**General**

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| ID[[1]](#endnote-1) |  |
| Use case name | Improving Productivity for Warehouse Operation |
| Application domain | Logistics |
| Deployment model | On-premise systems |
| Status | PoC |
| Scope[[2]](#endnote-2) | Big data analysis for enhancing productivity |
| Objective(s) | To improve productivity of warehouse operation by detecting and changing controllable factors  |
| Narrative | Short description(not more than 150 words) | AI-driven operating system that uses big data from work performance information to issue appropriate work instructions has been developed. In PoC, picking operation improvement was conducted in a distribution warehouse. As the result, 8% work reduction was performed. |
| Completedescription | Attempts are being made to increase the efficiency of work improvements through more widespread application of IT to work systems. However, as each new improvement is added or improvements are made with respect to environmental changes, it requires manual changes to the system, leading to increases in work improvement costs. This case has developed an AI system that uses big data such as work performance information, to understand worksite improvements and environmental changes and issue appropriate work instructions. It has conducted a demonstration test, which confirmed the effectiveness of this system for improving distribution warehouse work. In the future, we will continue to work on expanding the AI system to a wide range areas such as manufacturing and distribution. |
| Stakeholders[[3]](#endnote-3) | warehouse manager |
| Stakeholders’assets, values[[4]](#endnote-4) | reducing cost, reducing labor related problems (e.g. minimizing labors complaint), speed up of operation. |
| System’s threats and vulnerabilities[[5]](#endnote-5) | possibility of back action |
| Key performance indicators (KPIs) | ID | Name | Description | Reference to mentioned use case objectives |
| 1 | Number of labors | reduced % of labors | improvement of productivity |
| 2 | Number of complaints | reduced % of labor's complaint | improvement of productivity |
| 3 | Lead time | time from order to shipment | improvement of productivity |
| AI features | Task(s) | Optimization |
| Method(s)[[6]](#endnote-6) | modeling of relationship between explaining variables and outcome, and optimization |
| Hardware[[7]](#endnote-7) | PC, wearable sensor |
| Topology[[8]](#endnote-8) |  |
| Terms and concepts used[[9]](#endnote-9) | Human big data analysis, regression analysis |
| Standardization opportunities/ requirements | standardization of data format, sensors to be used, and API of IT and mechanical systems |
| Challenges and issues | understanding of workers' human factors (privacy, additional work etc.) |
| Societal concerns | Description | solving labor shortage problem and improving labor related issues with aiming improving productivity. |
| SDGs[[10]](#endnote-10) | Industry, Innovation, and Infrastructure |

**Data (optional)**

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| Data characteristics |
| Description |  |
| Source[[11]](#endnote-11) |  |
| Type[[12]](#endnote-12) |  |
| Volume (size) |  |
| Velocity (e.g. real time)[[13]](#endnote-13) |  |
| Variety (multiple datasets)[[14]](#endnote-14) |  |
| Variability (rate of change)[[15]](#endnote-15) |  |
| Quality[[16]](#endnote-16) |  |

**Process scenario (optional)**

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| Scenario conditions |
| No. | Scenario name | Scenario description | Triggering event | Pre-condition[[17]](#endnote-17) | Post-condition[[18]](#endnote-18) |
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**Training (optional)**

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| Scenario name | Training |
| Step No. | Event[[19]](#endnote-19) | Name of process/Activity[[20]](#endnote-20) | Primary actor | Description of process/activity | Requirement |
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| Specification of training data[[21]](#endnote-21) | 　 |

 **Evaluation (optional)**

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| Scenario name | Evaluation |
| Step No. | Event[[22]](#endnote-22) | Name of process/Activity[[23]](#endnote-23) | Primary actor | Description of process/activity | Requirement |
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| Input of evaluation[[24]](#endnote-24) | 　 |
| Output of evaluation[[25]](#endnote-25) | 　 |

**Execution (optional)**

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| Scenario name | Execution |
| Step No. | Event[[26]](#endnote-26) | Name of process/Activity[[27]](#endnote-27) | Primary actor | Description of process/activity | Requirement |
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| Input of Execution[[28]](#endnote-28) |  |
| Output of Execution[[29]](#endnote-29) |  |

**Retraining (optional)**

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| Scenario name | Retraining |
| Step No. | Event[[30]](#endnote-30) | Name of process/Activity[[31]](#endnote-31) | Primary actor | Description of process/activity | Requirement |
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| Specification of retraining data[[32]](#endnote-32) |  |

**References**

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| References |
| No. | Type | Reference | Status | Impact on use case | Originator/organization | Link |
| 1 | company's technical journal |  | Published |  | Hitachi, Ltd., | http://www.hitachi.com/rev/archive/2016/r2016\_06/106/index.html |
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[1] F. Kudo T. Akitomi and N. Moriwaki, "An Artificial Intelligence Computer System for Analysis of Social Infrastructure Data," IEEE conf. Business Infomatics (CBI), 2015.

[2] J. Kimura et al., "Framework for Collaborative Creation with Customers to Improve Warehouse Logistics," Hitachi Review, 65, pp. 873-877, 2016.

[3] Hitachi News Release, "Development of Artificial Intelligence issuing work orders based on understanding of on-site Kaizen activity and demand fluctuation," 2015. http://www. hitachi.com/New/cnews/month/2015/09/150904.html

**Footnote**

1. Leave this cell blank. [↑](#endnote-ref-1)
2. The scope defines the limits of the use case. [↑](#endnote-ref-2)
3. Stakeholder involved in the scenario - examples are: type of organization; customers, 3rd parties; end users; humans; environment; negative stakeholders (attackers, criminals, etc). [↑](#endnote-ref-3)
4. Assets and values that are valuable to the stakeholders and at the risk of being compromised by the AI system deployment – examples can include competitiveness; reputation or trust; fairness; safety; privacy; stability; etc. [↑](#endnote-ref-4)
5. Threats and vulnerabilities can compromise the assets and values above. Examples are: different sources of bias; incorrect AI system use; new security threats; challenges to accountability; new privacy threats (hidden patterns). [↑](#endnote-ref-5)
6. AI method(s)/framework(s) used. [↑](#endnote-ref-6)
7. Hardware system used. [↑](#endnote-ref-7)
8. Topology is the study of geometric forms differentiated by intersection and bifurcation. The term is used for the graphic aspects network architectures. [↑](#endnote-ref-8)
9. Terms and concepts listed here can be used to extend the work of WG 1 (AWI 22989 and AWI 23053) as necessary. [↑](#endnote-ref-9)
10. The Sustainable Development Goals (SDGs), otherwise known as the Global Goals, are a collection of 17 global goals set by the United Nations General Assembly. SDGs are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity.

See URL for more details: <http://www.undp.org/content/undp/en/home/sustainable-development-goals.html> [↑](#endnote-ref-10)
11. Origin of data, which could be from instruments, IoT, web, surveys, commercial activity, or from simulations. [↑](#endnote-ref-11)
12. Structured/unstructured Images, voices, text, gene sequences, and numerical. Composite: time-series, graph-structured [↑](#endnote-ref-12)
13. The rate of flow at which the data is created, stored, analysed, or visualized. [↑](#endnote-ref-13)
14. Data from a number of domains and a number of data types. The wider range of data formats, logical models, timescales, and semantics complicates the integration of the variety of data. [↑](#endnote-ref-14)
15. Changes in data rate, format/structure, semantics, and/or quality. [↑](#endnote-ref-15)
16. Completeness and accuracy of the data with respect to semantic content as well as syntactical of the data (such as presence of missing fields or incorrect values) [↑](#endnote-ref-16)
17. Describe which condition(s) should have been met before this scenario happens. [↑](#endnote-ref-17)
18. Describe which condition(s) should prevail after this scenario happens. The post-condition may also define "success" or "failure" conditions. [↑](#endnote-ref-18)
19. The event that triggers the step. This might be completion of the previous event. [↑](#endnote-ref-19)
20. Action verbs should be used when naming activity. [↑](#endnote-ref-20)
21. Training data can be further specified. [↑](#endnote-ref-21)
22. The event that triggers the step. This might be completion of the previous event. [↑](#endnote-ref-22)
23. Action verbs should be used when naming activity. [↑](#endnote-ref-23)
24. Specify input of evaluation. [↑](#endnote-ref-24)
25. Specify output of evaluation. [↑](#endnote-ref-25)
26. The event that triggers the step. This might be completion of the previous event. [↑](#endnote-ref-26)
27. Action verbs should be used when naming activity. [↑](#endnote-ref-27)
28. Specify input of evaluation. [↑](#endnote-ref-28)
29. Specify output of evaluation. [↑](#endnote-ref-29)
30. The event that triggers the step. This might be completion of the previous event. [↑](#endnote-ref-30)
31. Action verbs should be used when naming activity. [↑](#endnote-ref-31)
32. Retraining data can be further specified. [↑](#endnote-ref-32)