Robotics: State of Practice in Thailand

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Supply Chain in Automation and Robotics

Parts Manufacturers
- Robot Structure, metal and plastic parts
- Controller and actuators
- Sensors

Software Developers
- PLC
- Embedded Software
- Cognitive and monitoring modules

Integrators/Builders
Installing of robotics system and automation plant

Robots
- Service Robots

Industrial Robots

Automation

Repairs and Maintenance

30%-40%

20%
Current Situation of Automation and Robotics

Global Expenses of Automation and Robotics

<table>
<thead>
<tr>
<th>Year</th>
<th>Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>500 Billions $US</td>
</tr>
<tr>
<td></td>
<td>↑ 15% Per year</td>
</tr>
<tr>
<td>2020</td>
<td>1.4 Trillions $US</td>
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</table>

Asia
Relatively ranked at the Top: 40%

Thailand imports 200 Billions Baht/year

Global Expenses of Automation and Robotics

Big Players

Industrial Robots

- ABB
- YASKAWA
- FANUC Robotics
- KUKA

Service/Medical Robots

- dyson
- Robotnik
Import and Export: Automatic Parts/Machines

Import 266,000 MB annually
Continuously increases

Import Value of industry overview

Export 134,000 MB annually
Slightly increases

Export Value of industry overview: Simple Packaging Machines

The three highest demand
1) Conveyor system
2) CNCs, Robots, ASRS
3) High Precision Machines

Thailand is 132,000 MB deficit has balance of trade. When combining with plans of increasing industrial productivity, the figure becomes 200,000 MB annually.
“Industry 1.0 was the invention of mechanical help,

Industry 2.0 was mass production, pioneered by Henry Ford,

Industry 3.0 brought electronics and control systems to the shop floor Industry

4.0 is peer-to-peer communication between products, systems and machines.” IoT, BigData and Cloud => Smart Manufacturing

Stefan Ferber, Director for business development of the IoT at Bosch Software Innovations
Smart Manufacturing

The Connected Factory in Action

**Innovation**
- **Tap Commercial Innovation**
  - Mobilize employees and supervisors to move across the factory floor and access data wherever they are. The iPad and other like devices are making their way into industrial settings — along with an expectation that much of the commercial innovation it brings will also apply to industrial activities.
- **Connect Engineers with Machines (M2M)**
  - Apply predictive maintenance. Gain early warnings when production, machinery or network performance is about to degrade.

**Agility**
- **Connect & Collaborate Externally**
  - Extend visibility beyond your four walls. Link the extended supply chain and distribution to create dynamic workflows. Help and expertise are available in an instant.
- **Expandable Infrastructure**
  - Design and build an Industrial Ethernet infrastructure to minimize cost and effort to expand or improve processes. One infrastructure for safety, control, SCADA, physical security, and LAN.

**Efficiency**
- **Link Information & Operational Technology**
  - Bridge the gap from data center to control room to collaborate and share best practices and common goals between manufacturing and IT.
- **Optimize Assets**
  - Identify where your people, equipment, work in process and finished goods are in real-time. Adjust the schedule and inventory on the fly.

**Risk**
- **Secure Physical & Cyber Assets**
  - Traditional security devices, like keypad entry systems, call boxes and security cameras, need power from Industrial Ethernet cables, with secure networks, to protect your processes, people, and plans from cyber sabotage.
- **Maximize Uptime**
  - Design rugged industrial networking infrastructure that will endure in harsh environments with redundant communications, power and configuration backup — especially for business processes under extreme conditions.

Source: Belden
Smart Manufacturing

- Factory visibility
- Automation
- Energy management
- Proactive maintenance
- Real-time optimization of manufacturing production and supply chain networks
- Rapid manufacturing of new products
- Dynamic response to product demands
Smart Manufacturing

- Equipment connectivity
- Data collection
- Information management and visualization
- Analysis and Algorithm development
- Complex event processing
Thailand 4.0
- Value-based Economy
- Restructuring economy: From Manufacturing To Value added with advanced manufacturing

EEC
- Development of Eastern Economic Corridor (i.e. Chonburi, Rayong, Chacherngsao). Preparation for investment.
- Robotics & Automation Industry is a target that will be promoted in this region.
Thai Economy 4.0: Transforming towards Value-Based Economy

More for Less → Less for More

Industries → Technology

Commodities → Innovation

New economic paradigm where commercialization of innovative ideas lead to new startups & new industries, and, hence value-based economy

Cr: H.E Suvit Masinsee
Marginal usage of robotics and automation in manufacturing industry in Thailand. There is a high opportunity (85%) to transform operations. 85% of industry have an opportunity to adopt robot & automation to improve process (Group 1,2,3). Group 4,5 are the target levels.

Source: from the survey on 94 entrepreneurs, Strategy for improving competency of Thai industry with manufacturing automation system (2015)
Status of manufacturing industries in Thailand

50% of industry in Thailand is ready to adapt their manufacturing process to use robotics/automation within 1-3 years

- Majority of **Large** companies are ready to change in 1-3 years.
- Majority of **Medium** companies are ready to change in 3-5 years.
- Majority of **Small** companies are ready to change in later than 5 years.

Source - from the survey on 94 entrepreneurs, Strategy for improving competency of Thai industry with manufacturing automation system (2015)
Limitation in Competitiveness of Robotics and Automation Industry in Thailand

Majority of manufacturing industry & service business import technology from overseas

Import

Buy from local

Limitation in Competitiveness of Robotics and Automation Industry in Thailand

- Reliability
- Technology
- Cost

- Majority of manufacturing industry & service business import technology from overseas
1) Demand Driven (Incentive)
Create the demand of using robots and automation (50% DTD)

2) Enhance Competitiveness
- Reduce cost of local manufactureres
- Import tax restructuring: reduce import tax of spare parts to the same level as products (0%)

3) Technology Capability Enhancement Center of Excellence (CORE)
Technology transfer mechanism 1. Certify technology 2. HR Development 3. Consultant/ Technology Transfer 4 Industrial prototypes

Outcome
- Industry in Thailand increase productivity
- Local robot manufacturers are able to be a technology owners and brand owners
- Local investment resulting in business expansion
A. Manufacturing Industry / Service Business

1. Need automation
2. Buy parts
3. Design / Build / System Integrate
4. System installation

S1 Database SI / Suppliers / Innovation List / Invention / DOPA / TGI / NSTDA
I1 50% DTD if invested automation
I1 Deduct expense 200% Training
I1 Credit line for buying automation

S2 Consultant and Knowledge TGI / FIBO / Academic institutes
I5 Matching Fund
I6 Soft Loan

S3 Industrial Prototyping TGI / NSTDA / FIBO / Academic institutes
I7 Reduce Tax for spare parts
I8 Deduct 200% Training expense Tax for spare parts
I9 8 years Tax exemption / 5 years Tax 50% reduction

B. System Integrators (SI) in robotics & automation

I1 Fund / Project supported by government

C. Automation Machinery / Service

S4 TISI Certification

D. Component / Software Supplier

E. FDI / JV

2. Buy parts
3. Design / Build / System Integrate

I9 8 years Tax exemption / 5 years Tax 50% reduction
**Committee review proposal for approval**: set the regulation for tax incentive eligibility.

**Certify Body**: review proposal according to the regulation.

**Note**: Post Audit and penalty in case that the company is informed later than 1 month.
Measure of Mobility of Robotics Cluster - Urgency

CoE Functions

- Certification Technology
- Knowledge Transfer
- Industrial Prototype
- HRD

Organization
- FIBO
- Chulalongkorn Univ.
- Mahidol Univ.
- KMUTNB
- KMITL
- Chiangmai univ
- Khonkan Univ
- TGI
- EEI
WHA-Hemaraj: Robotics and Aerospace Clusters assigned by EEC

Agenda November 23
Pattana Golf Court

8:30-9:00 Registration (300 CEOs of industries in WHA-Hemaraj IEs)
9:00-9:10 Opening Remark By WHA Group CEO, Khun Jareeporn Jarukornsakul
9:15-9:25 Video Presentation with English Subtitle
9:30-9:50 Cluster Robotics and Automation-RA: How important it is towards EEC development? by H.E Uttama Savanayana, Ministry of Industry
10:00-10:30 BOI Incentive Package towards Investment and Implementation of RA, by BOI Secretary General
10:30-10:45 Coffee Break
10:50-11:15 Additional Support-Ecosystem in EEC, by EEC Secretary General
11:20-12:00 Panel Discussion: How to proceed. Representatives from CoREs (Centers of Robotics Excellence) and Office of Industrial Economics
Moderator: Director of Thai-German Institute
12:00-13:00 Lunch
Drafted by Djitt Laowattana
SCG

Pilot Project: Automatic Warehouse (AS/RS) Project

AS/RS System to improve storage efficiency (utilization and accuracy) and safety

Total Investment 179 MB
Local Content 135 MB
Supplier Automation Works (บริษัทไทย)

Pilot Project: Automatic Warehouse (AS/RS) Project
SCG
AS/RS System to improve storage efficiency (utilization and accuracy) and safety

Increase Warehouse Space from AS/RS
Reduce Warehouse Rental Expenses
Less Manpower

Total Savings 10.8 MB per Year

<table>
<thead>
<tr>
<th>Item</th>
<th>Investment (MB)</th>
<th>Supplier</th>
<th>% Local Content</th>
<th>Local Content (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS/RS (9,000 Location)</td>
<td>115</td>
<td>Thai &amp; Import</td>
<td>62%</td>
<td>71</td>
</tr>
<tr>
<td>Civil and Construction</td>
<td>32</td>
<td>Thai</td>
<td>100%</td>
<td>32</td>
</tr>
<tr>
<td>Fire Protection System</td>
<td>25</td>
<td>Thai</td>
<td>100%</td>
<td>25</td>
</tr>
<tr>
<td>Warehouse Rental &amp; Transportation</td>
<td>7</td>
<td>Thai</td>
<td>100%</td>
<td>7</td>
</tr>
<tr>
<td>(6 Months, while WH Construction)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>179</td>
<td></td>
<td>75%</td>
<td>135</td>
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Future Plans:

1) SCG’s potential automation and robotics projects of 6,000 MB
2) Set up a System Integrator (SI) company

Government’s 4x support to make the project feasible (Payback period from 10 to 5 years)
**Supreme Products**  และกลุ่มบริษัทในเครือ

**OUR PLAN**
- พัฒนาการผลิต รถยาบาลและระบบด้านการแพทย์ โดยการใช้ Automation

- ผลิตหุ่นยนต์ทางการแพทย์ ติดตั้งในโรงพยาบาล เพื่อช่วยบริการเครื่อง Pharmacy Robot
  - Medical Robot เช่น AMBOT, ERBOT, ICUBOT
  - Medical Logistic system and Robot for intra and inter hospitals

- เพื่อให้โรงพยาบาลนำไปใช้ในการพัฒนาระบบการให้บริการ ยกระดับการแข่งขันเพิ่มประสิทธิภาพและลดค่าทุนโดยใช้ Digital และ Robot การออกแบบระบบด้านการแพทย์เพื่อสามารถแข่งขันกับต่างประเทศได้

**ระบบการลงทุน**

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB</td>
<td>1000</td>
<td>2000</td>
<td>3000</td>
<td>3000</td>
<td>3000</td>
</tr>
</tbody>
</table>

Local Content Developer [60%] - Melon Technology (Startup): Robot + Automation Dev.
- Premium Robotics (Startup): Robot + Automation Dev.
- Rung Dee Tools & Die: Mechanical and Electrical Dev.
Food Production at CPF

Throughput 9,000 Units/hr

Investment 944 MB
Workforce Replacement 1,050 Persons/day

NPV -232 MB
IRR 8.2 %
Payback 6 Years

IRR 15.3 %
Payback 4 Years

อุดหนุน 30 % (283 ล้านบาท)
PTT

REMOTELEY OPERATING VEHICLE (ROV)
Development for Gas Pipeline Operation & Maintenance

Project Prospectus

- Cost saving for PTT’s platforms & pipeline maintenance
- Cost saving expected to be 70 MB with 1 ROV are expected to be invested.
- Future Opportunity: Service provider for Offshore Asset Inspection & Monitoring in GoT and SEA regions

2016-2017
R&D

2018-2019
Replace the outsources service within PTT’s own assets
- Investment: 1 ROV with full system
- Expected service: 2 Platforms
- Expected benefit: Cost Saving 70 MB

2020 onward
Provide service for other Platforms in GoT and SEA
- Services in GOT
  - Investment: 2-3 ROVs
  - Market: PTT’s Group platform and customers in Gulf of Thailand
  - Expected revenue: 525 MB
- Services in SEA
  - Investment: 5-7 ROVs
  - Market: Platform and Pipeline in SEA
  - Expected revenue: 2,625 MB
Robotics
What is it?
Aspects of Robotics

Robotic Technologies:

“Disciplines” Computers, DC-motors, Cameras, AI techniques, programming etc.

Robotic Capabilities:

“R&D” Jamming and Wedging avoidance, Dynamic control of redundant manipulators

Robotic Systems:

“Automated devices” FMS & FMC, Snake endoscope, Spatial Remote Center of Compliance(SRCC)
Conceptual flow of robot activities.

The real world

Cognition

Strategies

Tactics

Control Signals

Actuator

Time

Geometry

Semantics

Sensor Signals

Sensor

Symbolic Description

Semantic interpretation

Perception

Manipulation

Geometry

Semantics

Strategies
Artificial intelligence is about replacing human decision making with more sophisticated technologies.

--FALGUNI DESAI

Figure 1-1: The many names of artificial intelligence.
FIBO Industrial Robotics

- HDD Automatic fabrication and assembly systems [HARDDISK DRIVE INDUSTRY]
- Automatic System for Part Assembly [AUTOMOTIVE INDUSTRY]
- Auto Rubber Loading Machine: ARM [RUBBER INDUSTRY]
- AGV Mobile Platform [AUTOMOTIVE INDUSTRY]
- Crop Collector system [RUBBER INDUSTRY]
- Automatic Foam pipe Cutting Machine [RUBBER INDUSTRY]
- Automatic Meat Cutting [FOOD INDUSTRY]
- Palletizer and Automatic packing systems [FOOD INDUSTRY]
How to improve operations?

- Automated scanning of tagged products
- Automated inventory management with connected shelves
- Automated pick & pack
- Real-time goods tracking
- Real-time tracking of trucks
- Real-time goods tracking
- Collaborative forecast
- Automated vending
- In-bound logistics
- Warehousing
- Out-bound logistics
- Sales / Customer Service
- Real-time tracking of arrival time
- Automated replenishment
- Predictive maintenance of equipment
- Optimized routes
- Transport forecast & optimized routes (traffic, weather)
- Monitoring of driving conditions (speed, safety, driver)
- Monitoring of product conditions (vibration)
- Real-time updates on goods movements & estimated delivery time
FIBO Medical Robotics

Sensible Tab

Variable damper knee prostheses

Force feedback Exoskeleton Hand

TailGate
Field Robotics

UAV

Long-Range Remotely Controlled Boat for 3D Waterway Mapping

Display robot status, sensor data, and GPS location

RF Transceiver

Laptop

Extension Monitor

Operator

Boat Robot

Tele-operated Survey Boat for Cannel 3D Mapping

Tiny Rose MK-II

UAV

ROV

Platform/Jacket

Water line

Clump weight

Clump weight

Platform/Jacket

ROV

UAV

Tiny Rose MK-II

UAV

Tiny Rose MK-II

UAV

Tiny Rose MK-II
FIBO Field Robotics

Vertical Transportation System for Dust Collector on High Tower

Remote Control System for Water Gate

In-pipe Inspection Robot

Demining Robot
Sudsoi 911 Robot

A Cradle of Future Leaders in Robotics
In-Pipe Robot
FIBO Educational Robotics
FIBOLUTION: A Cradle of Future Leaders in Robotics

UPCOMING

2015 - 2024

1995 - 2014
At FIBO, we do not design problems. Problems design FIBO.

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Email : djitt@eeico.or.th  www.eecthailand.or.th
Primary Mechanism for Development of Robotics and Automation Industry

Automation Buyers
1. Demand Stimulation Creating Robotics and Automation demand
2. Supply Driven Reducing business cost and enhancing competitiveness of local manufactures

Automation Service Provider
(System Integrator: Si)
1. Demand Stimulation Creating Robotics and Automation demand
2. Supply Driven Reducing business cost and enhancing competitiveness of local manufactures

Center of Robotic Excellence (CoRE)
1. Human Resource Development and Enhancing technology

Development Targets

Short-term (1 year)
Stimulating domestic robotics market:
- Investment in Robotics and Automation: 12,000 mb.
- Productivity increasing 50%

Medium-term (5 years)
Enhancing production technology to produce high value added and complicated robots:
- Expecting investment up to 200,000 mb.
- Using robots in factories > 50%
- Import substitution 30%
- Building up Si from 200 to 1,400 within 5 years

Long-term (10 years)
Thailand becomes the leader of using and manufacturing R&A in ASEAN:
- To be ASEAN leader
- To be technology owners
- Become exporter of robotics & automation

Measures

Demand stimulation
1. BOI: deducts 50% corporate income tax for using R&A to improve their productivity.
2. Ministry of Finance: exempts 100% corporate income tax on expenses of R&A research and development.
4. Ministry of Industry: encourages SMEs using R&A to improve their efficiency through SME development funds and other funds.

Supply driven
1. BOI: Promotes System integrator (Si) and offers maximum investment benefits.

Human resource development and enhancing technology by setting up Center of Robotic Excellence (CoRE)
- Leading universities/agencies including:
  1. TGI
  2. EE
  3. R&D
  4. CHULALONGKORN UNIVERSITY
  5. MAHIDOL UNIVERSITY
  6. KMITL
  7. KHON KAEN UNIVERSITY
  8. CHIANG MAI UNIVERSITY

Missions and Targets
1. Industrial Prototype
2. CERTIFY SI
3. HRO
4. Technology transfer