A ROBOTICISING LABOUR MARKET: IMPLICATIONS FOR WORKERS & VOCATIONAL EXPERTS

Karolus Kraan,
Marjolein Douwes
& Maaike Huysmans

TNO innovation for life

29.30.31 March 2017
Nancy (F)
Technological innovation and organisational changes: the potential impacts on prevention

AGENDA OF TODAY'S PRESENTATION

- Aim: project commissioned by AKC
- Introduction: robotisation, broad definition and typology, used in project
- Method: Case studies and ALERT
- Case: 'pick-to-light' system
- Findings
- Implications: disbalances
- Conclusions and Future directions: knowledge gaps and needs

AIM: PROJECT COMMISSIONED BY AKC

- Comissioned by the Dutch Vocational Expertise Agency (in Dutch: AKC), TNO and VUmc investigated:
  - different types of robotisation, and the implication of the changed human-robot relation: consequences, opportunities and disbalances for
    - job demands,
    - workers without and with disabilities, and
    - the practice of vocational experts (f.i., rehabilitation specialists).
  - knowledge gaps and development needs for practice of vocational experts

INTRODUCTION: ROBOTISATION BROAD DEFINITION AND TYPOLOGY

- Technological developments [robotisation] affect job demands and labour market (Brynjolfsson & McAfee, 2014; Frey & Osborne; 2013):
  - challenges and/or opportunities for (impaired) workers

- Definition: developments of programmable or self-learning hard- and software (e.g. cobots, vision-technology, cognitive support systems, workflow software.
  - systems take over, entirely or partly, physical, cognitive-perceptual and/or physical tasks from humans.

- Applications in full spectrum of field of work:
  digitised administrative processes in banks - to industrial manufacturing robots.

MATRIX: ROBOTISATION TYPOLOGY

TNO innovation for life

Physical support — *Cognitive-perceptual support*

Robot supports *physical* task performance *to a large extent*. For **humans**, only some physical tasks are left and/or other tasks. *E.g.*: cleaning robot	**Robot** supports *cognitive-perceptual* task performance *to a large extent*. For **humans**, some cognitive-perceptual tasks left and/or other tasks. *E.g.*: digitised administrative process
Humans *remain closely involved* with *physical* task performance. **Robot** supports physical task performance *to some extent*. *E.g.*: surgery robot	**Humans** *remain closely involved* with *cognitive-perceptual* task performance. **Robot** supports cognitive-perceptual task performance to some extent. *E.g.*: automated instructions: **cf. 'pick-to-light'**

METHOD: INDICATORS, CASE-STUDY

- Several case-studies on different types of robots and support:
  mainly cognitive-perceptual-cognitive support, or mainly physical

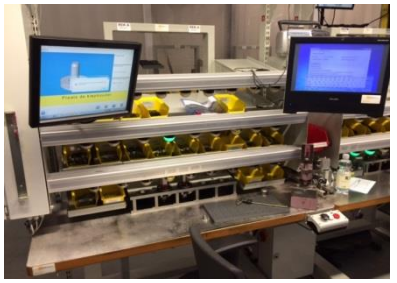
- Changes in job demands assessed comparing job tasks before and after robotisation, retrospectively
  (structured interview format: ALERT method: Age & Load Experttool).

- Potential effects assessed on job demands, namely:
  - psychosocial demands (task load; job autonomy; social support);
  - cognitive-perceptual
    (information processing; concentration; information absorption and acting);
  - physical demands and ambient risks (out of scope of today's presentation).

CASE: ‘PICK-TO-LIGHT’ SYSTEM

- Pick-to-light system for cognitive-perceptual support in assembly task at supplier company in automotive industry
  - The studied task: assembly of part of a shock absorber, two operators.
  - *Old situation:*
    - operator read from drawing how the product was to be assembled;
    - the parts lay in separate compartments in a large box on the table in front of them.
  - The employees assembled the entire product themselves (and still do so, since the pick-to-light system).

  - *In the new situation* - pick-to-light system combined with screen
    - screen provides the cognitive-perceptual support: replaces reading the drawings,
    - prescribes task order



CASE FINDINGS PICK-TO-LIGHT

- *Psychosocial changes* involved, mainly:
  - Task simplification and less variation
  - Method autonomy decreased because the system fuylly prescribes the assembly order and method.
  - Dependency between operators increased due to splitting of tasks.

- *Cognitive-perceptual demands* were reduced:
  - lights indicate what, and where to pick.
  - Also, a screen provides written and visual instructions at the right moment, which traditionally had to be derived from drawings.

GENERAL FINDINGS, FROM CASES AND LITERATURE

- Robotisation influences organisation of work:
  - changing job profiles and job demands
- Robotisation influences pysical, psychosocial and cognitive-perceptual demands, and can influence ambient risks.
  - → opportunities and threats to workers without and with disabilities
- Opportunities for human-robot collaboration:
  - if robot adapted to humans, threats may be reversed into opportunities
    - → inclusive work and labour market

IMPLICATIONS: DISBALANCES IMPAIRED WORKERS

- Potential disbalances for impaired workers:
  - Cognitive
  - Psychosocial
  - Communicative
  - Motoric
  - Visual
  - Auditive
  - Energetic
  - Organic

EXAMPLE: COGNITIVE DISBALANCE

Example: employee with brain damage

Opportunity by cognitive-perceptual support system:

task instruction can be offered
- in a individually adapted manner,
- with the right timing,
- as often as needed, et cetera,

by sensors at the work station.

IMPLICATIONS FOR VOCATIONAL EXPERTS

he/she should be able, for prevention, and reintegration/inclusion of workers, to:

1. recognise changes by robotisation;
2. have insight into opportunities and threats;
3. avail opportunities and take away threats.

And should have access to more knowledge:

1. on (expected) effects of robot types on job demands, and (impaired) workers;
2. opportunities of new technology, *e.g.*, programming;
3. at operational level: databases, roadmap, best practices

By means of:
education and training,
tools.

BIBLIOGRAPHY

- Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies.* New York: WW Norton & Company.
- Frey, C. B., & Osborne, M. A. (2013). *The future of employment: how susceptible are jobs to computerisation.* Retrieved September, 7, 2013.

CONTACT

- karolus.kraan@tno.nl


THANK YOU FOR YOUR ATTENTION