Image: dailymotion

CONTRIBUTIONS OF MUSLIM SCIENTISTS TO THE 4TH INDUSTRIAL REVOLUTION

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I

THE 4TH INDUSTRIAL REVOLUTION AND THE ENABLING TECHNOLOGIES

WHAT IS INDUSTRY 4.0?

(Ovtcharova & Wicaksono 2017)

ENABLING DISCIPLINE FOR INDUSTRY 4.0

[Adapted from ABB 2016]

INDUSTRY 4.0 ENABLING TECHNOLOGIES

**Advanced and
Multimodal
Human Computer
Interaction**

Intelligence

**Infrastructure and
Interconnection**

(Wicaksono 2018)

THE HISTORY OF ARTIFICIAL INTELLIGENCE

Algorithm

Turing Test

First chat bot

Deep Blue

AlphaGo

8th Century

1763

1950

1955

1964

1966

1997

2011

2017

Bayesian inference

Founder of
the term AI

AI winter

Many unsuccessful project, no funding
Lack of awareness of interdisciplinary
R&D

Siri

II

THE CONTRIBUTIONS OF THE ISLAMIC GOLDEN AGE TO THE ENABLING TECHNOLOGIES

THE PIONEERS OF MECHANICS AND CONTROL ENGINEERING

- Jafar Muhammad, Ahmad, and al-Hasan bin Musa bin Shakir (803 – early 900s) from Khorasan
- كتاب الحيل (*The Book of Ingenious Devices*): 100 devices and how to use them. It was based partly on the work of Heron of Alexandria, Philon of Byzantium, ancient Persian, Chinese and Indian engineering
- Examples:
 - Self trimming lamp
 - Valves
 - Self playing flutes
 - Automatic crank
 - Clamshell grab

Image: Science and Faith

Image: Ummahsoniv

THE PIONEER OF ROBOTICS AND AUTOMATION

- Ismail al Jazari (1136–1206 M) from Diyarbakir, now Turkey
- Some of his works
 - Castle water clock (1), inspired by Archimedes and Banu Musa
 - Elephant clock (2), featuring elephant and dragon, gratitude to Indian and Chinese engineering
 - Musical robot band (3), the early programmable automata
 - Peacock fountain with automated servants (4), automation motivated by Islamic rituals (wudu and ghusl)

Source: Muslimheritage.com

THE PIONEER OF COMPUTER SCIENCE AND MATHEMATICS

- Muḥammad bin Mūsā al-Khwārizmī (c. 780 – c. 850) from Khiza, now Uzbekistan
- كتاب المختصر في حساب الجبر والمقابلة (*The Compendious Book on Calculation by Completion and Balancing*): solving daily activity problems (inheritance, trade, etc.) systematically by modelling/breaking-down into linear and/or quadratic equations
- Systematic problem solving $\Rightarrow$ al-Khawarizmi $\Rightarrow$ algoritmi $\Rightarrow$ algorithm
- Alan Turing: machines can follow algorithmic instruction to solve complex (mathematical) problems
- Other works
 - Introduction of Indian numerical system
 - Zīj al-Sindhind: calendrical, astronomical, and astrological calculations
 - Trigonometry: tables of sin, cos, tan

Image: <https://www.citizenonline.org.uk/>

Image: Algorithm is everywhere

Image: Esposito 1999

„Algorithm is everywhere in Industry 4.0“

THE DEVELOPMENT OF SCIENCES AND TECHNOLOGIES IS AN INTERCULTURAL HISTORY

Ancient Greece

Ancient India

Ancient China

Astronomy,
Mathematics

Mathematics,
Medicine,
Architecture,
Engineering

Pottery,
Art,
Applied Technologies

Islamic Golden Age

Astronomy, Mathematics,
Physics, Medicine, Engineering, Agriculture,
Textile, Art, Writing, Music, Economics (coin)

Rennaisance Europe

III

IMPLICATIONS OF INDUSTRY 4.0 TECHNOLOGIES

IMPLICATIONS ON BUSINESS MODELS

Largest
retailer

amazon

Largest
taxi company

UBER

Largest
movie
provider

NETFLIX

Largest
accommodation
provider

airbnb

Largest
information
provider

IMPLICATIONS ON BUSINESS MODEL: DATA DRIVEN SERVICE

Airplane engines +
real time monitoring,
predictive maintenance,
optimization service

Farming machines +
Farm monitoring, social media
<https://myjohndeere.deere.com>

Sport shirts +
Health monitoring, early
warning system

Product-Service Business Model: **Physical product (local)** + **digital service (global)**

IMPLICATIONS ON ENTREPRENEURSHIPS

IMPLICATIONS ON LEADERSHIPS

Leadership 1.0

Charismatic

Leadership 2.0

Directive

Leadership 3.0

Relational

Leadership 4.0

Swarm

- Unity of Mission
- Leader provides the instruments
- No Ego, No Blame
- Generosity of Spirit and Action
- A Foundation of Trust-based Relationships

Source: Harvard University

IMPLICATIONS ON EDUCATION

Technical education

- No interdisciplinarity, no innovation
- Adaptability to rapid changes and life long learning
- IT skills are the key to survive.

Entrepreneurship

- Collaboration in the „global village“
- Taking risks and dealing with uncertainty
- Responsible creativity

Adaptive learning

- Individualization
- Multi access
- Flexible curriculum and recognition of credits from **various education providers**

IMPLICATION ON LEARNING

Coventional learning

Modern learning

(Wicaksono 2018)

IV

CONTRIBUTIONS OF CURRENT EUROPEAN MUSLIM SCIENTISTS AND COMMUNITIES

MUSLIM SCIENTISTS COMMUNITY

PROFESSIONAL AND ENTREPRENEUR COMMUNITY

Zahnräder Netzwerk

International, interorganization,
interdisciplinary discussion

Science and technologies

informal talks

Global PCINU discussion

German-Indonesian dialogues

Santri visits

World muslima summit

CHALLENGES FACED BY MUSLIM COMMUNITY IN GERMANY/EUROPE IN SCIENCE AND TECHNOLOGIES

- Too strong homeland roots, lack of common vision
- Struggling with the integration into the society $\Rightarrow$ integration paradox
- Dragged into political issues from their homeland
- Lack of both religious and professional quality

Image: Tagesspiegel

Image: Tagesspiegel

Image: RT deutsch

THE ROLES OF MUSLIM DIASPORA

What we have

Multi and transdisciplinary
backgrounds

International experiences

Multiple perspectives

Broad network

Approach

CENTER

Deutschland

Goals

Rahmatan lil-alamin

رَحْمَةً لِّلْعَالَمِينَ

Knowledge Transfer

TAKEAWAYS

1. Learning **beyond time, space** and **ideology boundaries**
2. **Interdisciplinary works** in science and technologies
3. **Swarm learderships**: find common visions, environment/social awareness, team work, no ego, tolerance
4. Muslims in Middle East struggle with politics/conflicts, in Europe with inequality. **Indonesia** has the great potential to host „**The Next Islamic Golden Age**“
5. **Problems, challenges, and phenomena in our universe are „Ayat“ from Allah, mastering sciences and technologies are the effort to understand them and extract the „Hikma“ from them**

Image: deutschlandfunk.de

Image: East Java Trans

THANK YOU

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