Information and Communication Technology Architecture

For TVET Institutions in DX

Programme “Reform of TVET in Viet Nam”
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Deutsche Gesellschaft
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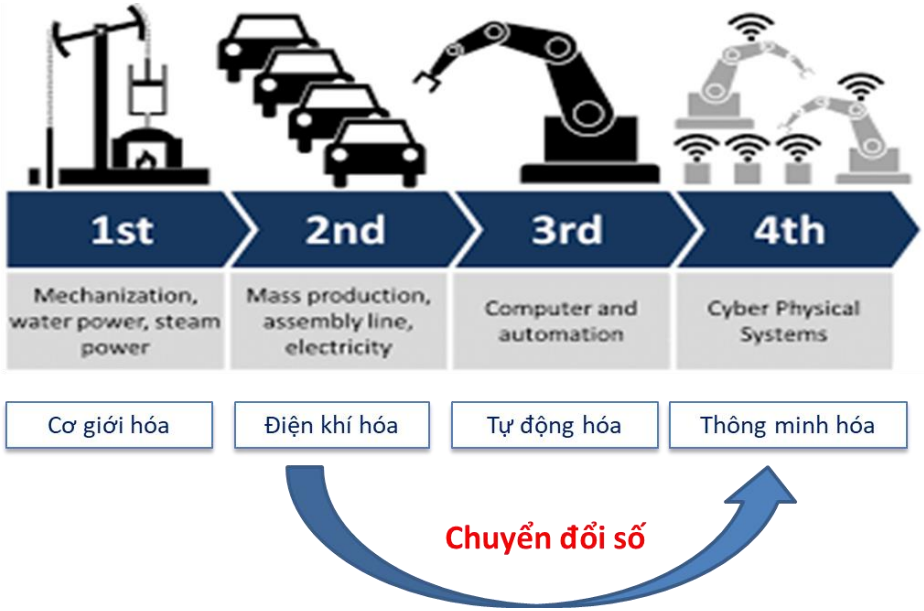
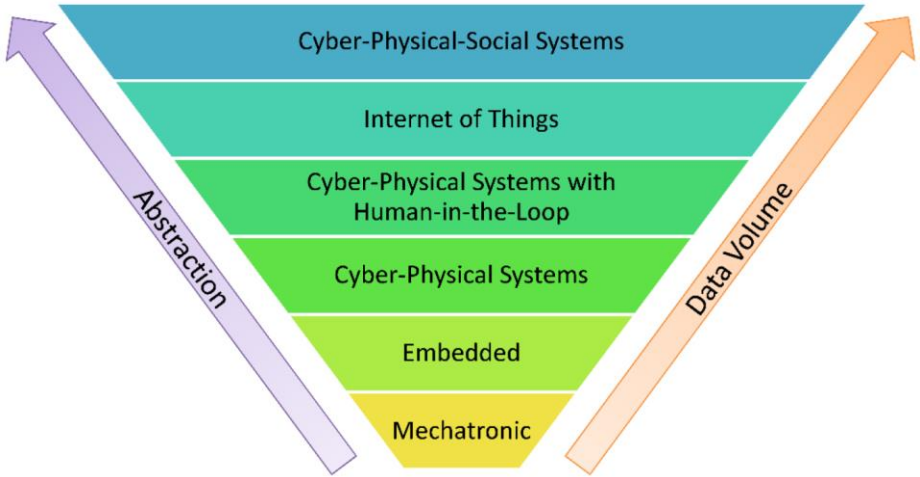
1.The Fourth Industrial Revolution and DX

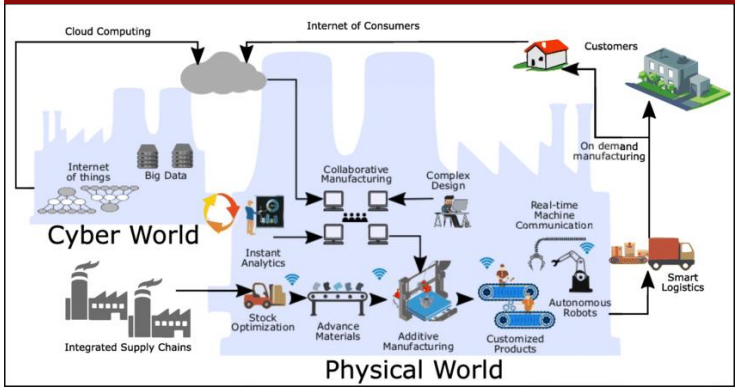


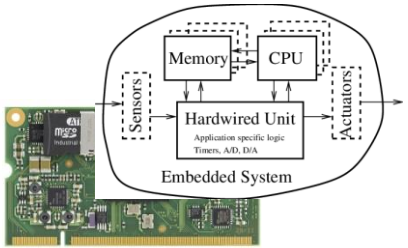
Thế giới thực – số. Cyber – Physical – Social world

Cyber Physical Social System

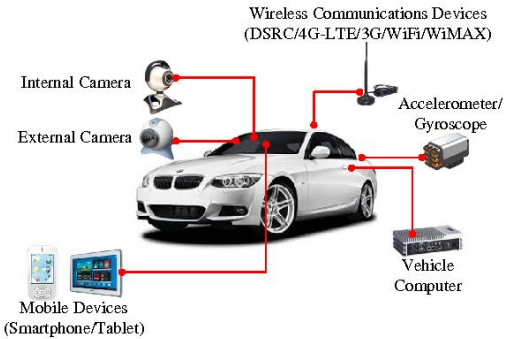


Cyber Physical Social System

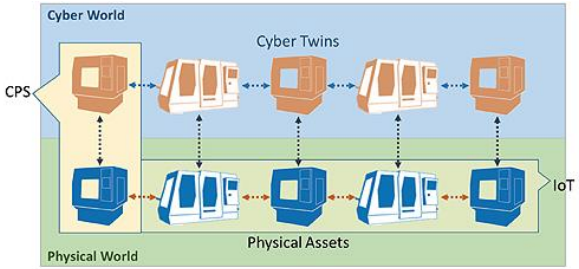




Embedded system

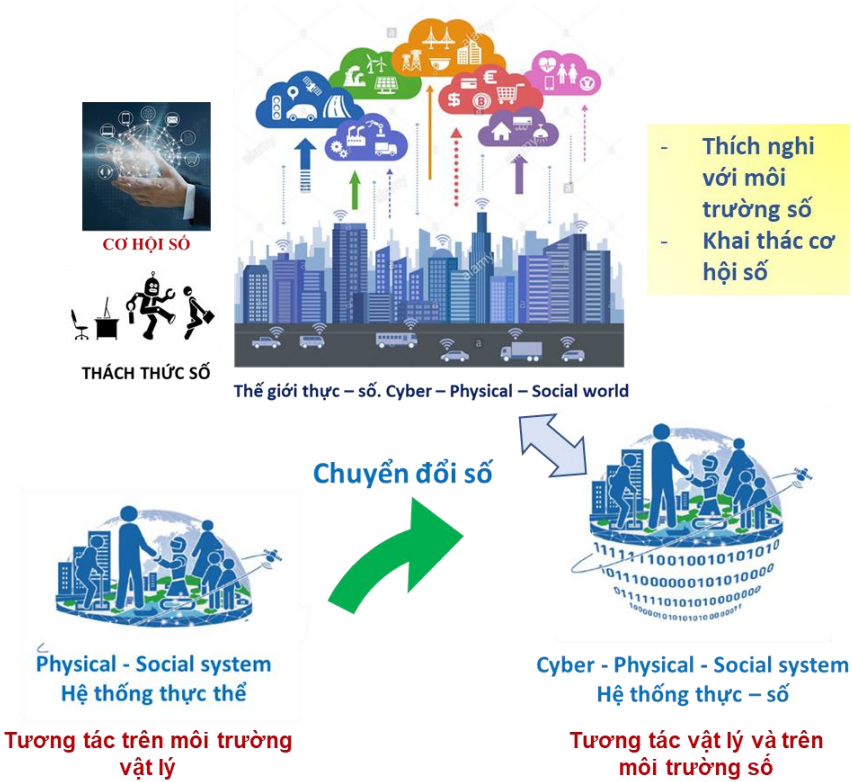


Cyber – Physical system



IoT – Internet of Things

What is DX?

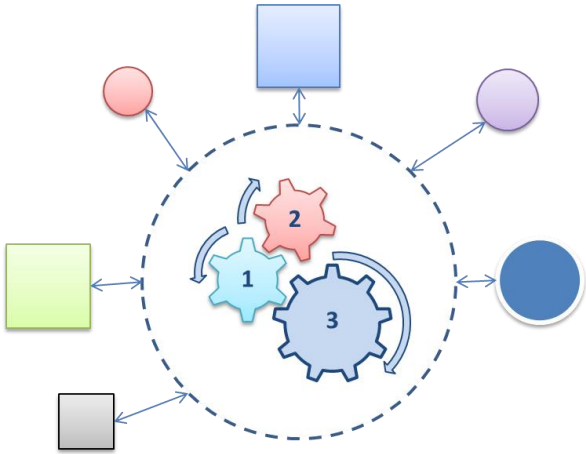


- Digital transformation is the process by which real systems change themselves to become smarter, more efficient real-digital systems where IT is no longer a tool but becomes an organic component of the system.
  - The world becomes a digital world
  - A country that becomes a digital country (smart one)
  - A province becomes a digital province
  - A city becomes a digital city (smart one)
  - A business becomes a digital business
  - A factory becomes a digital factory (smart one)
  - A farm becomes a digital farm (smart one)
  - All products and services are integrated with digital technology and connected to the Internet to become smart products and services

A college becomes a digital college

System approach method

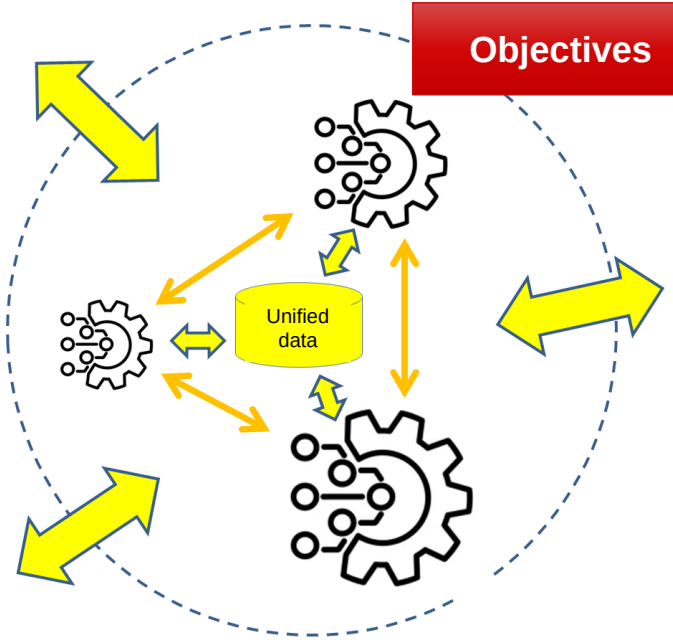
Current status



A system as a collection of components that interact with each other and interact with the outside as a whole. A system can be a subsystem of another system

DX

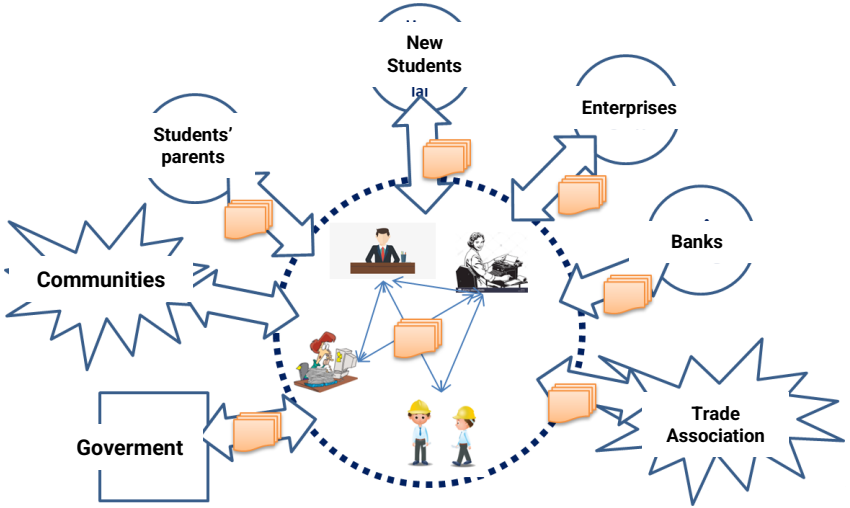
Objectives



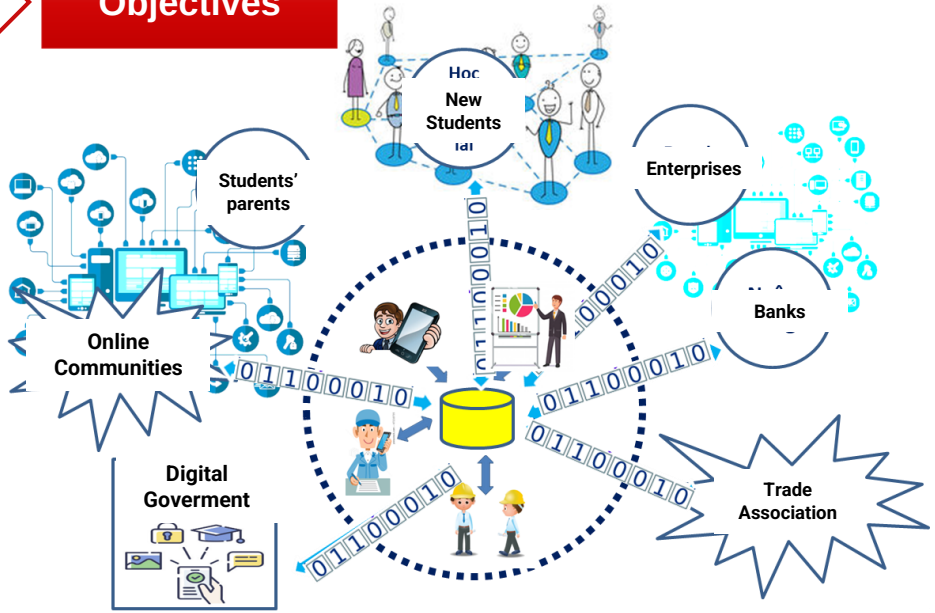
A cyber – physical - social system consisting of components that are also cyber – physical - social systems connected to each other and to digital data in a digital environment.

DX in TVET Institutions

Current Status → **DX** → **Objectives**

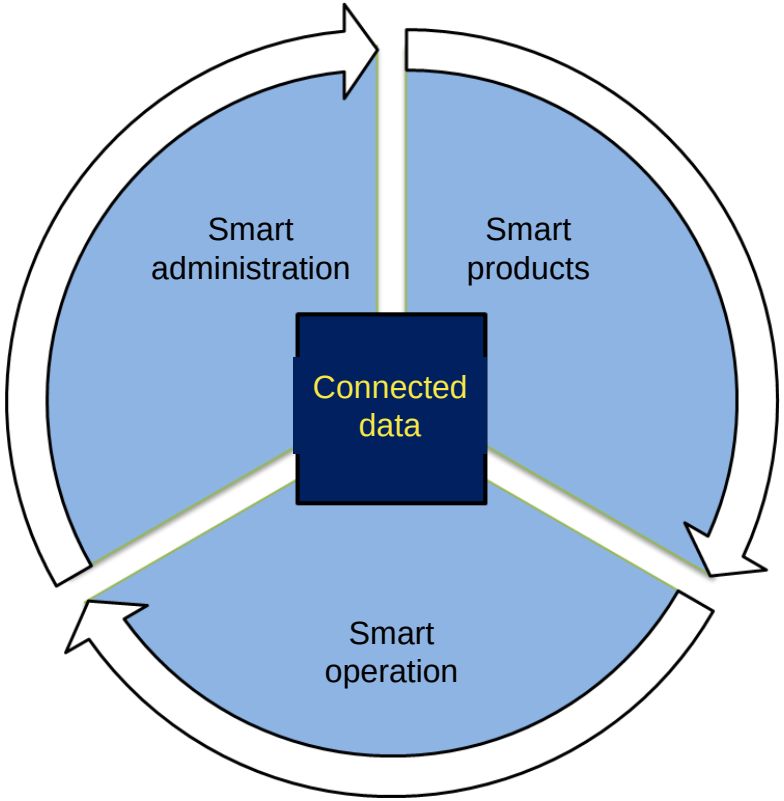


TVET College as a system with external and internal interactions



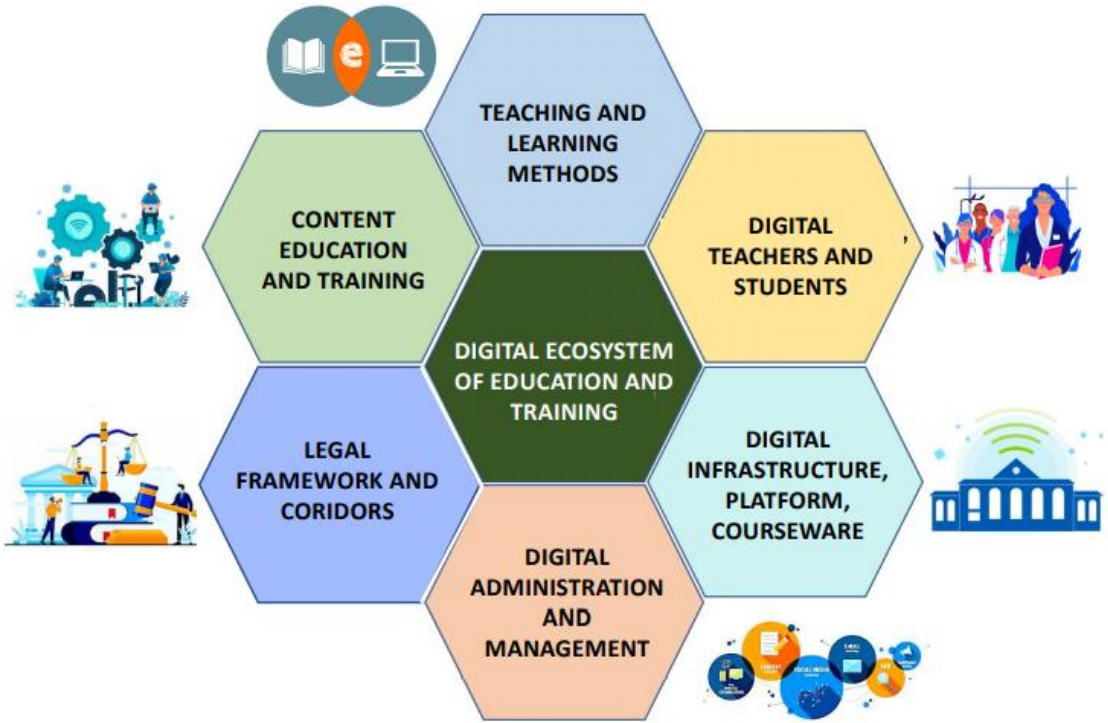
TVET College as a cyber – physical - social system with external and internal interactions implemented through digital connection

Data and Connection in Cyber Physical Social System



- Using a unified digital data infrastructure to personalize training to best meet students' learning needs
- Through digital connection to expand training and retraining space. Meeting the needs of learning anytime, anywhere, lifelong learning
- Connecting all teaching resources, operating the college in a continuously optimized process based on data
- Connecting businesses to the training process to expand training capacity and improve practice quality
- Using data and connectivity to smartly manage your college

Six components of DX in TVET sector and roles of ICT Architecture



- Digital infrastructure serves as the foundation for all components of the DX ecosystem for TVET institutes
- Digital infrastructure needs to be designed to fully meet the needs of training and college management
- The investment in building digital infrastructure needs to be synchronized with the DX process of the colleges and the DX of TVET in general.

Integration levels in ICT system

Smartening

Using data and connectivity to smarten products, optimize operations and administrate an enterprise smartly , transform business models to become digital enterprises

Cyber Physical Social System

Computerization

Connecting and automating business processes, complying with the enterprise data model and related technical regulations and standards. Accumulating data through activities. Integration of external digital platforms (e-payment, e-invoice ,etc.,)

Conne ction

Computer application

Digital Identifier, digital Locator, Digital Twin – Documents are turned into data. Building an enterprise data model. Obtaining external data sources to enrich the data warehouse

Data

3 levels of digital transformation at TVET college

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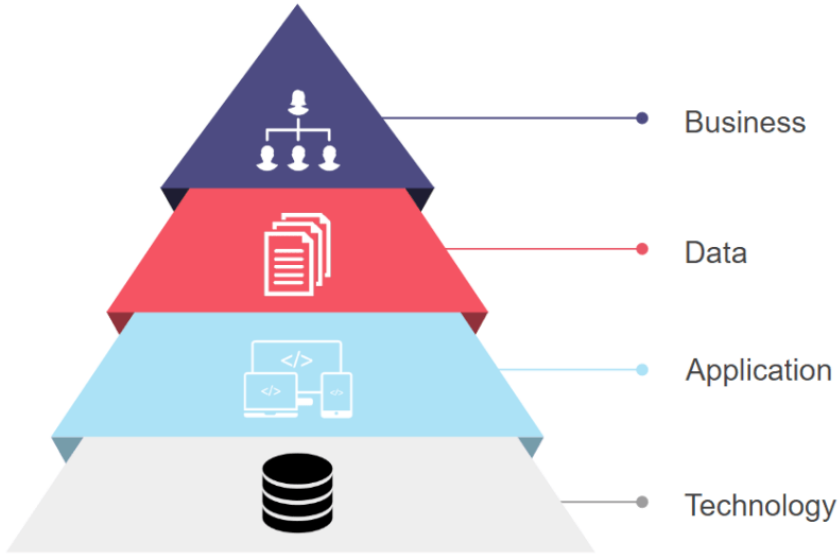
Layers of ICT architecture



- The business architecture reflects the training, operation and governance processes of a college. In digital transformation, the business architecture needs to be redesigned in synchronization with the application architecture and data architecture
- Application architecture implements business architecture, it needs to be able to adjust and be flexible according to the digital transformation process
- Data architecture needs to be consistent throughout the system. It is necessary to build a single data model, which can be used for all applications. Data security and safety needs to be at a high level
- Technology infrastructure needs to be oriented towards using cloud computing services

Architectural frame for a digital school application

Security system

collaboration platform

- Administration
- Remote meetings
- Messeges /Emails
- Online learning
- Virtual assistants Worksheets

application infrastructure

- System administration
- HR organization
- Student management
- learning management
- workload management
- resources management
- Data analysis report information

Data Infrastructure

- Unified data
- Learning resources repository
- Thư viện công việc
- Kho tri thức
- External data

Human resources and regulatory framework

Chiến lược dữ liệu

- Cần xây dựng và ban hành thiết kế tổng thể hệ thống CSDL cho tất cả các ứng dụng đã và sẽ triển khai, các quy chế quản lý dữ liệu và quy chuẩn kỹ thuật dưới dạng bảng danh mục dữ liệu (Data catalogue)
- Việc thu thập dữ liệu cần gắn liền với các ứng dụng tương ứng, tốt nhất là thông qua các bản sao số của các đối tượng
- Hệ thống định danh số cần được thiết kế để tuân thủ hệ thống định danh chung của ngành và các cơ quan chính phủ

Chuyển đổi số → **Digital Transformation**: Sử dụng dữ liệu và kết nối tạo ra dịch vụ mới, nâng cấp dịch vụ hiện có, tối ưu hóa hệ thống — **Hệ thống thực số**

Số hóa quy trình → **Digitalization**: Xây dựng nền tảng kết nối, nền tảng cộng tác. Tự động hóa các quy trình nghiệp vụ. Tích lũy dữ liệu ghi nhận trong quá trình vận hành — **Kết nối**

Số hóa thực thể → **Digitization**: Định danh số, bản sao số (Digital Twin) – Tài liệu chuyển thành dữ liệu. Xây dựng mô hình dữ liệu và hạ tầng dữ liệu, các quy chế và quy chuẩn quản lý dữ liệu — **Dữ liệu**

3 bước tích hợp dữ liệu và kết nối vào hệ thống

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ICT architecture investment principles

- ICT systems of TVET institutes are difficult to fully build in one project. Even a complete system needs significant expansion every few years
- To ensure consistency when investing in multiple steps, it is necessary to build:
  - ICT architecture model with foresight
  - Investment regulation system of ICT components
  - System of technical regulations to ensure data consistency and connection reliability
- When conducting investment projects on ICT systems, it is necessary to pay attention to the principles of DX:
  - Carrying out synchronous changes in human, institutional and technological factors
  - Investing in applications should cover the costs for implementation (training, technical support, institutional change)
  - Which module to invest in and put into operation and evaluate the effectiveness of that module
  - To avoid depending on a technology contractor
- Priority should be given to investment in human resources in charge of IT and teaching staff of the IT department to be able to master the operation of information systems.

Discussion