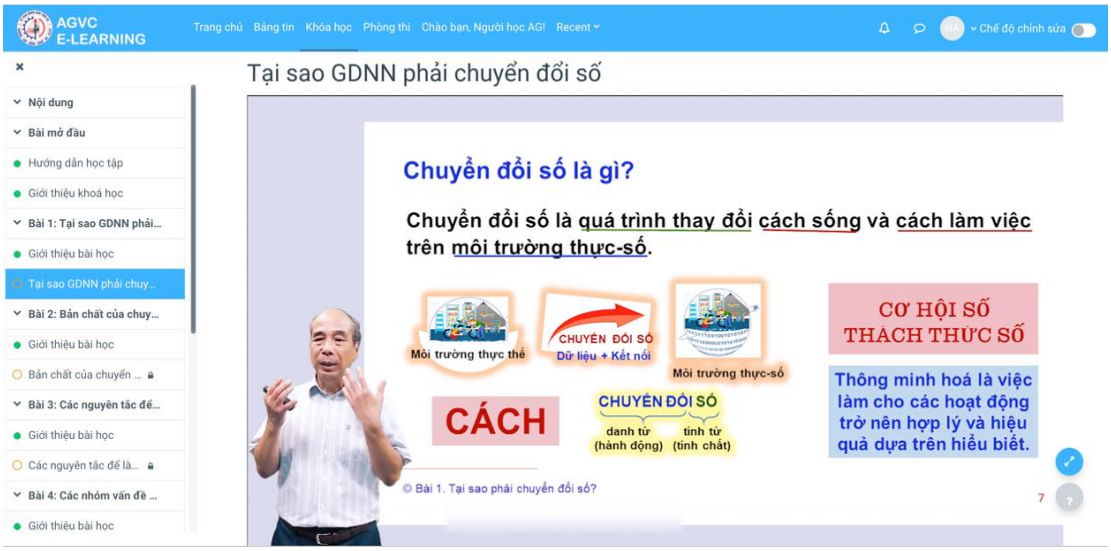

Figure 6. Snapshot from the videoclips

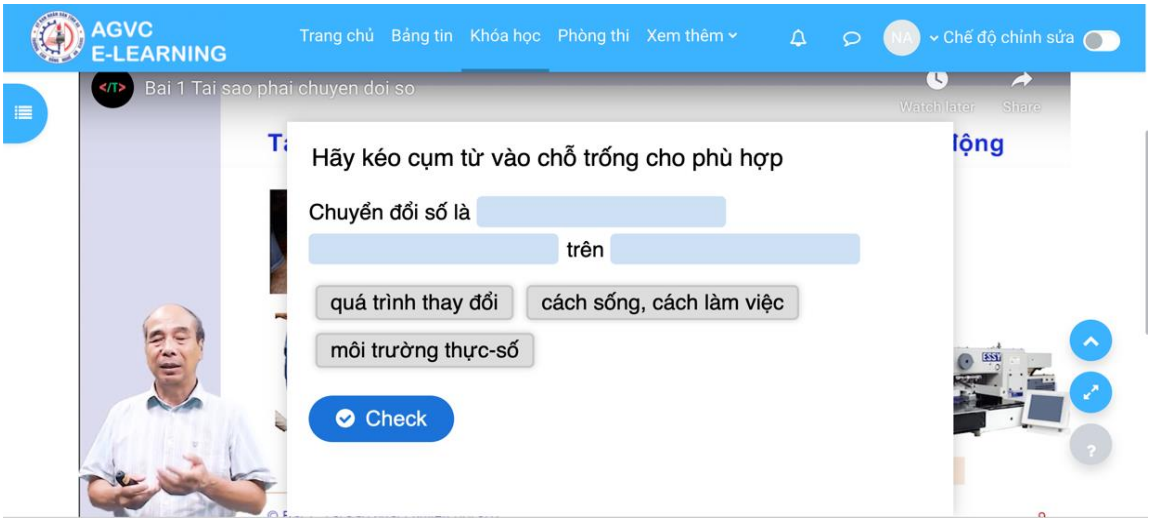

Figure 7. Evaluation questions in many formats

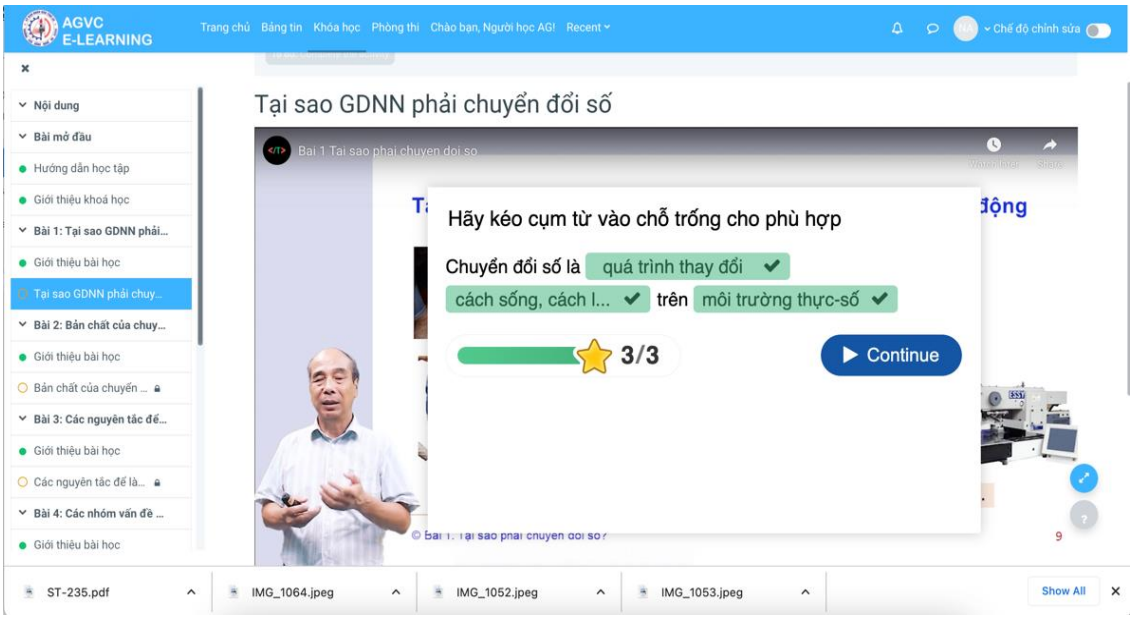

Figure 8. Complete the answer and gain scores. If the answer is wrong, learners need to go back and relearn

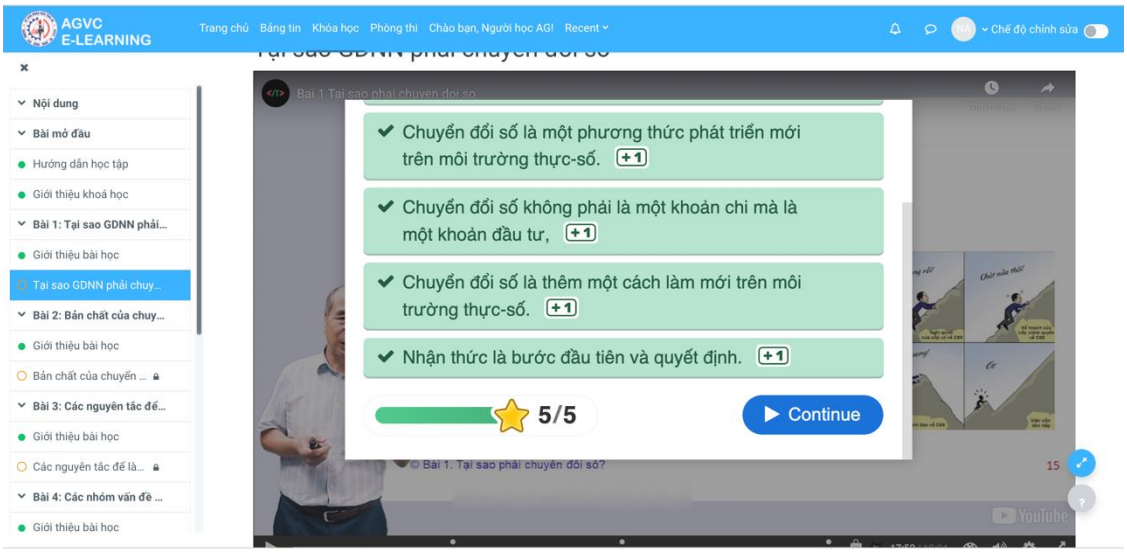

Figure 9. Another question accepting multiple answers.

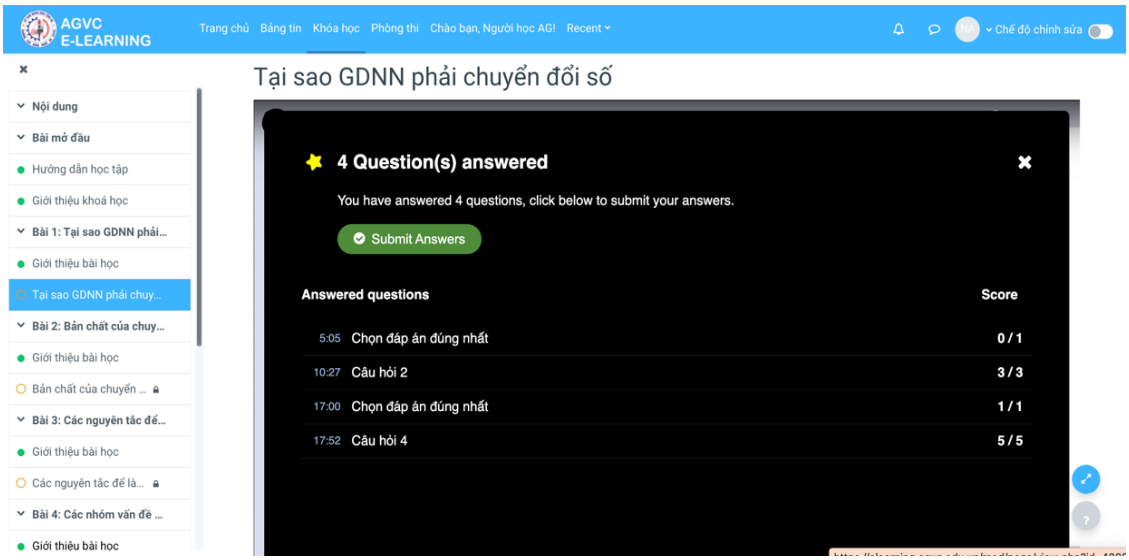

Figure 10. End-of-lesson review

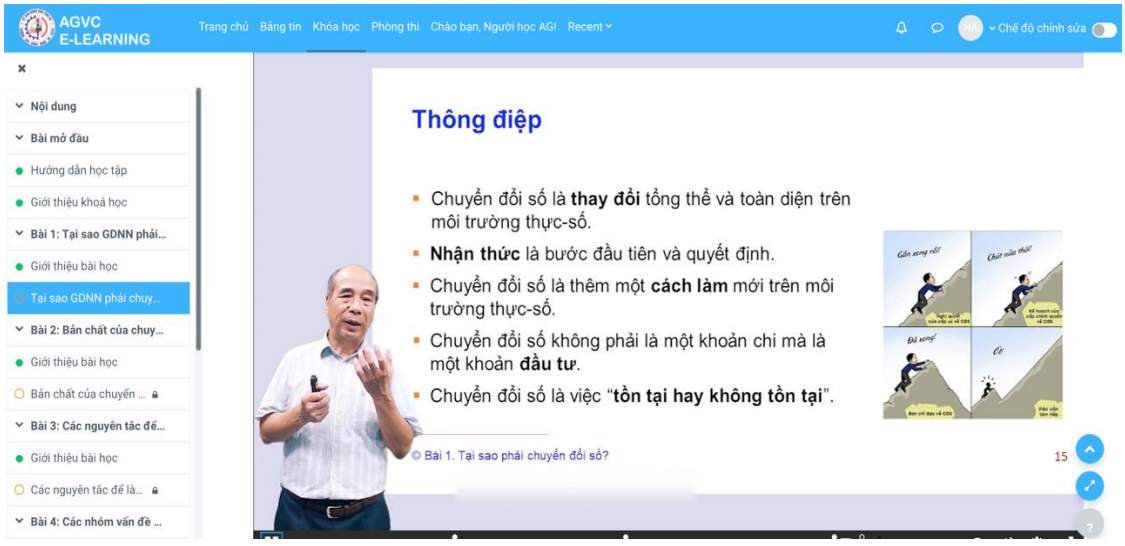

Figure 11. Messages and highlights at the end of each lesson

3. DEVELOPING A SMART TVET INSTITUTE MODEL

The model of a smart TVET institute suggested in this report is only the first version and more research activities, workshops, collecting ideas from colleges and state managing agencies of TVET are needed for this to be amended, become more accurate and detailed. Nevertheless, although it is only at this stage, authors still hope this report is helpful for the colleges in their digital transformation process. The model of technology architecture shown in Figure 3 is the results of the discussions with colleges that implemented digital transformation platforms supported by GIZ and are in the process of investing to actualise some components.

3.1. Introduction

Cyber-Physical-Social systems are characteristic of the Fourth Industrial Revolution. The common feature of these systems is that the cyber component is organically integrated into the physical and social components. Due to this integration of real components (physical-social) there are more methods of information exchange through the digital environment in addition to traditional methods of information exchange in the real environment. The digital environment enables the exchange of information in large volumes, high speed and regardless of geographical distance so that entities, including mobile entities, can connect with each other effectively.

Besides, breakthrough advances in data processing algorithms such as big data analysis, machine learning, deep learning, blockchain... help systems greatly improve data capacity. Digital components with the main characteristics of digital data and digital connectivity, when organically integrated into real systems make real systems more logical and efficient. On the other hand, for cyber-physical systems to be truly effective, the real components in the system themselves (machines, facilities, humans) must also change themselves to adapt to the new structure and mode of operation of the system. Such cyber-physical systems can be called smart systems, and the process by which real systems change themselves to become cyber-physical systems is called digital transformation. We can see the emergence of more and more concepts such as smart cities, smart factories, smart farms or even a smart country.

Although there is no universally recognized definition of what a smart organization is, some common characteristics can be mentioned:

- With finite resources, smart organizations have the most effective way of operating, bringing the highest benefits to themselves and all related entities.
- A smart organization must be one that is capable of continuous innovation. Innovation content must include innovation in products and services, innovation in operation and management methods.
- The intelligent organization needs the ability to continuously collect data about its environment and operations and the ability to process that data to gain insights (i.e. information and knowledge) about the changing trends of the environment and adjust its operations to adapt.

- Smart organizations need to have the ability to record information about all aspects of their internal operations with data, analyze and process those data to continuously optimize their own operating processes.
- Smart organizations need to be able to analyze data obtained from the outside and record internally to make restructuring decisions, adjusting goals as needed.
- Smart organizations need to have the capacity to accumulate, preserve and distribute knowledge, including explicit knowledge and implicit knowledge.

Digital transformation is the process by which an organization changes its structure and mode of operation by integrating more digital technology systems organically into existing structures to become smarter and more efficient. Digital technology systems allow organizations to have more forms of connectivity in the digital environment, enhance the capacity to collect and process digital data to achieve the criteria of a smart organization mentioned above. Along with the integration of digital technology, the elements of the organization such as humans, institutions and technology must also change to realize new modes of operation.

A very important point of digital transformation at an organization lies in connecting people, all devices and facilities in the organization with each other and with external entities (customers, partners ...). Through digital connectivity, systems can collect data at a larger scale, at a much faster rate than just using the connection in a physical environment. This resonates with recent advances in digital data processing capacity (big data, AI...) making the flow of information in the organization smooth and the organization can optimize its own operations, providing products and services that were previously impossible, at the same time react more effectively to changes in the surroundings.

A smart organization needs to operate on knowledge. Ability to collect data, process data to have reliable information, compare information received with existing knowledge to make accurate decisions, decide on the performance of the organization. Thus, smart organizations need to have the capacity to accumulate knowledge, both explicit knowledge and implicit knowledge.

Explicit knowledge is encrypted knowledge, which can be accumulated through Knowledge Management Systems (KMS), Expert Systems, through well-organized records and documents. Implicit knowledge is unencrypted knowledge, which is not expressed in written form but indirectly through the processes of interaction between members of the organization with each other and with external subjects. For example, the knowledge that is in the head of each individual (explicit knowledge) is written into books (implicit knowledge).

Each individual's implicit knowledge are shown through the individual's interactions with others and through data that records the individual’s activities. Recording and processing operational data using data processing algorithms will help exploit implicit knowledge that was previously a difficult task to do. Implicit knowledge is harnessed through data analysis that can be recorded, used to smarten products and services, to automate (such as using RPA – Robotic

Process Automation), to continuously optimize operational processes and to make administrative-management decisions more correctly. Another example is that during the admissions counseling process, the questions of potential students and the answers of admissions officers are recorded, systematically organized into a database for the construction of autoresponding Chatbox, making admissions more efficient even with fewer personnel.

An important feature of smart organizations is that the data, information, and knowledge gained not only for the decision-making of organizational leaders but also need to be effectively distributed to all positions. Each person in the organization needs to be provided with all the data, information and knowledge needed to best complete the assigned work. In other words, the quality and efficiency of the work being processed depends on whether the knowledge, information, data that the person is provided through that organization's knowledge management system quickly or slowly, sufficiently, or insufficiently/fragmentedly ....

Thus, in a smart organization thanks to digital transformation, the knowledge of the organization will be a combination of knowledge of each individual, knowledge of the organization and knowledge from machines. Thanks to digital connectivity and digital data capabilities, organizations become smarter and more efficient. Therefore, it can be affirmed that smart organization is the destination of digital transformation of an organization.

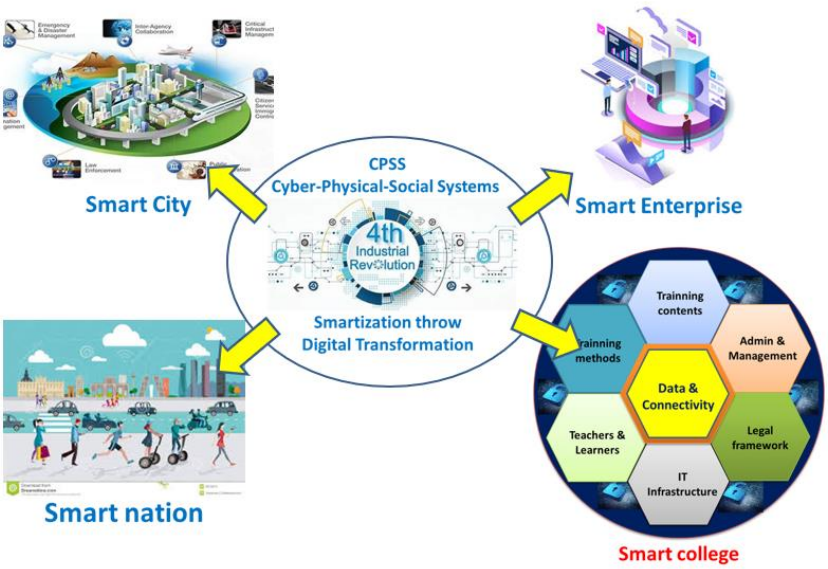

Figure 1. Smart vocational colleges in the trend of smartization

The concept of smart TVET institutes mentioned in this report is in the general trend of smartening organizations through digital transformation. In other words, smart TVET institutes are the destination of college digital transformation.

In recent years, colleges in the TVET system are starting the process of digital transformation. Having a common model of a smart TVET institute is useful to improve the digital transformation efficiency of colleges and design digital technology infrastructure for the construction of related investment projects.

This model of a smart TVET institution is proposed by experts in collaboration with managers at all levels and teaching staff at 11 partner colleges and it is bound to create a product of people involved .

Since this is the first time performing such a complex task, there will be some flaws in the model proposed. However, it can be considered as version 1.0 and be a helpul reference document for parner colleges at the moment. Further research in the next stages, especially lessons learned during the implementation process at colleges, will help complete this model before being replicated throughout the TVET system.

3.2. Model of a smart TVET institute

A TVET institute is an organization, so a smart TVET institution also has the common characteristics of a smart organization mentioned above. A smart TVET institution can be understood as an institution in the TVET system that makes extensive use of digital technology focusing on using appropriate data capabilities and digital connection to innovate its operating model in the direction of better responding to the needs of the rapidly changing labor market under the impact of the 4.0 industry. The following section of the report will paricularize the general ideas of a smart organization into the context of a TVET institution.

3.2.1. Expectation

A smart TVET institute is expected to have effective operation and brings benefits to all stakeholders. This reflects the principle of the “human factor is the core of digital transformation.” The expectations of different stakeholders were widely discussed among TVET **institutes** during the last research. Some of the observations are as follows.

- **Students and parents**

At the moment of admission, students and parents expect to get sufficient knowledege on specific occupations that can help them find good jobs after graduation. To achieve this goal, the TVET **institutes** need to have sufficient capacity to advise students to choose occupations and training levels in accordance with the recruitment trend of the labor market, not only at the moment of admission but also in the future when they graduate and later on. The chosen occupations must also match their interests, ability and time and financial conditions of each student. Students and parents also expect to be provided with information about the training programme and progress, living and studying conditions in the institutesbefore making the final decision on choosing occupations and training levels. When dealing with admission procedures, the administrative procedures should be simplified and flaws should be minimized as much as possible in order not to deal with such paper work repeatedly.

Students would like to be provided with adequate and timely necessary information for the studying and living process during their training time such as timetables, grades, remaining studying roadmap until graduation; assignments, tests, extracurricular activities and other obligations to perform. Whenever the system gathers and analyzes big data about learners during the studying process, students can be automatically suggested by the system with relevant training content, appropriate student services, and occupation orientations, even warnings about risks during the studying process (personalized learning).

In terms of life, students would like to enjoy a happy studying and living environment; an easy connection with classmates, with students of the same industry, with seniors and also with students who have graduated and got jobs to gain experience and get to know more about their future jobs and salaries as well as to get support whenever they are in need, especially when they would like to apply for jobs.

Parents would like to get sufficient and timely information about their children's studying and living conditions, tuition fees and other contribution obligations for their proactive financial plan as well as fluctuations in the labor market directly related to the occupation that their children are studying.

- **TVET institutes**

The TVET institutes, whose representatives are the rectors and other members of the rector boards, expect that building smart institute is an effective way to achieve their strategic goals, improve education and training quality and to make the most effective use of existing material resources, equipment installed in practical workshops, manpower and current institutions to maximize the training scale, fulfill the social responsibility and the same time ensure a solid financial foundation

More specifically, the TVET institutes expect to be able to catch the changing trends of the labor market, the studying needs and occupation choices of the young generation, the need for additional training and retraining of enterprises and thereby they can adjust the enrollment structure and prepare the necessary resources early to implement major training courses in accordance with the needs of the society.

From the perspective of the rectorboards, smart TVET institutes must have efficient and smooth operation. Governance and management decisions must be objective, based on data. Information systems must be modern, reliable, easy to use and have minimum operating costs.

Finally, the leaders of TVET institutes, besides ensuring income for teachers and staff, they expect all institution-related stakeholders such as students, parents, enterprises as well as state management agencies to be satisfied with their training quality.

- **Teachers**

The most direct expectation of all teachers participating in the discussion is to digitize the entire system of training management paperwork and administrative procedures to minimize

compliance time, save more time for their professional activities leading to their income improvement.

Teachers also expect to have good conditions to continuously improve their professional qualifications, digital competence and e-pedagogy to be able to meet the requirements of the new working environment. Smart TVET institutes need to have adequate ability to provide the most up-to-date knowledge, the best professional documents, the best understanding about their own classes and students so that they can complete their teaching performance well.

In term of society, teachers expect the smart TVET institutes to create an environment where they can easily get good connection with the internal and external colleagues. Due to this network, teacher community can share knowledge, experiences, or learn from each other to improve their professional qualifications and focus on career development.

- **Administrative staff**

It is very hard for administrative staff to deals with administrative work and even easy for them to make mistakes during their performance. The direct expectation of administrative staff is that administrative management activities need to be digitalized to minimize the paperwork. Under ideal conditions, when the legal corridor allows smart TVET institutes to be paperless organizations. When administrative activities are automated for maximum efficiency, administrative staff will have less working pressure, and they can have more time to participate in professional activities and join further training to improve their qualifications.

- **Enterprises**

The expectation of enterprises when recruiting is that they can recruit a sufficient number of employees with appropriate expertise so that they can minimize their time and efforts for training such employees after recruitment. To meet these requirements, enterprises need to be provided with sufficient information about the training process, the studying results of each student and have a good connection with TVET institues.

- **Government**

State management agencies in TVET expect smart TVET institutes to have effective operation, develop in accordance with the national TVET strategy, and provide accurate and timely information to state management agencies to serve for strategic planning and common policy formulation.

Local governments and related ministries and branches expect the TVET institutes to provide enough high-quality human resources to meet the development needs of localities and industries.

- **Social organizations**

Organizations and associations such as industry skills councils, institution-level industry advisory boards will be provided with a connected data platform to help them conduct researches and develop recommendations appropriate to the socio-economic context, specific needs and requirements of human resources and training capacity in each region and locality.

3.2.2. Criteria set

Based on the analysis of the expectations of the stakeholders, the study authors would like to propose a set of criteria for smart TVET institutes. These criteria can be applied to develop qualitative/quantitative indicators measuring how smart the TVET institutes are in subsequent research periods.

- *Labor market needs- based training.* Smart TVET i institutes need to have sufficient ability to forecast accurately the enrollment for each industry in the coming years, the requirements on knowledge and skills of these industries.

- *Personalized learning*. The training management system of TVET institutes should allow an increasing degree of *personalized learning. Each s*tudent can have their own schedule. The system must be capable of learning analytics and giving recommendations to each student to improve their studying results.

- *The training programme should be open and flexible*, based on the digital technology application, allowing adjustment / updating to quickly respond to the labor market's requirements on knowledge and skills.

- *Automatic operation*. Training and administrative processes should be automated to minimize compliance time. It is necessary to apply the principle of "each data can only be entered once" (Single Input), to completely stay away from doing the same thing twice: both dealing with paperwork and entering data into the computer. Training management needs to be automated smoothly for programme management, training progress, teacher's schedule and teaching plan, lesson plans for each lesson.

- *Effective administration and management.* The system must have good data analysis capabilities to support the decision making at all levels of management, good ability to create and accumulate knowledge and use such knowledge to support staff and teachers to continuously improve their qualifications.

- *Competence and culture.* Smart TVET institutes need to build a culture of continuous innovation, a culture of conduct in the digital environment, a culture of lifelong learning. Learners, teachers and all staff have the necessary digital competencies to do their jobs well.

- *Internal institutions.* The system of regulatory documents, report forms, economic and technical norms, salary, and bonus regimes in the TVET institutes must be consistent with the method of operation of the smart TVET institutes. In other words, the smart TVET institutes need to design a regime and regulations system suitable for the data and connection-based operation method.

- *Good technology infrastructure.* In a smart TVET institute, it is obvious that good data and connection capabilities should be invested. This topic will be mentioned later in this report.

3.2.3. Operation model with data and connection

Like other smart organizations, the intelligence of a TVET institutes depends on its connection and data capabilities. In addition to traditional connections in the physical

environment, smart TVET institutes need to effectively create connection channels in the digital environment. A reliable digital connection platform allows to increase the interaction frequency between stakeholders and thereby the TVET institute will obtain a large amount of useful data. With enhanced data processing capabilities due to advanced data science and artificial intelligence, TVET institutes s can have better understanding about stakeholders and continuously improve their method of operation to adapt to new conditions.

Figure 2 shows the main connections of TVET institutes. Current technology infrastructure allows them to build effective digital connection channels with stakeholders. Each type of connection requires the right tools such as Mobile apps, web apps, websites, fan pages and groups on social media networks, forums or simply QR codes or other technologies.

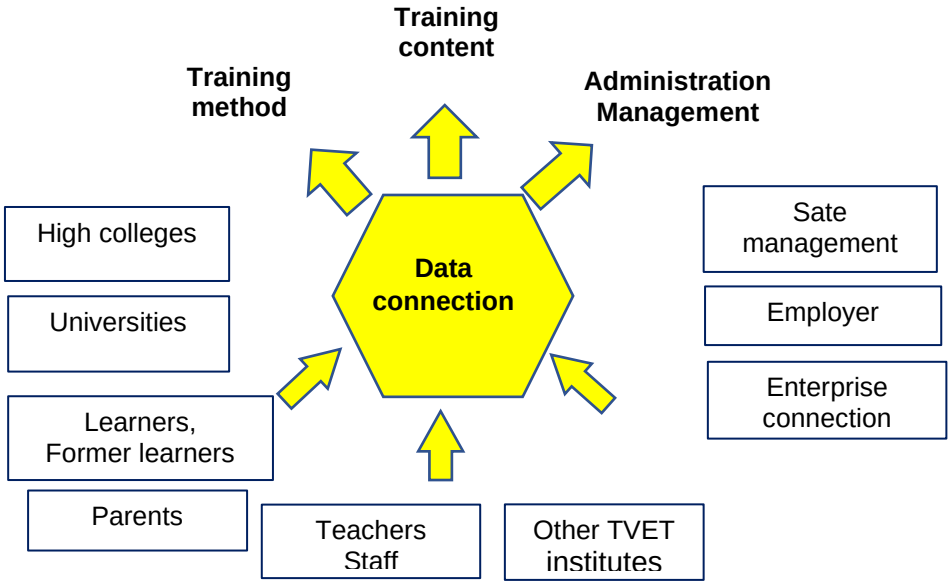

Figure 2. Connections in a smart TVET institution

An effective connection must involve the interaction, exchange of information, valuable data on a regular basis, internet connection is only a necessary condition of connection. Without connection, there will be no data capacity, and conversely, without data capacity, the connection is not valuable.

In a TVET institution, there are many different types of data, and these data are usually stored in the form of paper documents or stored in the computer in the form of electronic documents but they are not well organized (Excel files, databases combining with other management applications that lack consistency and cannot connect with each other).

It is required that the data in a smart TVET must be unified, shared and used throughout the system. To meet this requirement, there should be a unified and long-term data architecture built professionally.

Data related to stakeholders in the TVET institute can be classified into two categories: entity-descriptive data (e.g. student personal data) and data on that stakeholder's activities (e.g. data on the students' learning activities). As mentioned above, the nature of intelligence is the ability

to analyze an object's 's activity data to get further understanding about that object. For example, the system can analyze data about the learning activities of a student, compare them with the learning data of other students to accurately assess the learning process, then make useful recommendations for students so that they can improve their learning results.

Such approach is also suitable for other objects in the institute like it manages and evaluates teachers and staff via their teaching and working activities rather than just manages information and personal records; it manages the use of facilities rather than just manages static data about those assets.

3.2.4. Digital security safety

To be smart, it is necessary to have digital connection with the surrounding environment. Digital connectivity helps smart organizations enhance enormous data collection and distribution capabilities, however it also brings safety and security risks. Smart TVET institute is not an exception. Besides data and connection capabilities, they need to be able to protect themselves against threats to security and safety. In the framework of this report, we do not have deeper analysis of this important topic but we just emphasize that this is an essential requirement of smart organizations in general and smart TVET institutes in particular.

3.2.5. Digital infrastructure of a smart TVET institute

Smart TVET institutes need to have good digital infrastructure. Digital infrastructure includes hardware, software, data, human resources and respective institutions. The following section of the report will briefly describe components required in the digital infrastructure of smart TVET institutes based on the discussions between experts and TVET institutes as well as the fact finding activity on the implementation of digital infrastructure in TVET institutes. Due to the limited time available for this project, the descriptions are only preliminary to guide further studies later on

Hardware and network infrastructure

Consists of main components like server system, personal computers and network infrastructure.

Regarding the server system, TVET institutes can do the investment in their own server system, or the server can be rented. According to the general trend, it is found to be much more efficient to rent a server than to buy it because it seems to be more economic, especially in the condition that the requirements for servers are increasing as TVET institutes accelerate digital transformation activities. On the other hand, when renting a server, TVET institutes may not need a system administrator and can entrust the security and safety issues to qualified companies. Renting a server helps to increase the flexibility of the environment to install, exploit and use the service according to different needs at different moments to avoid the waste. They can rent the cloud service or physical server and the server can be kept at companies providing data center

service. One of the problems preventing the trend of shifting from investment to renting is that there are no regulations and recurrent spending regimes for this content.

In a smart TVET institute, in addition to the server physical connection, all students or teachers, must have digital connection with the system and with others, so everyone needs to be able to access the computers, smartphones, and other peripheral equipment. The vast majority of staff and teachers have smartphones, but they also need computers to perform professional tasks requiring a lot of data entry. The percentage of college students with smartphones is quite high, then the tool will be used to connect everyone due to general trend. At the intermediate and elementary levels, the percentage of smartphone ownership is still not high and TVET institutes will have to invest to ensure enough computers for students to access the system.

Network infrastructure is an important element in the overall hardware infrastructure. In a smart TVET institute, everyone and everything must be connected, and exchange of information will be performed continuously. To ensure this, TVET institutes must have a wireless access system (wifi) within the college and enough bandwidth to connect to the outside. With the current situation of 5G network deployment, hopefully in a short time the network connection problem will be solved.

Software infrastructures

The data and connection capabilities of a smart TVET institutes are mainly shown via respective software modules. The TVET institutes are using current softwares to manage different professional processes and they are installed on single computers, meanwhile the software system of a smart TVET institute may have different modules but it must form a unified system which can be shared, can communicate and use the same data infrastructure. In addition to the good data analysis capabilities (descriptive analysis, predictive analysis, and recommendation analysis) the software system must ensure the ability to create and maintain reliable and efficient connections.

The following section of the report briefly describes the software modules that may be needed for a smart TVET institute

Figure 3 shows some key components of the architectural model proposed for digital infrastructure in a smart TVET institute.

a. The main activity of a TVET institution is vocational training. **The Teaching Management System (TMS)** is the backbone to manage this core activity. TMS ensures the functions of training planning, monitoring the activities implementation, training quality control for full-course.

training programme, detailed training progress including lesson plan. The data on training plan after being approved will be transferred to the LMS for implementation. The system of training records and paperwork as well as training quality control activities are thoroughly digitized and processed on TMS. The updating of training content in the direction of digital transformation to meet the rapidly changing requirements of job positions is implemented through this important

module. Based on the institute's training plan, each student can develop their own study plan in accordance with the general requirements and regulations.

b. Learning management system - LMS (or LCMS) manages all data about students' learning process, including each lesson. It is noted that LMS is not only used for online learning but it is also a general learning management system. All kinds of teaching and learning activities whether offline or online training courses need to be recorded in the LMS and this is the most important digital data source for Learning Analytics aiming at continuously improving the teaching and learning quality. Data on teaching and learning activities must be recorded in detail for each pedagogical activity in each lesson. This learning data needs to be analyzed by appropriate algorithms aiming at continuously improving teaching quality. The LMS must ensure that it allows personalized learning of students according to the requirements of a smart TVET institute. The TMS-LMS application platforms create the backbone of the teaching and learning process. The data of these two systems must be interconnected, all teaching and learning activities must be recorded in the form of digital data, analyzed so that the smart TVET institute can continuously improve and innovate this activity.

c. Via connection system: students can add and update personal information, receive announcements, and submit proposals for the TVET institutes as well as pay tuition fees, borrow and return books to library, do the registration for canteen and dormitory... In addition, the system also provides related services for parents or guardians. Students can use this module to access all information related to the study path, personal timetable, study results...

d. Digital learning management system. Besides the traditional library system, electronic archives and other digital learning materials are important resources for teaching and learning activities in TVET institutes This materials source needs to be well managed, continuously supplemented and completed in order to improve the training quality. The TVET institutes' digital data source needs to be connected to the open material source of the entire TVET sector as well as other national and international open data sources. At the same time, digital data source also needs to be connected with TMS-LMS to ensure effective exploitation of learning materials for training.

e. The administration - management system of a TVET institute includes functional groups that manage and provide administrative services for all stakeholders and have the functions of an Enterprise Resource Planning (ERP). Functional modules can include Human Resource Management (HRM), Facilities Management (AM/FM), financial management, materials management, practical tools...

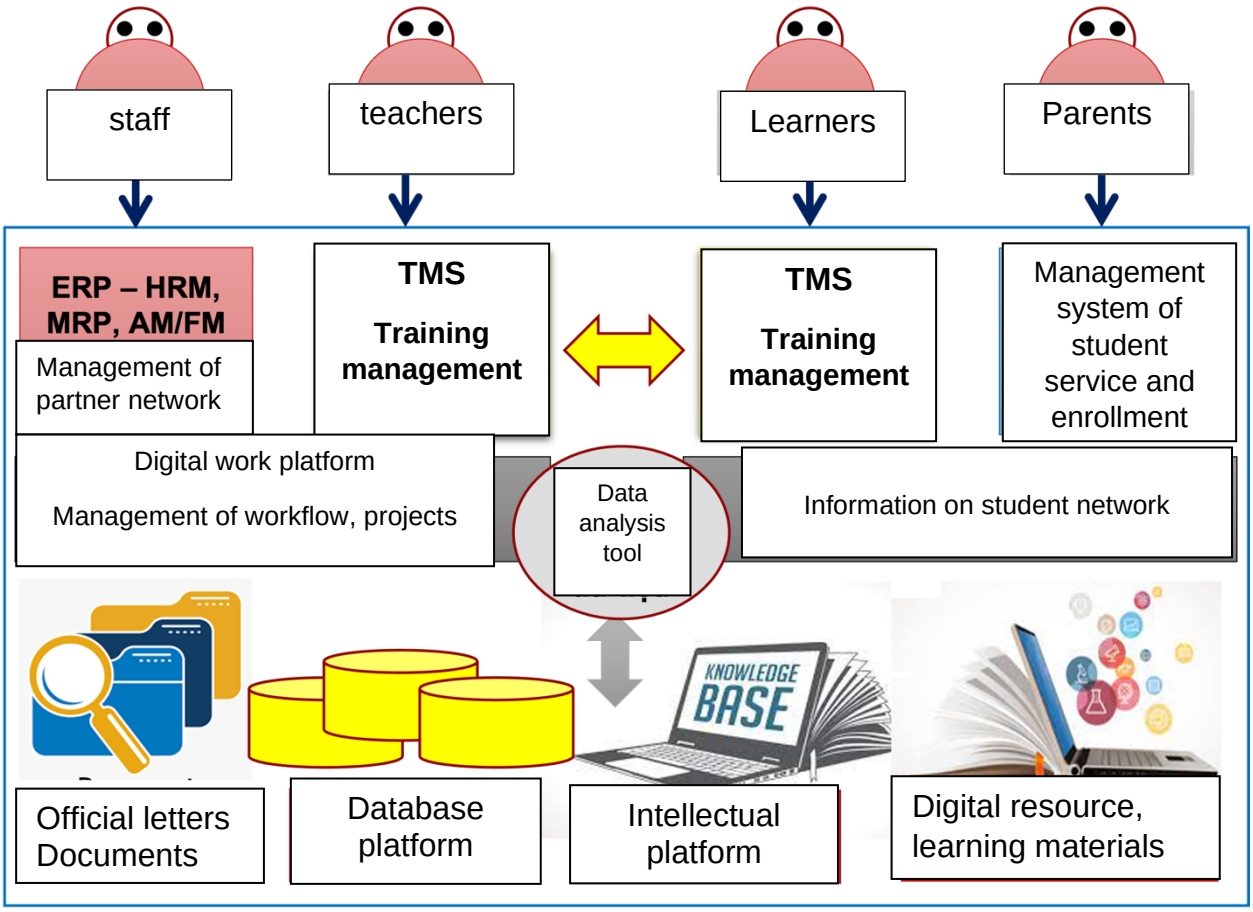

Figure 3 . Technology architecture model in a smart TVET institute.

f. Enrollment is a vital activity of the institues. Smart TVET institutes need smart enrollment systems which have the same capacity as an omni channel marketing system (Omni channel), or customer relationship management (CRM) of enterprises. The modern digital media environment allows TVET institutes to have many ways to create connections with potential students. As soon as students or parents show their interests in vocational training, the TVET institutes must immediately establish an effective connection to provide information and advice to them. The intelligent enrollment system needs high data capacity to orient the enrollment areas, accurately forecast enrollment results for the next years so that the institutes have enough time to prepare their respective training capacity.

g. Connection with enterprises and other partners. In order to regularly understand the changing requirements for job positions and effectively organize the practice process of students, mobilize teachers working at enterprises to participate in vocational training, smart TVET institutes need to have effective connection channels with enterprises. It should be noted that whenever we talk about the connection between TVET institutes and enterprises, we must understand that we are talking about a network connecting with many specific people in enterprises and in TVET

institutes. The current digital technology helps us to build such connection networks in a simple way. The information exchanged by individuals on such a mini-social network can be recorded and processed to get many useful insights which are necessary for the administration-management system of TVET institutes. In addition to enterprise connection, smart TVET institutes also need a reliable and effective digital connection to all other external partners such as state management agencies at all levels, banks and service providers for the institute. Such connections will significantly reduce operating costs.

h. The data analysis module is responsible for analyzing all teaching and learning data as well as other activities to detect knowledge gaps, create reminders and advice for each student about what they need to study again, or need to get further training to strengthen their missing knowledge and skills to achieve the best learning results. This module also creates suggestions for teachers on what needs to be improved in the lesson plan and how to conduct lessons to achieve the best training results, analyzes performance data of the institutions and provides results for all job positions. Data analysis can be at different levels: descriptive analysis, predictive analysis and recommendation analysis. In the early stage, when the necessary data has not been accumulated, the smart TVET institutes can still deploy data analysis at the lowest level - descriptive analysis to provide insights into the current status of all their activities. Such analysis results need to be distributed in real time to every job position according to the information needed for each position.

Data infrastructure

The unified data infrastructure is the core of the model of a smart TVET institute. In a traditional way of IT application, TVET institutes use a variety of software to automate their management and the respective databases are designed to optimize the operation of those individual softwares. As a result, each institution has many different databases with duplicated and contradictory contents, so the data entry becomes challenging because they have to repeat the data entry many times on different softwares.

In the digital architecture of a smart TVET institute, the databases must form into one whole that can be used for the entire system and strictly comply with the principles that data can only be entered into the system once (single input). Data infrastructure is normally designed as a single platform consisting of micro services which are used by all applications instead of directly querying the database. Unifying the database system in TVET institutes can help them make the current operation method become more efficient and that is considered a prerequisite for them to become smart TVET institutes It is necessary to have a good data architecture to build a good data infrastructure. Thus, a unified data model and a system of related statutes, regulations and standards to ensure different application software, possibly created by different suppliers should be complied.

Data consistency in external connections such as state management agencies at all levels, national databases, connections with other institutes in the TVET system, enterprise connections,

etc., makes external interactions more effective. In an ideal situation, DVET could build a common data architecture for the entire industry, in which TVET institutes in general and smart TVET institutes in particular would use that unified data architecture to ensure that the target of digital transformation is a collection of smart TVET institutes which are connected, shared data, information and knowledge with each other to form a smart TVET system on a national scale.

Human resources in charge of building, operating and ensuring the security and safety of the system

It is required that stakeholders in the TVET institutes including officers, teachers or students should have the corresponding awareness, capacity and culture. In this section, the report just mentions about the group of stakeholders who are directly responsible for the construction and operation of the technology infrastructure. The technology infrastructure of a smart TVET institute is a complex information system, using many modern technologies, on the other hand, all activities of the institutes depends on the stable, safe and reliable operation of information systems. So, the smart TVET institutes need to have appropriately qualified IT staff. This is mandatory requirement and also an important content in projects forming smart TVET institute

Setting up a team to be in charge of building and operating digital technology infrastructure is not easy. That means TVET institutes need more attention and investment in this team. They can also collaborate with external partners, with solution providers to operate the system and the cost to ensure that long-term cooperation must be considered an important component of the overall operating budget of the institutions.

Institutions and regulations for the system operation

Like other information systems, the technology infrastructure of smart TVET institutes requires a system of regulations, regimes appropriately designed to have effective and safe operation. This factor is often overlooked or underestimated during the process of building smart TVET institutes and can be one of many reasons leading to many unsuccessful digital transformation projects.

The system of regulations must clearly define the rights and responsibilities of each user on data and connection, attach responsibility for updating data to each individual's professional work. The general rule is that all teaching and learning activities as well as other activities in the institutes must be planned, evaluated, suggested to improve and recorded using digital data in the information system. At the same time, in order to reduce the workload, whenever entering data into the system, the regulations on dealing with paperwork must be abolished in order to eliminate duplication and unnecessary workload.

When stakeholders transfer a part of their work from the real environment to the digital environment, the system of economic and technical norms also needs to be extended to all activities in the digital environment. Without such norms, TVET institutes may face many difficulties in developing their digital learning materials.

4. SUGGESTIONS AND RECOMMENDATIONS

4.1. Suggestions and Recommendations on evaluation of digital transformation implementation

Based on the survey, data collection and analysis of the recommendations of the 11 TVET partner colleges, we would like to have suggestions and recommendations as follows

4.2. DVET

During the research for building a smart TVET institue model with the aim of quickly smartening TVET institutes in the entire TVET system, we recommend DVET to quickly build a unified data model of smart TVET institutes nationwide, especially the identification of objects compatible with existing national identification systems.

We expect DVET to continue their efforts to improve legal regulations to promote digital transformation under the project "Digital transformation in TVET" issued under Decision 2222/QD-TTg dated 30/12/2022. At first, the issuance of documents on recognition of learning outcomes, exams, digital-based online training courses, digital certificates, and recognition of digital documents during the accreditation are issues mentioned by many TVET institutes.

- Allocate resources to support TVET institues to implement digital transformation activities, promote investment in technology infrastructure for TVET insitutes in TVET system, guide local DOLISAs to implement project 2222/QD-TTg

- Support in terms of policies and orientations implementing pilot projects, or replicating results of digital transformation activity implementation supported by GIZ at 11 partner TVET colleges

- Create a sandbox mechanism and invest in sufficient server infrastructure to meet the pilot requirements of an open educational resource (OER) platform at 11 GIZ partner TVETcolleges, create a premise for DVET to upgrade the platform for TVET system.

- Allow the pilot of updating the curriculum for Informatics 05 according to a module – based orientation of digital litercy training for college level students at some of GIZ's partner colleges.

- Disseminate a number of training courses that have been built according to the model of mass open online courses (MOOCs) to help learners access the courses freely such as: Disseminate basic knowledge about digital transformation in TVET (8 lessons) , Environmental protection, efficient use of energy and resources (5 lessons), Inclusive teaching skills (4 lessons); giving refresher courses on pedagogical skills for elementary-level enterprise trainers (5 lessons), management skills for training staff at enterprises (6 lessons).

- Approach a number of models, lessons learned, including challenges in building a digital learning studios system, learning management platforms (LMS), digital management platforms (DMP) at 11 GIZ partner TVET colleges, as the basis for the development of documents guiding and supporting the TVET system in these areas.

4.2. 11 partner TVET colleges

11 TVET partner colleges need to strengthen their self-determination in digital transformation activities. They need to be aware that, with or without the support of GIZ, TVET colleges still have implemented digital transformation activities. Moreover, the support of external partners can only be effective when there is an appropriate reciprocity. A specific example is that even though GIZ has supported some TVET institutes to implement LMS platform, if these institutions have not put teaching and learning activities into that platform, the LMS will not bring any benefits.

- Partner TVETcolleges need to **develop a specific action plan** for each year as a basis to implement activities and at the same time to call for support frompartners (including GIZ).

- For partner TVET colleges that have already installed LMS platform, it is **necessary to quickly implement teaching and learning activities on this platform**. A way to do is choosing at least one teacher of each occupation to coordinate with the digital transformation taskforce to implement teaching and learning activities on LMS for piloting and getting experience, and then replicating to the whole faculty. It is also possible to select a faculty or an occupation to pilot and then dissemminate to the whole college.

- It is necessary for partner TVET colleges to quickly make statistics, tally and re-evaluate the entire digital learning materials, and meanwhile prepare the plan for their training contents, training programs, and the subjects that need to be digitized in order to set up the schedule to complete and renew existing digital learning materials, then upload to the OER platform and integrate into LMS to form an LCMS for teaching and learning.

- For partner TVET colleges that have already invested in an administration platform, it is necessary to quickly **put administration and management activities into a common platform** and quickly unify the data platform. Priority should be given to digital transformation of training management activities, digitization of the entire paperwork system in accordance with Circular 23 to radically reduce the time and effort of teachers for paperwork.

- For TVET institutes that have not yet invested in technology platforms, they need to quickly seek for **financial resources to invest in necessary technology platforms** in parallel with conducting digital transformation activities on these platforms.

– Focus on building **a digital transformation taskforce**, clearly mentioning job descriptions, incentive mechanisms and remuneration regimes, investment in capacity building to help them to be confident to play the leading and coordinating roles in partner TVET **colleges**.

- Focus on some **breakthroughs and important solutions**. For example, developing technology solutions (API, SSO...), integrating data from existing platforms and software, focusing on solutions in terms of technology and human capacity for network safety and security.

- Prepare appropriate planning for IT architecture to determine priorities and investment roadmap to ensure efficiency, systematic nature... serving digital transformation implementation.

– Have commitment **to effectively exploit GIZ's supporting resources** for digital transformation activities in partner colleges.

4.3. GIZ

– For building **a smart TVET institute model**, in order to complete and implement this architecture in detail in order to disseminate to the remaining TVET institutes, we strongly recommend GIZ to continue its support in terms of consultancy service and resources for TVET institutes that are implementing this model and can expand the list of TVET institutes participating in the pilot group; continue to complete and detail the smart TVET model, especially the technology infrastructure model of smart TVET to help them build investment projects for such important infrastructure.

– Support partner TVET colleges to implement digital transformation activities, together with consultancy service, further specific and specialized training.

– For TVET colleges that have been supported with **technology platforms** in 2020-2021, it is necessary to support them to implement digital transformation activities and exploit the platform effectively.

– Support all partner TVET colleges with the statistics, inventory, evaluation of existing digital learning materials and plan development to improve the digital learning materials quality and the transition of digital learning materials to electronic libraries on the OER platform to be shared, forming an initial open deduction resource by learning materials provided through GIZ-funded projects.

– Select partner TVET colleges to support **the pilot implementation of the subject Informatics 05 in the direction of the advanced digital competency training module** with the purpose of getting experience for mass deployment.

– Continue to play the key role in promoting the establishment of **professional communities** on different topics, create forums/information channels or organize technical exchange seminars to motivate the sharing of successful stories, tips and practical experience among 11 partner TVET colleges community. Potential topics such as: digital transformation model/method of each college, LMS application, studio operation and digital learning materials production, digital governance platform, OER platform, and IT architecture

– Promote the multipliers approach, focusing on accompanying and supporting capacity building for such core staff groups.

– Promoting the digitization of digital transformation activities, giving priority to building and designing self-paced learning courses on the topics of raising awareness about digital transformation in TVET, improving digital literacy, digital pedagogy… providing free access to Open Educational Resources (OER) to create an intensive impact on many people.

- Summarize successful lessons, models, and experiences in digital transformation implementation at 11 partner TVET colleges and send them to DVET as a basis for strategic and policy consultation and replication.

5. CONCLUSION

Two activities on assessing the process and results of digital transformation at 11 GIZ partner TVET colleges as well as building smart TVET college model have been completed as planned, giving us a clear view of the transformation situation at 11 partner TVET colleges in particular as well as in the entire TVET system, getting lessons learned, recommendations and advice for organizations in the TVET system.

The consultancy group has completed our task and contributed the first steps to the roadmap of the digital transformation in TVET system.

6. REFERENCES

1. APEC (2017). Employer driven competencies to address skills shortages in the digital age, APEC Project DARE (Data Analytics Raising Employment).

2. Hồ Tú Bảo, Nguyễn Huy Dũng, Nguyễn Nhật Quang (2020). Q&A about Digital Transformation. Publishing House of Information and Communication.

3. Bates, A.W. (2019). Teaching in a digital age. https://opentextbc.ca/teachinginadigitalage/

4. Chang J.H, Rynhart G., Huynh P. (2016). Asian in transformation: How technology is changing jobs and enterprise. *International Labor Organization*. http://unctad.org/meetings/es/Presentation/cstd2016_p24_Jae-HeeChang_ILO_en.pdf.

5. Dziuban, C., C.R. Graham, P.D. Moskal, A.Norberg, N. Sicilia (2018). Blended learning: the new normal and emerging technologies, International Journal of Educational Technologies in Higher Education, https://educationaltechnologyjournal.springeropen.com/track/pdf/10.1186/s41239-017-0087-5.pdf

6. European Parliamentary (2020). Rethinking education in the digital age. https://www.europarl.europa.eu/RegData/etudes/STUD/2020/641528/EPRS_STU(2020)641528_EN.pdf.

7. KPMG (2020). The future of higher education in a disruptive world. https://home.kpmg/xx/en/home/industries/government-public-sector/education/the-future-of-higher-education-in-a-disruptive-world.html

8. Linsday Herbert (2017). Digital Transformation. Chuyển đổi số (bản dịch tiếng Việt), Alpha book (2020).

9. Max Claps (2015). Education Digital Transformation: a View of the Future of Learning. https://www.slideshare.net/massimilianoclaps9/education-digital-transformation-a-view-of-the-future-of-learning

10. OECD (2016). *Skills for a digital world*. https://www.oecd.org/els/emp/Skills-for-a-Digital-World.pdf

11. Peng, H, S. Ma, J.M. Spector (2019). Personalized adaptive learning: an emerging pedagogical approach enabled by a smart learning environment, *Smart Learning Environments*, https://slejournal.springeropen.com/track/pdf/10.1186/s40561-019-0089-y.pdf

12. Đỗ Thị Ngọc Quyên (2021). Chuyển đổi số trong giáo dục: Những thách thức và nguy cơ. Tia Sáng, https://tiasang.com.vn/-giao-duc/Chuyen-doi-so-trong-giao-duc-Nhung-thach-thuc-va-nguy-co-26836.

13. Roger D. L. (2016). *Rethinking and Transforming Your Business for the Digital Age*, Columbia University Press, 2016. Bản dịch tiếng Việt "Cải tổ doanh nghiệp trong thời đại số", PACE Institute of Management, 2018.

14. Thang Ho Vinh, Nakamori Yoshiteru, Ho Tu-Bao, Cher Ping Lim (2014). Blended Learning Model on Hands-on Approach for In-service Secondary College Teachers:

Combination of E-learning and face-to-face Discussion; *Journal of Education and Information Technologies*, Springer. https://link.springer.com/article/10.1007/s10639-014-9315-y#page-1

15. Think Tank VINASA (2019). *Việt Nam thời chuyển đổi số*, NXB Thế giới.

16. World bank (2016). Digital dividends: Overview. http://documents.worldbank.org/curated/en/896971468194972881/pdf/102725-PUB-Replacement-PUBLIC.pdf

APPENDIX

Appendix 1: Workshop on Model of a smart TVET institute

AGENDA

On 26.08.2022 in Ho Chi Minh city

Time	Content	Doers
9:00-9:10	Opening speech	Leadership Representative of DVET
9:10-10:00	Presentation of digital transformation methodology in TVET, Q&A	Pro. Hồ Tú Bảo
10:00-10:30	Model of a smart TVET institution: Topic presentation for group discussion activity, Q&A	Dr. Nguyễn Nhật Quang
10:30-10:45	Breaktime	
10:45-12:00	Divide into groups to discuss about components/criteria constituting a smart TVET institution model based on six components of digital transformation ecosystem: Group 1 & 2: discuss about: Training content, Teaching and learning methods, Digital teachers and learners Group 3 & 4: discuss about: Digital management and administration, legal corridor.	Prof. Hồ Tú Bảo, Dr. Nguyễn Nhật Quang
12:00-13:30	Lunch	
13:30-15:30	04 groups present their group work results, discussion/ Q&A	Presentation of 04 group

15:30-15:45	Breaktime	
15:45-16:45	Discussing and collecting opinions on building a draft smart TVET institute model	Leadership Representative of DVET, Prof. Hồ Tú Bảo, Dr. Nguyễn Nhật Quang
16:45-17:00	Summary and closing the workshop	Leadership Representative of DVET, Representative of GIZ

Appendix 2: Working agenda with 11 partner TVET institues

Time	Activity	Doers
9h00 - 9h05	Introduction of delegates, agenda, and purpose of the workshop	Partner TVET colleges
9h05 - 9h15	Opening speech	Leadership Representative of partner colleges, Departments/Provincial People's Committee, GIZ
9h15 - 9h45	Report on the results of digital transformation activities implemented at partner colleges and discussion	Representative of partner TVET colleges
9h45 - 10h30	Presentation of digital transformation methodology ST-235 and smart TVET college model	Consultants
10h30 - 10h45	Breaktime	
10h45 - 11h30	Discussion on a smart TVET institute model	All delegates
11h30 – 13h00	Lunch	

13h30 - 15h00	Working with digital transformation taskforce, representative teachers, staff in charge of e-learning room... on reviewing the legal corridor /internal institutions, and the effectiveness of digital transformation activities implemented at TVET colleges.	Consultants, GIZ, partner TVET colleges
15h00 – 16h00	Doing a survey on the implementation effectiveness of digital platforms, equipment and software in the e-learning room	Consultants, GIZ, partner TVET colleges
16h00 - 16h30	Working with the Rector Board of partner TVET colleges	Consultants, GIZ, partner TVET colleges

Report on the evaluation of the progress and results of digital transformation and the development of smart TVET college model was designed and developed within the framework of the Program Reform of Technical Vocational Education and Training in Vietnam, German Corporation for International Cooperation GmbH (GIZ), authorized by the German Federal Ministry of Economic Cooperation and Development (BMZ) in collaboration with the Vietnam Directorate of Vocational Education and Training.