Business Innovation with state-of-the-art AI
— *AI business conditions and issues from AI use cases collected by SC42/WG4* —

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1. Introduction

In recent years, there is increasing activity toward using artificial intelligence (AI) in industry. In October 2017 at its general assembly, ISO/IEC JTC1, which handles international standardization related to information technology, resolved to establish a new subcommittee on AI, JTC1/SC42 (Artificial Intelligence). The objectives of SC42 are to provide a foundation for developing standards related to use of AI, for standardization committees within and outside of JTC 1, and to explore new standardization themes related to AI[1]. This article reports on the current state of activity by SC42 working group 4 (WG4) (Use cases and applications), collecting AI use cases, well as AI business development conditions and issues in the world in light of these use cases.

2. Current state of SC42/WG4 activities

2.1 SC42 and WG4 (Use cases and applications) activities

The objectives of JTC1 are to develop, maintain and promote international standards for IT and ICT, and the role of SC42 is standardization in the domain of AI. More concretely, it has two activities: its first duty is to create proposals for AI-related standards, centered on the standardization programs of JTC 1, but it also provides guidance to JTC1, IEC, and ISO on developing standards for application of AI.

With the current, increasing activity toward application of AI in industry, issues are emerging related to reliability, biases, guidance, and ethics in AI, and there is increasing need for international standardization related to these areas. Working Group 4 (WG4) was established to collect representative AI use cases, to facilitate discussion of these issues, and the use cases that it collects will be provided to working groups and liaisons discussing these issues.

2.2 Publication of ISO/IEC TR 24030 and use-case collection

For the AI use cases, scenarios using AI were collected and classified by type based on how AI is used and the structure of the data, to help in utilizing AI. Use cases are also intended to be used and analyzed in order to facilitate discussion of abstract issues in terms of concrete scenarios, and to clearly identify stakeholders using AI in wide ranging fields.

WG4 will carry on the work of its predecessor, Study Group 3 (SG3), of collecting examples of practical uses of AI, in other words, use cases. Between June 2018 and October 2019, more than 80 use cases were provided by experts from countries participating in WG4. These use cases will be provided as discussion materials to SC42 and liaisons, and as decided at the 2nd General Meeting of SC42 (October 2018), a collection of use cases will be published as a technical report (TR), to widely share the state of AI system use around the world. The document, "ISO/IEC TR 24030 Information technology—Artificial Intelligence (AI)—Use cases," is being developed and publication is scheduled in 2020.

3. Use case collection and analysis of current conditions

3.1 Approach for collecting use cases

WG4 first created a use case submission template through repeated discussions. Details of use case descriptions are structured in three parts.

1. Basic information [Required]: A general overview of the use case, including use case application domain,

development model, status, narrative, KPI, stakeholders, AI system attributes, social concerns, etc.

2. AI Operation information [Optional]: Description of each process, from building (training) the AI system to practical use, and the data required for each process.

3. Reference documents [Required]: Credible reference materials such as academic papers, product manuals and patent documents that increase the quality and credibility of the use case. The content of this section can be used to analyze the current state and characteristics of AI use in each industrial field, and to clarify the data and processes needed to use the AI system.

3.2 Current AI use considering distribution of use cases
3.2.1 Fields of use

To reference and analyze the use cases more efficiently, WG4 discussed and studied the industries using AI systems, created a list of 24 fields as shown in the table[2][3], and introduced a mechanism to allow the field-of-use to be selected in the use-case template. The table shows the distribution of fields of use among the collected use cases. The highest ranked fields were Manufacturing (19%), Healthcare (16%), Transportation (7%), ICT (7%), and Education (6%). On the other hand they were not able to collect any use cases for seven of the fields: Construction, Defence, Energy, Knowledge management, Legal, Low-resource communities, and Media and entertainment. In addition to the use cases for which the usage-field could be defined clearly, for 13% of the use cases it was difficult to define the field in terms of those described above.

For the fields with many use cases, it is possible to extract AI system usage characteristics. For use cases in the Manufacturing field for example, we found that many of the applications were related to improving product quality, such as detecting defective parts in the manufacturing process, or inspecting products in use for faults. Many of the use cases in the health care field were to provide accurate information needed for diagnosis efficiently, to help doctors in making their diagnoses. In transportation, many of the use cases were to control traffic signals or self-driving construction vehicles, to achieve safety, efficiency, and to conserve energy. In this way, analysis of the use cases has clarified that the benefits of AI systems to stakeholders and how they are used have characteristics that are specific to each industry.

WG4 is continuing to seek collaborations with organizations that can provide use case in fields that have not yet been covered. Now we look at issues with collecting use cases in some of these not-yet-covered fields. Use cases must be described based on authentic public information, so it is difficult to collect use cases for which the data cannot be published, or which has not been published as a research paper, patent or other document. One would assume that in most countries, most of the use cases in the defense field have information that cannot be published.

Besides the above, there are also biases in the industrial fields of the companies that have participants in SC42 WG4, and also in fields that AI businesses are emphasizing in each country, so we can expect this to result in biases in the use-case application domains. For example, use cases produced in Europe included many in manufacturing and transport fields, while developing countries tended to provide a wider range of cases. Thus, while developed countries are implementing and applying AI in existing industries, it appears that developing countries are applying AI to create new industries.

■ **Table: AI system use-case distribution**

Field of use	Proportion
Manufacturing	19%
Healthcare	16%
Transportation	7%
ICT	7%
Education	6%
Security	5%
Work and life	5%
Fintech	4%
Digital marketing	4%
Public sector	4%
Retail, Mobility, agriculture, social infrastructure, home/service robotics, maintenance and support	2% (each)
Logistics	1%
Construction, Defence, energy, Knowledge management, legal, low-resource communities, media and entertainment	0% (each)
Other	9%

3.2.2 Status

Aggregating the status of collected use cases, we found that 39% were proof-of-concept (PoC), 31% were operating, and 29% were at a prototype stage. PoC represents 39% of cases, so we can see that in many cases use of the AI systems has not gone beyond proof-of-concept, regardless of the fact that AI is being applied in many types of business and the need is increasing in all fields. It suggests that even now, AI systems have still not advanced to doing practical work.

AI systems have features such as output that is data dependent, indeterminate, and cannot be explained, so procedures generally used to ensure quality during procurement, such as defining, testing and review, cannot be done. As such, before they can perform practical work, long periods of PoC execution for each use cases is essential, collecting data, identifying issues and resolving them. This may be the reason that many current AI systems have not proceeded beyond a PoC stage.

Currently, from results surmised from such conditions during the first phase of collecting use cases, it is easy to imagine that there will be more AI use cases in the future, but it is also clear that many issues are arising with systems being developed, before they can begin practical work (i.e. enter production, or be put in service). The collected use cases also included cases in which a specialized explanation was given for a particular algorithm, or machine learning was built-in to part of the overall system, mixed into a conventional IT system. This highlighted the ambiguity in the term "AI."

Considering the current state of collecting use cases, it is not difficult to expect that use cases for AI will increase further in the future. As we have nearly completed the collection of use cases, we expect that the field of applications will expand further. The work of WG4 will not stop at simply collecting examples, but will continue, eliminating duplicates, continuing to collect valuable use-case examples, and improving the content in both quantity and quality.

4. Issues with future expansion of AI business considering collection of use cases

We also expect that discussion will proceed quickly in fields where work or study has not yet started, such as quality assurance.

Various fields where study or work in AI has not yet begun have been considered, as mentioned earlier, such as security, quality assurance, data quality, reliability of interactions with users, and guarantees regarding various biases. Study of these various fields is certainly not limited to just SC42, and an issue currently considered to be of the highest-priority is the fact that fields in which a certain amount of standardization has already been done by other SCs need to be reexamined and checked, and

it is clear that the domain requiring study, including business issues, continues to expand. This article discusses three areas of study that require attention.

The first area is that of liaising and cooperating with other SCs and WGs. We are working to increase liaising and collaboration with WG2 (Big Data) and WG3 (Trustworthiness), which are also within SC42, and also with other SCs representing security issues. AI technology is producing significant paradigm shifts, suggesting that existing technologies need to be reexamined with respect to AI. There are currently 5 WGs within SC42, and collaboration is tending to grow exponentially, not only with liaison work and collaboration between WGs, but also including collaboration with other SCs, and even discussion among representatives of various countries within an SC. To issue a new work-item proposal requires complex and diverse work from WGs: investigating trends, checking examples and introducing technologies to each other; as exemplified by WG4. This requires a huge amount of work and time invested in negotiation by representatives from each country and WG members.

The second area is discussion of the life cycle and development processes for AI. Various topics are being discussed, such as:

(1) Are there differences between development processes for conventional general-purpose systems and AI? Are there completely new development processes for machine learning systems?

(2) Does "AI life cycle", include everything from the development process and start of operation till retirement of the system?

(3) Is there a concept of AIOps, similar to DevOps

It will be important to monitor trends in these areas in Japan and other countries in the future. Regarding AI development processes in particular, we expect a wide range of study, examining issues such as how they will be linked with existing standards for software and system development processes, and what sorts of differences are there in terms of process models, but from the use cases collected by WG4, we surmise that general purpose and common AI process lifecycles have not yet become established. Within WG4, the intention is to collect additional information regarding the overall life cycles with each use case, such as applicable development processes and after operation begins. We believe that the collected examples will be valuable information for deeper, fact-based discussion of processes and life cycles in the future.

The last area of discussion is AI Quality.

Currently, WG3 (Trustworthiness) is in discussion over an extremely wide range, including conventional biases, unpredictability, ethical issues, testing, and evaluation and it has obtained some results related to robustness and controllability of

AI systems. On the other hand, Human-Computer Interaction (HCI) topics are being discussed actively as areas of study in the future, under the title, "Challenges related to the use of AI Systems." This is regarding tertiary AI quality issues beyond machine learning algorithms and data quality, such as psychological factors with users of AI systems and the "Fraudulent Factor" with respect to AI systems. In the future, we expect various, previously sporadic AI quality elements to be classified and synthesized.

On another note, a feature of the WG4 use cases was that many were not completed and remained in a PoC state. The authors believe that the source of this phenomenon of "PoC suspended" and "PoC starved" projects is that there are AI quality elements for which we have not yet found an overall classification, synthesis, or definitive individual solution. Also, in discussion of AI quality, although we are gathering many examples, we are currently still not able to generalize from these concrete examples. This could be another reason why the discussion of AI quality is slow and not making progress.

Taking a more macroscopic perspective, discussion of appropriate AI quality cannot be realized in the future with simple rivalry and competition between countries. We expect this domain will require much more international cooperation, because it will require a broad range of thought and consideration based on fact and on the ethics, religion, race and commercial practices in the various countries. Without pushing cooperation more than we are now, by collecting examples of AI quality in a bottom-up approach, AI industries may not have a future. Collection of use cases by WG4 is part of that effort, and we believe it will be increasingly important in the future.

5. Conclusion

This article has reported on activities in WG4 of SC42, collecting AI use cases, and the state AI business development in the world and related issues, in light of these use cases. In October 2019, the year before the Olympics, the annual general meeting of SC42 was held in Tokyo. Some 150 people from 30 countries visited to discuss standardization activities for the future of AI. At this general meeting, there were individual discussions in each WG, but a Joint Working Group was also held jointly with multiple WGs, and we expect intense debate on various strategies for important crossroads that will control future trends in AI, including New Work Item Proposals (NWIP) carried forward from the two previous general meetings (Sunnyvale, USA and Dublin, Ireland). We expect that countries that are able to distance themselves early from the path taken in earlier standardization activities, competing for dominance or seizing initiative, will find it easier to make larger contributions to

standardization of AI. However, it is impossible to predict which countries will cooperate with each other on standardization, and in what fields they will cooperate, throwing us into a world of AI wars. It is certain that discussion on topics such as AI lifecycle and AI quality, as mentioned earlier, will follow the peak of such discussion, and will greatly affect future trends in standardization. Such important decision points will be something to watch in Tokyo.

The future of AI is moving in leaps and bounds before our eyes, from one minute to the next.

References
[1] IPSJ press release: Start of International Standardization of Artificial Intelligence, https://www.ipsj.or.jp/release/20180110_itscjnews.html
[2] Information-technology Promotion Agency, "AI White Paper 2019: Enterprise-changing AI, Choices for Japan and the world"
[3] Stanford University, "ARTIFICIAL INTELLIGENCE AND LIFE IN 2030," https://ai100.stanford.edu/2016-report

Cover Art

This picture is a scene from the Kabuki play, Genji moyô furisode hinagata. In this play, Naritayama Fudô Myôô (upper middle) is supported by his attendants Kongara Dôji (right) and Seitaka Dôji (left) while he rescues Hiranoya Tokubei from the sea.

Utagawa Toyokuni III
(1786~1865)

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