Skilled workers' skill structure model in the Industry 4.0 era

——Based on the literature over the past 7 years

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Keywords

- Industry 4.0
- skilled workers
- skill structure model

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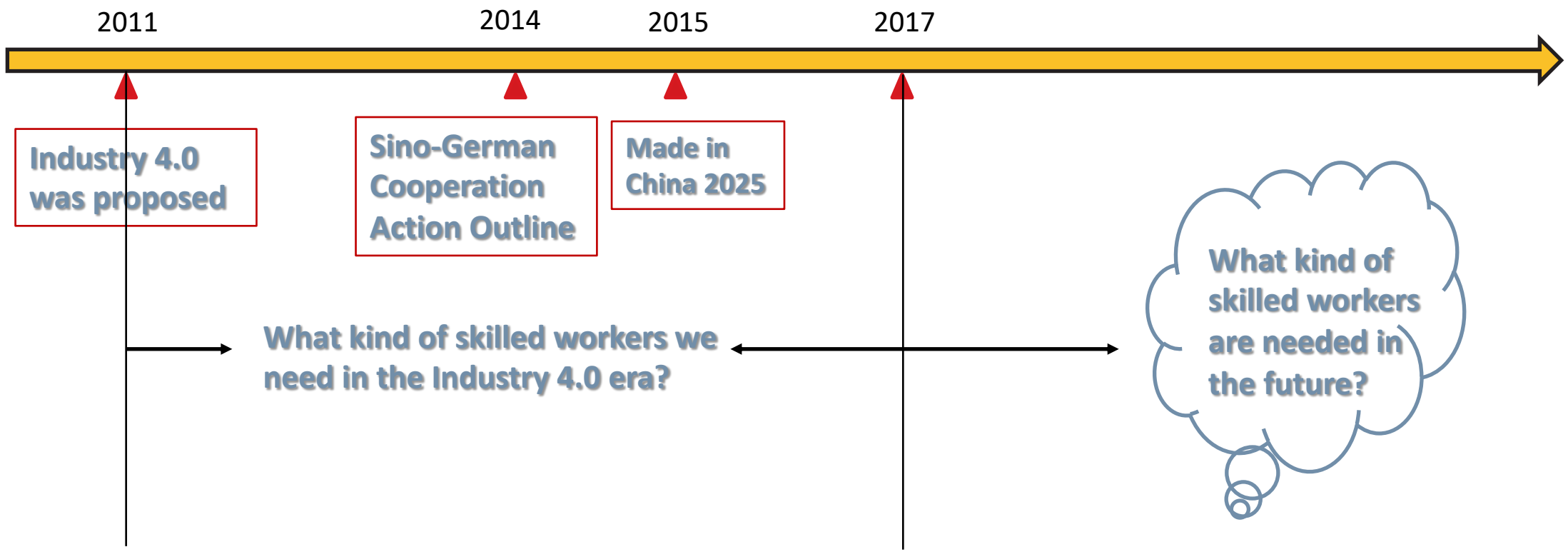
TONGJI UNIVERSITY

Content

I. Background of the age: Industry 4.0



II. Literature

– cnki.net:

“Industry 4.0 Skills" and "Intelligent Manufacturing Skills" were searched 30

– Web of Science:

“industry 4.0 skill” and “intelligent manufacturing skill” 112

– Related report:

World Economic Forum 2016: The Future of Jobs

McKinsey 2015: Industry 4.0 How to navigate digitization of the manufacturing sector.

III. Influence of Industry 4.0 on skilled workers:

– Working Conditions:

Networking、Intelligence、Information

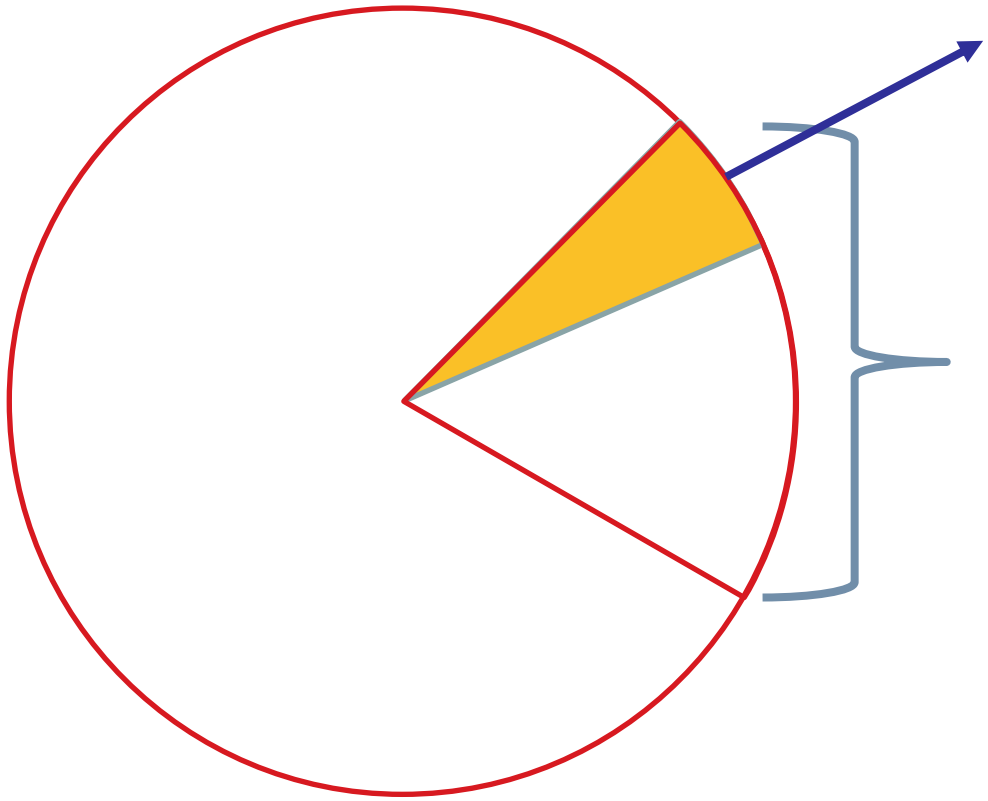
– Skills:

Shorten the shelf life of employees' existing skills

– Demand for skilled workers in the labour market:

There is a structural contradiction between recruitment needs and talent supply levels

structural contradiction :



High-skill talents:45

millions and 10 thousands

Skilled workers:165

millions

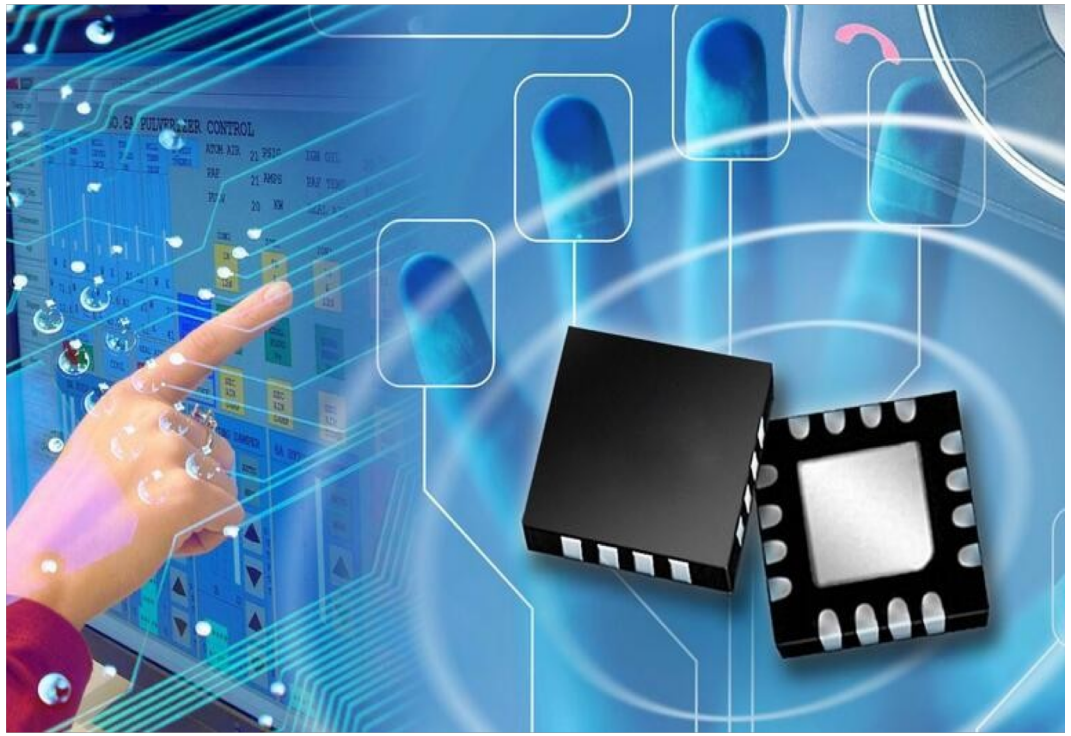
21%

Total employment

By 2015

◆ Ministry of Human Resources and Social Security: Notice on the publication of a new occupation:

1. Artificial Intelligence Engineering Technician
2. Internet of Things Engineering Technician
3. Big Data Engineering Technician
4. Cloud Computing Engineering Technician
5. Building Information Model Technician
6. E-sports Operator
7. E-sportsman



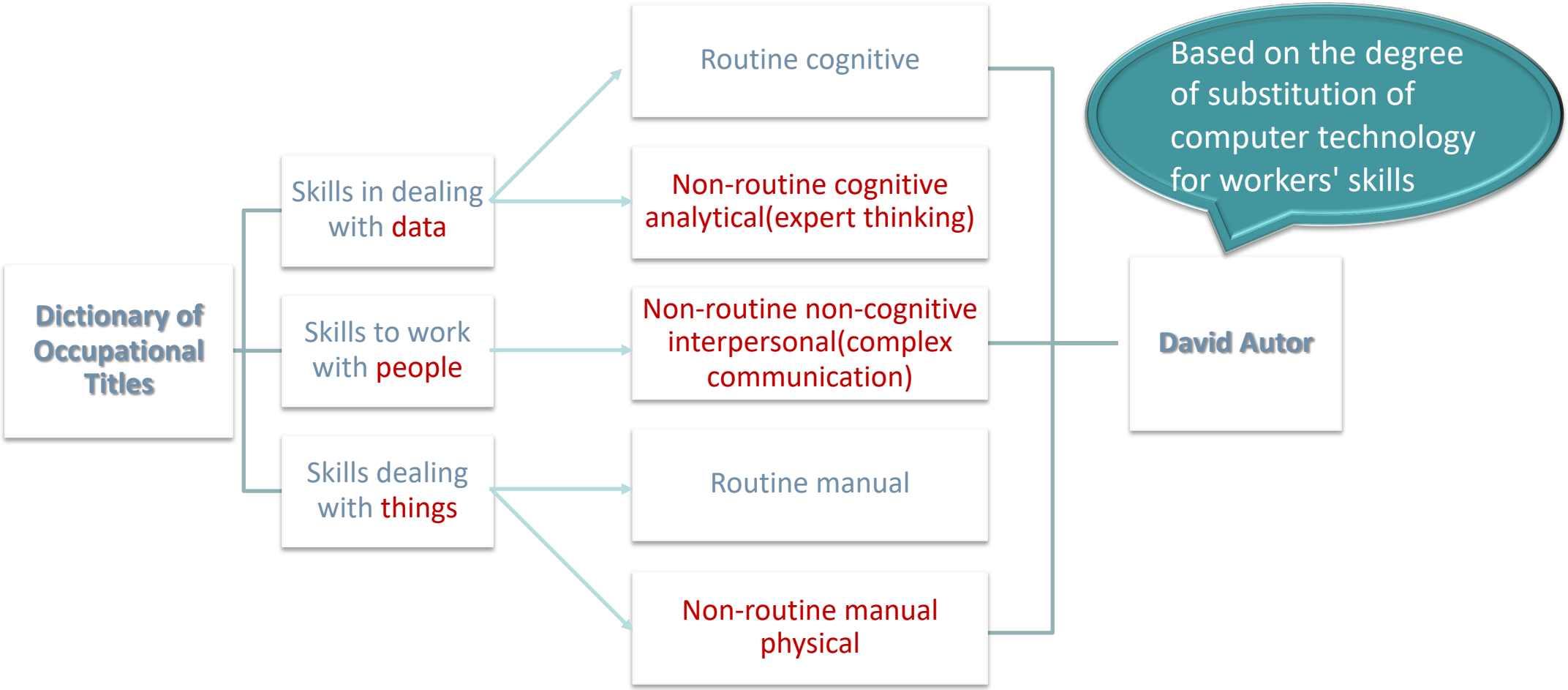
By 2019

◆ Ministry of Human and Social Affairs: Notice on the publication of a new occupation:

8. Drone Driver
9. Digital Manager
10. Agricultural Manager
11. Industrial Robot System Operator
12. Industrial Robot System Operator
13. Internet of Things Installation and Commissioner
14. Urban Rail Transit Line
15. Urban Rail Transit Train Overhaul

By 2019

IV. Skills of concern:



1. Non-routine cognitive analytical(expert thinking):

■ Refers to the skills of performing mental work without specific rules

[1] Zhang Hongliang. ***Changes in the Structure Demand of Skilled Talents in the Industry 4.0 Era and the Strategies of Vocational Education Adjustment.***

[2] Shi Huili. ***Technical Skills Talents in the Industry 4.0 Era: Connotation, Ability and Cultivation .***

[3] Wen Yifang, Jiang Jianchun. ***Corporate Perspective: The New Demand and Cultivation of Professional Professionals in Higher Vocational Education under the Background of Industry 4.0 .***

[4] Zhou Jing. ***Analysis on the Demand and Training Path of Technical Skills Talents under the Background of Industry 4.0.***

[5] Weng Weibin. ***On the Teaching Reform of Higher Vocational Education in the Age of Industry 4.0.***

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Innovation learning ability

1. Non-routine cognitive analytical(expert thinking):

■ Innovation

Ability to propose special or ingenious ideas about a particular topic or situation, or to develop creative ways to solve problems.

■ Learning ability

Ability to understand the impact of new information on current and future problem solving and decision making.

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1. Non-routine cognitive analytical(expert thinking):

- **Refers to the skills of performing mental work without specific rules**

[1] Andrea Benešová,Jiří Tupa. ***Requirements for Education and Qualification of People in Industry 4.0 .***

[2]World Economic Forum 2016: ***The Future of Jobs***

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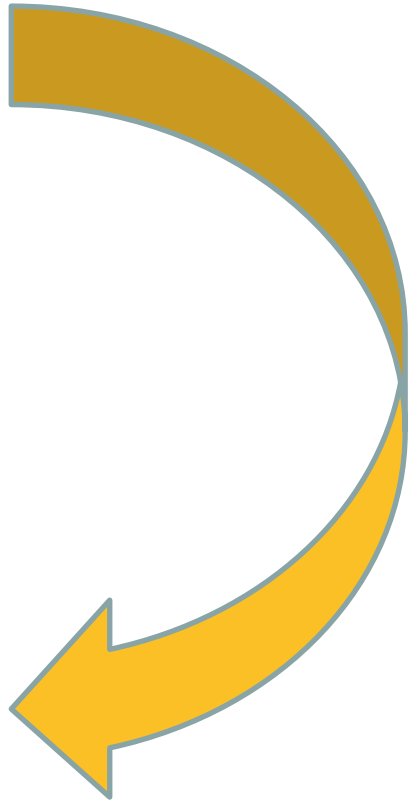

logic

1. Non-routine cognitive analytical(expert thinking):

Logic

This means to organize information to form general rules or conclusion (including finding relationships between seemingly unrelated events) and ability to apply general rules to specific questions to produce meaningful answers.

logic

1. Non-routine cognitive analytical(expert thinking):

■ Refers to the skills of performing mental work without specific rules

[1]World Economic Forum 2016: ***The Future of Jobs***

[2] McKinsey 2015: ***Industry 4.0 How to navigate digitization of the manufacturing sector.***

[3] Zhao Wenping. ***The Characteristics of Enterprise Employees' Quality Demand in the Age of Industry 4.0 and Its Enlightenment to Vocational Education.***

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Digital capability

1. Non-routine cognitive analytical(expert thinking):

■ Digital capability

Using digital technologies 、 communication tools and networks to capture, manage, integrate , evaluate and create information.

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2. Non-routine non-cognitive interpersonal (complex communication):

- **Skills that interact with people to obtain information, interpret information, or persuade others to influence their behavior**

[1] Wen Yifang, Jiang Jianchun. ***Corporate Perspective: The New Demand and Cultivation of Professional Professionals in Higher Vocational Education under the Background of Industry 4.0 .***

[2] Weng Weibin. ***On the Teaching Reform of Higher Vocational Education in the Age of Industry 4.0.***

[3] Cai Zezhen. ***Coping with Industry 4.0 Strengthening the Innovation of Industry-Teaching Integration Mechanism.***

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Cooperate with others

2. Non-routine non-cognitive interpersonal (complex communication):

- **Skills that interact with people to obtain information, interpret information, or persuade others to influence their behavior**

[1] World Economic Forum 2016: ***The Future of Jobs***

[2] Hecklau F., Galeitzke M., Flachs S., Kohl H. ***Holistic Approach for Human Resource Management in Industry 4.0.***

[3] McKinsey 2015: ***Industry 4.0 How to navigate digitization of the manufacturing sector.***

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Emotional intelligence

Persuasion

Service oriented

2. Non-routine non-cognitive interpersonal (complex communication):

- **Skills that interact with people to obtain information, interpret information, or persuade others to influence their behavior**

[1] World Economic Forum 2016: ***The Future of Jobs***

[2] Hecklau F., Galeitzke M., Flachs S., Kohl H. ***Holistic Approach for Human Resource Management in Industry 4.0.***

[3] Selim Erol, Andreas Jäger, Philipp Hold, Karl Ott, Wilfried Sihn. ***Tangible Industry 4.0: A Scenario-Based Approach to Learning for the Future of Production.***

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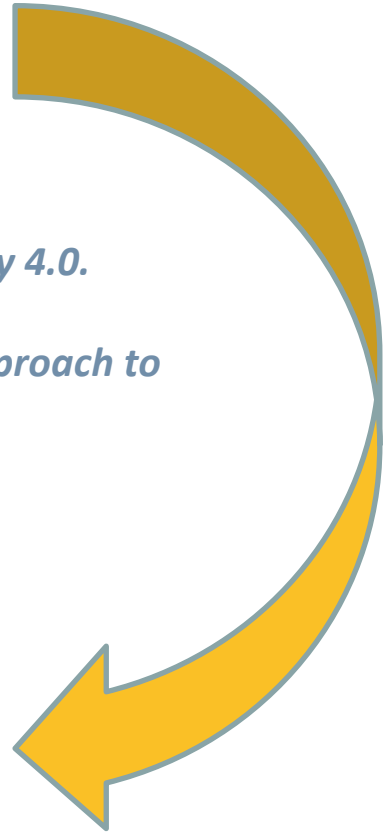

Train and teach others

2. Non-routine non-cognitive interpersonal (complex communication):

- In the production environment of industry 4.0, the electromechanical control system is an integrated system, which often needs to work in a team. In this team, everyone has strengths, so cooperation awareness and communication skill are very important. Then a good team can effectively improve work efficiency. The production line of industry 4.0 is more personalized, and many operations cannot be solved through general training. It requires old employees to train and tech new employees personally. Therefore, skilled workers need to have complex communication.

3. Non-routine manual physical:

- **Skills for dealing with physical tasks that require optical recognition and precise muscle control**

[1] Shi Huili. ***Technical Skills Talents in the Industry 4.0 Era: Connotation, Ability and Cultivation.***

[2] Xu Lan, Xu Ting. ***Research on the Innovation of Talent Cultivation Model in Higher Vocational Education under the Background of Industry 4.0.***

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Mechanical maintenance capability

To coordinate movements to control, manipulate, assemble and repair mechanical equipment.

3. Non-routine manual physical:

- **Skills for dealing with physical tasks that require optical recognition and precise muscle control**

[1] Yang Yan. ***Exploring the Work-oriented Electronic Skills Training Course Reform.***

[2] Tian Peicheng, Li Xueping, Jiang Yuquan. ***Practice and Exploration of Training Advanced Skilled Electronic Professionals in Combination with Electronic Skills Competition.***

[3] Shi Guofeng. ***Employment-oriented electronic skills training course reform.***

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Electronic skills

To assemble, commission and repair electronic products.

3. Non-routine manual physical:

- **Skills for dealing with physical tasks that require optical recognition and precise muscle control**

[1]Wang Zheng, Gao Xinxin, Chen Yi, Li Fei. The Decoupling and Suboptimal Design of Fault Detection Vector in Control System.

[2] Chen Zhong. Fault Analysis, Diagnosis and Maintenance Techniques of Electrical Control System.

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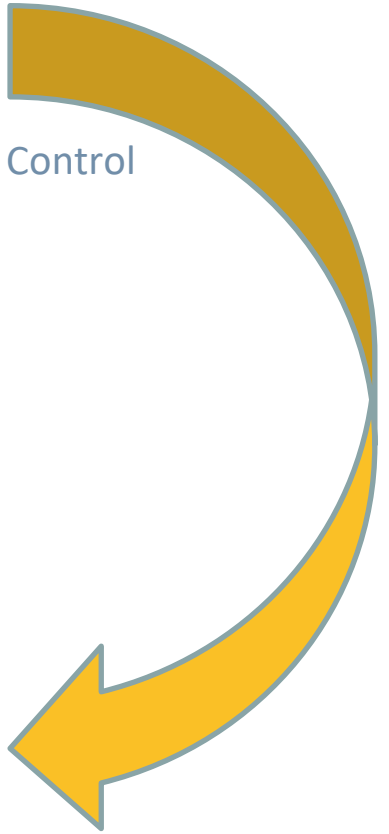
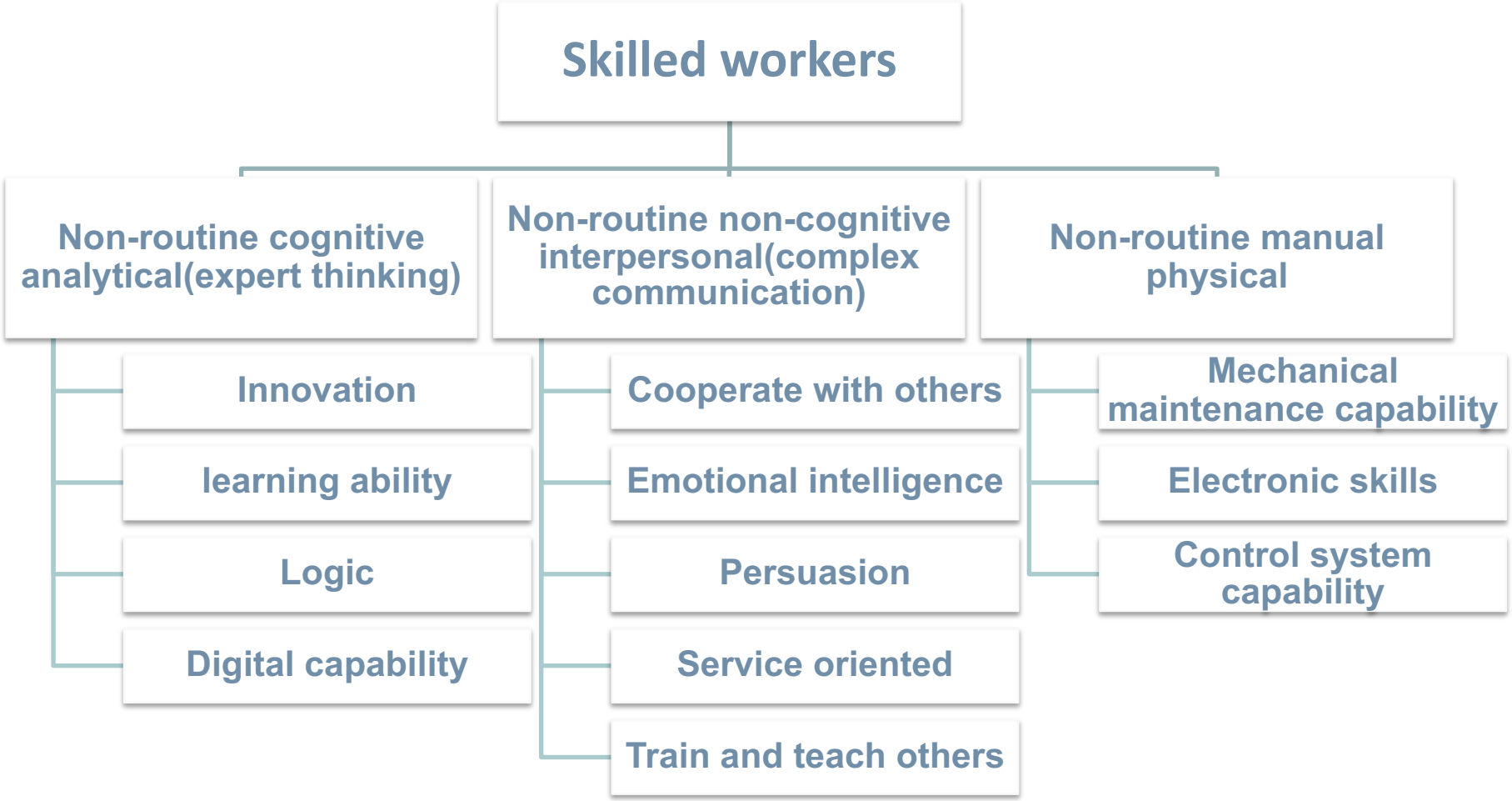


Control system capability

To analyze the failure of the control system and improve the safety and stability of the control system.

V. Skilled workers' skill structure model:



VI. Summary:

The advancement of Industry 4.0 does not have to be a race between people and machines, but it can be an opportunity to truly make people realize their full potential while promoting better development of manufacturing.