

## SECTION E: TECHNOLOGY AND INTELLECTUAL PROPERTY

The following section collects information on intellectual property and technology use for the business. Technology related questions in this section asks about the following technologies:

Artificial Intelligence: Artificial intelligence is a branch of computer science and engineering devoted to making machines intelligent. Intelligence is that quality that enables an entity to perceive, analyze, determine response and act appropriately in its environment.

Cloud-based Computing Systems and Applications: Cloud systems and applications are computing resources available on-demand via the internet.

Specialized Software (excluding Artificial Intelligence): Specialized software is software dedicated to performing a particular business function.

Robotics: Robotic equipment (or robots) are automatically controlled, reprogrammable, and multipurpose machines used in automated operations in industrial and service environments.

Specialized Equipment (excluding Robotics): Specialized equipment is equipment capable of automatically carrying out pre-specified task(s).

### E.3 PRODUCTION TECHNOLOGY FOR GOODS AND SERVICES

During the three years 2020 to 2022, did this business adopt/use the following technologies?

#### Artificial Intelligence

- ☐ This technology is not applicable to this business
- ☐ Applicable, but did not test or use
- ☐ Tested, but did not use as part of the processes or methods
- ☐ Used as part of the processes or methods
- ☐ Don't know

If this business used Artificial Intelligence, what percentage of the total costs were associated with the processes and methods that use Artificial Intelligence?

- ☐ Low percentage
- ☐ Medium percentage
- ☐ High percentage

#### Cloud-based Computing Systems and Applications

- ☐ This technology is not applicable to this business
- ☐ Applicable, but did not test or use
- ☐ Tested, but did not use as part of the processes or methods
- ☐ Used as part of the processes or methods
- ☐ Don't know

If this business used Cloud-based Computing Systems and Applications, what percentage of the total costs were associated with the processes and methods that use Cloud-based Computing Systems and Applications?

- ☐ Low percentage
- ☐ Medium percentage
- ☐ High percentage

### Specialized Software

- ☐ This technology is not applicable to this business
- ☐ Applicable, but did not test or use
- ☐ Tested, but did not use as part of the processes or methods
- ☐ Used as part of the processes or methods
- ☐ Don't know

If this business used Specialized Software, what percentage of the total costs were associated with the processes and methods that use Specialized Software?

- ☐ Low percentage
- ☐ Medium percentage
- ☐ High percentage

### Robotics

- ☐ This technology is not applicable to this business
- ☐ Applicable, but did not test or use
- ☐ Tested, but did not use as part of the processes or methods
- ☐ Used as part of the processes or methods
- ☐ Don't know

If this business used Robotics, what percentage of the total costs were associated with the processes and methods that use Robotics?

- ☐ Low percentage
- ☐ Medium percentage
- ☐ High percentage

### Specialized Equipment

- ☐ This technology is not applicable to this business
- ☐ Applicable, but did not test or use
- ☐ Tested, but did not use as part of the processes or methods
- ☐ Used as part of the processes or methods
- ☐ Don't know

If this business used Specialized Equipment, what percentage of the total costs were associated with the processes and methods that use Specialized Equipment?

- ☐ Low percentage
- ☐ Medium percentage
- ☐ High percentage

If all answers to E.3 are "This technology is not applicable to this business", "Applicable, but did not test or use", "Tested, but did not use in production or service", or "Don't know" then proceed to E.24 – IMPACT OF THE PANDEMIC ON VIEWS TOWARDS AUTOMATION

#### E.4 TIMING OF ADOPTION FOR ARTIFICIAL INTELLIGENCE TECHNOLOGY – PROCESSES AND METHODS

Approximately what year did this business *first* adopt or use Artificial Intelligence **in processes and methods**? Please enter the year to the best of your knowledge (even if approximate).

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**Don't know the year**

#### E.5 MOTIVATION FOR ARTIFICIAL INTELLIGENCE TECHNOLOGY ADOPTION AND UTILIZATION – PROCESSES AND METHODS

During the three years 2020 to 2022, why did this business adopt or use Artificial Intelligence? **Select all that apply.**

- ☐ To automate tasks performed by labor
- ☐ To replace or upgrade already existing automated processes or methods
- ☐ To improve quality or reliability of processes or methods
- ☐ To improve quality or reliability of goods or services
- ☐ To expand the range of goods or services
- ☐ To adopt standards and accreditation
- ☐ Some other reason

#### E.6 IMPACT OF ARTIFICIAL INTELLIGENCE TECHNOLOGY ON WORKFORCE – PROCESSES AND METHODS

During the three years 2020 to 2022, what were the effects of adopting or using Artificial Intelligence on the following?

- A. The **number of workers** employed by this business
  - ☐ Increased
  - ☐ Decreased
  - ☐ Did not change
- B. The **skill level of workers** employed by this business
  - ☐ Increased overall
  - ☐ Decreased overall
  - ☐ Did not change overall
- C. The **scientific, technological, engineering, and mathematical skills of workers** employed by this business
  - ☐ Increased overall
  - ☐ Decreased overall
  - ☐ Did not change overall
  - ☐ Not applicable, we did not employ workers with scientific, technological, engineering and mathematical skills

#### E.7 IMPACT OF ARTIFICIAL INTELLIGENCE TECHNOLOGY ON WORKER TYPES – PROCESSES AND METHODS

Indicate what effect Artificial Intelligence had on the following types of workers employed by this business during the three years 2020 to 2022.

- A. The ratio of **production workers** to **non-production workers**
  - ☐ Increased
  - ☐ Decreased
  - ☐ Did not change
  - ☐ Not applicable, we did not employ production workers
  - ☐ Not applicable, we did not employ non-production workers
- B. The ratio of **non-supervisory workers** to **supervisory workers**

- Increased
- Decreased
- Did not change
- Not applicable, we did not employ supervisory workers
- Not applicable, we did not employ non-supervisory workers

#### E.8 TIMING OF ADOPTION FOR CLOUD-BASED COMPUTING SYSTEMS AND APPLICATIONS TECHNOLOGY – PROCESSES AND METHODS

Approximately what year did this business *first* adopt or use Cloud-based Computing Systems and Applications **in processes and methods**? Please enter the year to the best of your knowledge (even if approximate).

- ☐ \_\_\_\_
- ☐ **Don't know the year**

#### E.9 MOTIVATION FOR CLOUD-BASED COMPUTING SYSTEMS AND APPLICATIONS TECHNOLOGY ADOPTION AND UTILIZATION – PROCESSES AND METHODS

During the three years 2020 to 2022, why did this business adopt or use Cloud-based Computing Systems and Applications? **Select all that apply.**

- ☐ To automate tasks performed by labor
- ☐ To replace or upgrade already existing automated processes
- ☐ To improve quality or reliability of processes or methods
- ☐ To improve quality or reliability of goods or services
- ☐ To expand the range of goods or services
- ☐ To adopt standards and accreditation
- ☐ Some other reason

#### E.10 IMPACT OF CLOUD-BASED COMPUTING SYSTEMS AND APPLICATIONS TECHNOLOGY ON WORKFORCE – PROCESSES AND METHODS

During the three years 2020 to 2022, what were the effects of adopting or using Cloud-based Computing Systems and Applications on the following?

- A. The **number of workers** employed by this business
  - Increased
  - Decreased
  - Did not change
- B. The **skill level of workers** employed by this business
  - Increased overall
  - Decreased overall
  - Did not change overall
- C. The **scientific, technological, engineering, and mathematical skills of workers** employed by this business
  - Increased overall
  - Decreased overall
  - Did not change overall
  - Not applicable, we did not employ workers with scientific, technological, engineering and mathematical skills

#### E.11 IMPACT OF CLOUD-BASED COMPUTING SYSTEMS AND APPLICATIONS TECHNOLOGY ON WORKER TYPES – PROCESSES AND METHODS

Indicate what effect Cloud-based Computing Systems and Applications had on the following types of workers employed by this business during the three years 2020 to 2022.

A. The ratio of **production workers** to **non-production workers**

- ☐ Increased
- ☐ Decreased
- ☐ Did not change
- ☐ Not applicable, we did not employ production workers
- ☐ Not applicable, we did not employ non-production workers

B. The ratio of **non-supervisory workers** to **supervisory workers**

- ☐ Increased
- ☐ Decreased
- ☐ Did not change
- ☐ Not applicable, we did not employ supervisory workers
- ☐ Not applicable, we did not employ non-supervisory workers

**E.12 TIMING OF ADOPTION FOR SPECIALIZED SOFTWARE TECHNOLOGY – PROCESSES AND METHODS**

Approximately what year did this business *first* adopt or use Specialized Software Technology **in processes and methods**? Please enter the year to the best of your knowledge (even if approximate).

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**Don't know the year**

**E.13 MOTIVATION FOR SPECIALIZED SOFTWARE TECHNOLOGY ADOPTION AND UTILIZATION – PROCESSES AND METHODS**

During the three years 2020 to 2022, why did this business adopt or use Specialized Software? **Select all that apply.**

- ☐ To automate tasks performed by labor
- ☐ To replace or upgrade already existing automated processes
- ☐ To improve quality or reliability of processes or methods
- ☐ To improve quality or reliability of goods or services
- ☐ To expand the range of goods or services
- ☐ To adopt standards and accreditation
- ☐ Some other reason

**E.14 IMPACT OF SPECIALIZED SOFTWARE TECHNOLOGY ON WORKFORCE – PROCESSES AND METHODS**

During the three years 2020 to 2022, what were the effects of adopting or using Specialized Software on the following?

A. The **number of workers** employed by this business

- ☐ Increased
- ☐ Decreased
- ☐ Did not change

B. The **skill level of workers** employed by this business

- ☐ Increased overall
- ☐ Decreased overall
- ☐ Did not change overall

- C. The **scientific, technological, engineering, and mathematical skills of workers** employed by this business
  - Increased overall
  - Decreased overall
  - Did not change overall
  - Not applicable, we did not employ workers with scientific, technological, engineering and mathematical skills

#### E.15 IMPACT OF SPECIALIZED SOFTWARE TECHNOLOGY ON WORKER TYPES – PROCESSES AND METHODS

Indicate what effect Specialized Software had on the following types of workers employed by this business during the three years 2020 to 2022.

- A. The ratio of **production workers** to **non-production workers**
  - Increased
  - Decreased
  - Did not change
  - Not applicable, we did not employ production workers
  - Not applicable, we did not employ non-production workers
- B. The ratio of **non-supervisory workers** to **supervisory workers**
  - Increased
  - Decreased
  - Did not change
  - Not applicable, we did not employ supervisory workers
  - Not applicable, we did not employ non-supervisory workers

#### E.16 TIMING OF ADOPTION FOR ROBOTICS TECHNOLOGY – PROCESSES AND METHODS

Approximately what year did this business *first* adopt or use Robotics **in processes and methods**? Please enter the year.

- ☐ \_ \_ \_ \_
- ☐ **Don't know the year**

#### E.17 MOTIVATION FOR ROBOTICS TECHNOLOGY ADOPTION AND UTILIZATION – PROCESSES AND METHODS

During the three years 2020 to 2022, why did this business adopt or use Robotics? **Select all that apply.**

- ☐ To automate tasks performed by labor
- ☐ To replace or upgrade already existing automated processes
- ☐ To improve quality or reliability of processes or methods
- ☐ To improve quality or reliability of goods or services
- ☐ To expand the range of goods or services
- ☐ To adopt standards and accreditation
- ☐ Some other reason

#### E.18 IMPACT OF ROBOTICS TECHNOLOGY ON WORKFORCE – PROCESSES AND METHODS

During the three years 2020 to 2022, what were the effects of adopting or using Robotics on the following?

- A. The **number of workers** employed by this business
  - Increased
  - Decreased
  - Did not change
- B. The **skill level of workers** employed by this business
  - Increased overall

- Decreased overall
- Did not change overall
- C. The **scientific, technological, engineering, and mathematical skills of workers** employed by this business
  - Increased overall
  - Decreased overall
  - Did not change overall
  - Not applicable, we did not employ workers with scientific, technological, engineering and mathematical skills

#### E.19 IMPACT OF ROBOTICS TECHNOLOGY ON WORKER TYPES – PROCESSES AND METHODS

Indicate what effect Robotics had on the following types of workers employed by this business during the three years 2020 to 2022.

- A. The ratio of **production workers** to **non-production workers**
  - Increased
  - Decreased
  - Did not change
  - Not applicable, we did not employ production workers
  - Not applicable, we did not employ non-production workers
- B. The ratio of **non-supervisory workers** to **supervisory workers**
  - Increased
  - Decreased
  - Did not change
  - Not applicable, we did not employ supervisory workers
  - Not applicable, we did not employ non-supervisory workers

#### E.20 TIMING OF ADOPTION FOR SPECIALIZED EQUIPMENT – PROCESSES AND METHODS

Approximately what year did this business *first* adopt or use Specialized Equipment **in processes and methods**? Please enter the year to the best of your knowledge (even if approximate).

- ☐ \_\_\_\_
- ☐ **Don't know the year**

#### E.21 MOTIVATION FOR SPECIALIZED EQUIPMENT TECHNOLOGY ADOPTION AND UTILIZATION – PROCESSES AND METHODS

During the three years 2020 to 2022, why did this business adopt or use Specialized Equipment? **Select all that apply.**

- ☐ To automate tasks performed by labor
- ☐ To replace or upgrade already existing automated processes
- ☐ To improve quality or reliability of processes or methods
- ☐ To improve quality or reliability of goods or services
- ☐ To expand the range of goods or services
- ☐ To adopt standards and accreditation
- ☐ Some other reason

## E.22 IMPACT OF SPECIALIZED EQUIPMENT TECHNOLOGY ON WORKFORCE – PROCESSES AND METHODS

During the three years 2020 to 2022, what were the effects of adopting or using Specialized Equipment on the following?

- A. The **number of workers** employed by this business
  - ☐ Increased
  - ☐ Decreased
  - ☐ Did not change
- B. The **skill level of workers** employed by this business
  - ☐ Increased overall
  - ☐ Decreased overall
  - ☐ Did not change overall
- C. The **scientific, technological, engineering, and mathematical skills of workers** employed by this business
  - ☐ Increased overall
  - ☐ Decreased overall
  - ☐ Did not change overall
  - ☐ Not applicable, we did not employ workers with scientific, technological, engineering and mathematical skills

## E.23 IMPACT OF SPECIALIZED EQUIPMENT TECHNOLOGY ON WORKER TYPES – PROCESSES AND METHODS

Indicate what effect Specialized Equipment had on the following types of workers employed by this business during the three years 2020 to 2022.

- A. The ratio of **production workers** to **non-production workers**
  - ☐ Increased
  - ☐ Decreased
  - ☐ Did not change
  - ☐ Not applicable, we did not employ production workers
  - ☐ Not applicable, we did not employ non-production workers
- B. The ratio of **non-supervisory workers** to **supervisory workers**
  - ☐ Increased
  - ☐ Decreased
  - ☐ Did not change
  - ☐ Not applicable, we did not employ supervisory workers
  - ☐ Not applicable, we did not employ non-supervisory workers

## E.24 IMPACT OF THE COVID-19 PANDEMIC ON AUTOMATION

During the period 2020-2022, did the COVID-19 pandemic specifically affect automation of tasks performed by labor in this business?

(Automation refers to automatically controlled operation of an apparatus, process, or system by mechanical or electronic devices or software that take the place of human labor)

- ☐ Yes, increased automation of tasks performed by labor
- ☐ Yes, decreased automation of tasks performed by labor
- ☐ No, did not change automation of tasks performed by labor
- ☐ Not applicable, this business did not have any tasks performed by labor that could be automated



## **E.25 TECHNOLOGY BASED GOODS AND SERVICES**

During the three years 2020 to 2022, did this business sell the following technologies or provide goods or services that included the following technologies?

Artificial Intelligence

- ☐ Yes
- ☐ No
- ☐ Don't know

Cloud-based Computing Systems and Applications

- ☐ Yes
- ☐ No
- ☐ Don't know

Specialized Software

- ☐ Yes
- ☐ No
- ☐ Don't know

Robotics

- ☐ Yes
- ☐ No
- ☐ Don't know

Specialized Equipment

- ☐ Yes
- ☐ No
- ☐ Don't know