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# Information technology — Artificial intelligence — Process management framework for big data analytics

*Technologies de l'information — Intelligence artificielle — Cadre de gestion des processus pour les analyses des megadonnées*

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# Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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# Introduction

This document provides a process management framework for using big data analytics (BDA) across most functions of an organization. The quantum of data, the collection, storage, utilization, technology, the speed of data generation, structure and variety of data cannot be handled by the conventional data handling methods and frameworks.

This document provides a BDA process reference model (BDA PRM) and then provides process assessment model (BDA PAM). The BDA PAM are composed of two dimensions: process dimension that includes processes based on a set of PRMs including the BDA PRM and capability dimension based on process measurement framework (PMF).

This document defines a PRM and PAM as part of the framework for big data analytics, in accordance with the requirements of ISO/IEC 33004:2015 and ISO/IEC 33020:2019, for use in performing a conformity assessment in accordance with the requirements of ISO/IEC 33002:2015.

Primary audiences of this document are implementers of BDA in organizations as well as BDA capability assessors. This document provides five process categories such as organization stakeholder, competency development, data management, analytics development, and technology integration.

This framework can be used for:

— managing the processes that are considered to be best practices;

— enabling risk determination and process improvements of the incumbent organization.

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Value delivered through automation, either prediction, or decision-making support or both using BDA is valuable to organizations. Implementing, improving, and assessing BDA processes based on this document expect benefits such as:

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— competitive advantages;

— better decision-making;

— improve customer experiences;

— sales improvement;

— responsiveness to opportunities and threats;

— mistakes and errors reduction;

— cost reduction.

Clause 5 provides an overview of PRM and Clause 6 details out the specific processes under each process categories for the PRM. Clause 7 provides an overview of the PAM and Clause 8 provides details of process attributes and process performance indicators and Clause 9 provides process capability indicators.

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# Information technology — Artificial intelligence — Process management framework for big data analytics

## 1 Scope

This document provides a framework for developing processes to effectively leverage big data analytics across the organization irrespective of the industries or sectors.

This document specifies process management for big data analytics with its various process categories taken into account along with their interconnectivities. These process categories are organization stakeholder processes, competency development processes, data management processes, analytics development processes and technology integration processes. This document describes processes to acquire, describe, store and process data at an organization level which provides big data analytics services.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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ISO/IEC 33001:2015, *Information technology — Process assessment — Concepts and terminology*

ISO/IEC 33003:2015, *Information technology — Process assessment — Requirements for process measurement frameworks*

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## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 33001:2015 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

**3.1**
**big data**
extensive datasets, primarily in the data characteristics of volume, variety, and either velocity or variability or both, that require a scalable technology for efficient storage, manipulation, management and analysis

Note 1 to entry: Big data is commonly used in many different ways, for example as the name of the scalable technology used to handle big data extensive datasets.

[SOURCE: ISO/IEC 20546:2019, 3.1.2, modified]

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**3.2**
**data analytics**
composite concept consisting of data acquisition, data collection, data validation, data processing, including data quantification, data visualization, and data interpretation

Note 1 to entry: Data analytics is used to understand objects represented by data, to make predictions for a given situation, and to recommend on steps to achieve objectives. The insights obtained from analytics are used for various purposes such as decision-making, research, sustainable development, design, planning, etc.

[SOURCE: ISO/IEC 20546:2019, 3.1.6]

**3.3**
**data governance**
development and enforcement of policies related to the management of data

Note 1 to entry: ISO/IEC 38500 specifies six principles of information technology governance: responsibility; strategy; acquisition; performance; conformance; human behaviour. These principles also apply to data.

[SOURCE: ISO 8000-2:2022, 3.16.1]

**3.4**
**benefit**
advantage to the organization of the actionable knowledge derived from an analytic system

Note 1 to entry: It is often ascribed to big data due to the understanding that data has potential benefit that was typically not considered previously.

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[SOURCE: ISO/IEC 20546:2019, 3.1.1]

**3.5**
**strategic plan**
document specifying how data management is to be aligned to the organizational strategy

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Note 1 to entry: This term has the same meaning as strategic asset management plan (SAMP) defined in ISO 55000:2014 with data point of view.

**3.6**
**base practices**
**BP**
activities that contribute to achieving a specific process purpose and fulfil the process outcomes when consistently performed

**3.7**
**process attributes**
**PA**
process features that can be evaluated on a scale of achievement to provide a process capability measure

**3.8**
**capability level**
set of process assessment indicators that together describe an ability to operate and perform a process at a given capability level

**3.9**
**process attribute rating**
judgement of the degree of achievement of the process attribute for the assessed process

**3.10**
**process**
**process attribute rating**
means of assessing the capabilities addressed by the defined process attributes


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**3.11**
**outcome**
observable result of the successful achievement of the process purpose

## 4 Abbreviated terms

| | |
|---|---|
| BDA | big data analytics |
| PRM | process reference model |
| PAM | process assessment model |
| PMF | process measurement framework |
| BDAP | big data application provider |
| BDFP | big data framework provider |
| BDSP | big data service partner |
| PaaS | platform as a service |
| SaaS | software as a service |
| DevOps | development and operations |
| IP | information product |
| PoC | proof of concept |
| MDM | master data management |
| EDW | enterprise data warehouse |
| API | application programming interface |
| FMEA | failure modes and effects analysis |
| ER | entity relationship |
| SIPOC | supplier input process output customer |
| CTQ | critical to quality |
| KRA | key result area |
| KPI | key process indicator |
| BSC | balance score card |
| RACI | responsible accountable consulted informed |
| CRM | customer relationship management |
| ERP | enterprise resource planning |
| PoS | point of sale |
| HRMS | human resource management software |

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| | |
|---|---|
| PIM | product information management |
| MSE | mean squared error |
| MAPE | mean absolute percentage error |
| MoM | minutes of meeting |
| BFSI | banking financial services and insurance |
| AMC | annual maintenance contract |
| CSM | customer service management |
| OSP | organization stakeholder processes |
| CDP | competency development processes |
| DMP | data management processes |
| ADP | analytics development processes |
| TIP | technology integration processes |
| GP | generic practices |

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## 5 Overview of process reference model

ISO/IEC 33001:2015 defines process reference model (PRM) as a model comprising definitions of processes described in terms of process purpose and outcomes, together with an architecture describing the relationships between the processes. To define a process reference model, the requirements specified in ISO/IEC 33004:2015 should be met. ISO/IEC 33004:2015, Annex A provides detailed requirements. ISO/IEC 33004:2015 requires that processes included in a PRM satisfy specific requirements.

A process description shall meet the following requirements:

a) a process shall be described in terms of its purpose and outcomes;

b) the set of process outcomes shall be necessary and sufficient to achieve the purpose of the process;

c) process descriptions shall not contain or imply aspects of the process quality characteristic beyond the basic level of any relevant PMF in accordance with ISO/IEC 33003:2015.

Figure 1 details the key process categories for advancement of data analytics in an organization. These key process categories interplay with each other in terms of the readiness of an organization to implement and deploy big data analytics.

There are 5 process categories such as organization stakeholder processes, competency development processes, data management processes, analytics development processes and technology integration processes which stand on the foundation of technology infrastructure and are guided by the organizational leadership strategy and culture. The big data analytics processes and their categories are not based on any particular organization and it is not mandated to implement them.

Organization stakeholder processes - organization top management is a key facilitative force in various ways – starting from creating shared understanding for the requirements of data analytics to mapping the benefit of embarking on such projects to strategic goals of the organization. Assignment of decision rights and accountabilities to stakeholders is key to overall success of long-term data analytics projects. The top management should also enable identification of the key data providers, data consumers, application requirements and data quality and management rules to kick start the data analytics

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journey. Defining a data centric culture and mitigation of resistance to change in such a situation should also be addressed.

Competency development processes - data analytics projects need capabilities related to big data application provider (BDAP), big data framework provider (BDFP), big data service partner (BDSP) defined in ISO/IEC 20547-3. These capabilities can either be outsourced or developed from within. If outsourcing is preferred, then one needs additional competency to manage the outsourcing. Hence, relevant capability build-up and continuous maintenance and enhancement is critical for data analytics projects success.

Data management processes - data requires strong management and governance, preferably integrated with IT, information and information security management and governance which includes monitoring of emerging data sources, measurement of data quality metrics and data ownership roles. Privacy, security, policy compliance should be ensured. Specific legal requirement can apply.

Analytics development processes - data analytics development processes include data exploration, data diligence (outlier and missing value), algorithm adjustment and customization, algorithm development, algorithm validation, algorithm fine-tuning, evaluation of population stability index, etc. Analytics development processes, throughout their life cycle, rely on close cooperation with IT function of organization.

Technology integration processes - relevant technology infrastructure is required to implement data analytics. Ensure the results are formatted and optimally presented to target consumers or stakeholders. Capability should be integrated with the functional architecture. Processes to select these functional components and integrating them into the overall data analytics architecture are crucial. These processes include technology maturity evaluation, implementation approach (e.g. leveraging PaaS or SaaS) definition, and configuration or version management (e.g. DevOps).

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Figure 1 shows process categories and processes of big data analytics.

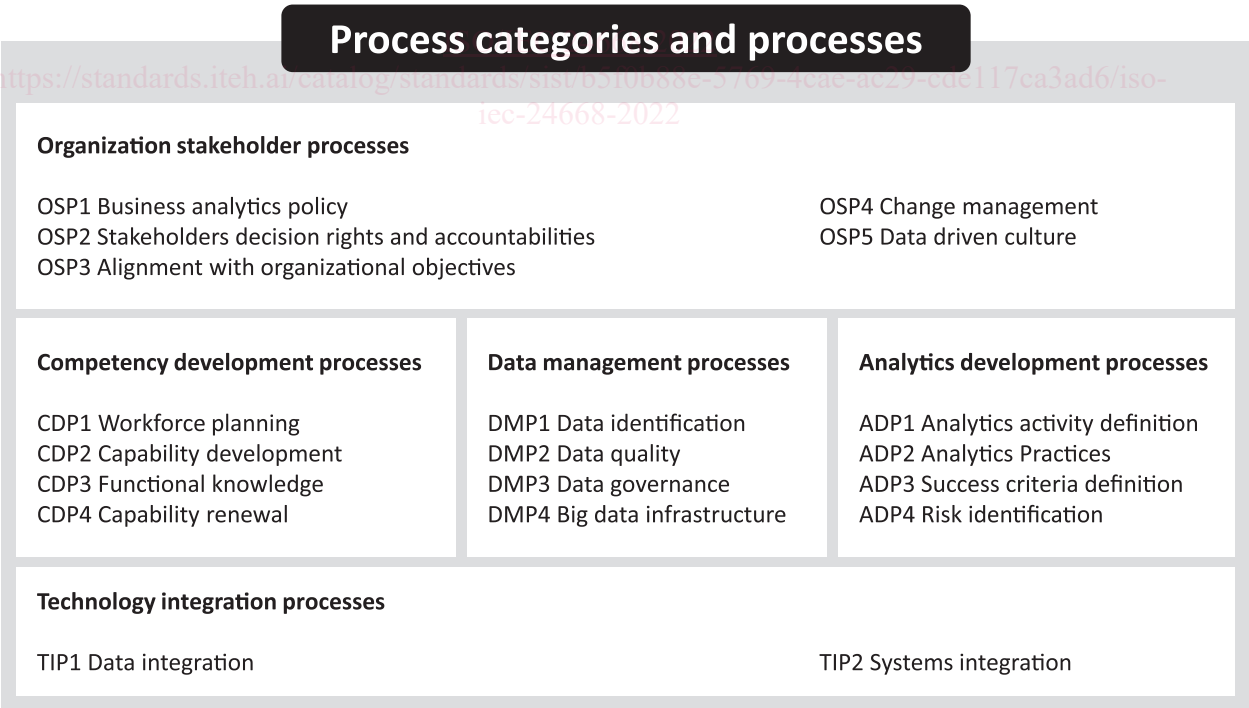


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**Figure 1 — Big data process categories and processes**

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# 6 Process reference model

## 6.1 General

Tables 1 to 19 contain the following descriptive elements according to ISO/IEC/IEEE 24774 for each process in the PRM. The individual processes are stated in terms of process name, process purpose and process outcomes:

a) name: the name of a process is a short noun phrase that summarizes the scope of the process, identifying the principal concern of the process, and distinguishes it from other processes within the scope of the PRM;

b) context: for each process, a brief overview describes the intended context of the application of the process;

c) purpose: the purpose of the process is a high level and overall goal for performing the process;

d) outcomes: Outcomes are measurable, tangible technical or business results that are achieved by a process. They are observable and assessable.

## 6.2 Organization stakeholder processes

Tables 1 to 5 contain the relevant processes related to organization stakeholders:

— Table 1: OSP1 Business analytics policy;

— Table 2: OSP2 Stakeholders decision rights and accountabilities;

— Table 3: OSP3 Alignment with organizational objectives;

— Table 4: OSP4 Change management;

— Table 5: OSP5 Data driven culture.

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**Table 1 — OSP1 Business analytics policy**

| | |
|---|---|
| ID | OSP1 |
| Name | Business analytics policy |
| Context | This process covers establishing business objectives and strategies for the organization specific to big data analytics. This involves analysing the external environment and finalizing the strategic goals and business objectives of the organization. |
| Purpose | The purpose of the OSP1 process is to define a policy for big data analytics initiatives, roadmap and a guideline to implement these initiatives. |
| Outcomes | The outcomes of this process include:<br>a) business objectives, direction and strategies are defined and shared to the organization and relevant stakeholders;<br>b) strategic roadmaps are developed within the constraints of the service provider resources. |


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**Table 2 — OSP2 Stakeholders decision rights and accountabilities**

| | |
|---|---|
| ID | OSP2 |
| Name | Stakeholders decision rights and accountabilities |
| Context | This process covers the assignment of stakeholders who are responsible, accountable, consulted and informed for successful implementation of big data analytics projects and initiatives. |
| Purpose | The purpose of the OSP2 process is to identify and assign specific responsibilities to key stakeholders. |
| Outcomes | The outcomes of this process include:<br>a) key stakeholders are identified with expertise in big data technology and process or domain knowledge;<br>b) assignment of roles and responsibilities are done;<br>c) accountability of the stakeholders is defined;<br>d) succession plan of the roles based on responsibilities are defined. |

**Table 3 — OSP3 Alignment with organizational objectives**

| | |
|---|---|
| ID | OSP3 |
| Name | Alignment with organizational objectives |
| Context | This process covers the alignment of the big data analytics with the overall organization objectives. This is to ensure proper mobilization of resources, planning and arrive at actionable from the recommendations out of analytics outcomes or inferences. |
| Purpose | The purpose of the OSP3 process is to align an organization's big data analytics initiatives with its business strategy. |
| Outcomes | The outcomes of this process include:<br>a) big data analytics initiatives, specific to relevant departments or processes are arrived;<br>b) each of the initiatives is aligned with the stated objectives of departments or processes;<br>c) the high-level initiatives are published across the organization with relevant stakeholders. |

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**Table 4 — OSP4 Change management**

| | |
|---|---|
| ID | OSP4 |
| Name | Change management |
| Context | This process covers the change management amongst the internal stakeholders of the organization. |
| Purpose | The purpose of the OSP4 process is to identify and manage people who are impacted by business analytics initiatives and manage the changes, including resistance and workarounds. |
| Outcomes | The outcomes of this process include:<br>a) big data analytics initiatives or projects are subjected to progress monitoring and reviewed against expected outcomes;<br>b) progress is communicated to stakeholders;<br>c) the impact of the changes, issues and improvement is analysed and reported;<br>d) awareness sessions and trainings are organized across the organization for different roles of stakeholders regarding big data analytics. |

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**Table 5 — OSP5 Data driven culture**

| | |
|---|---|
| ID | OSP5 |
| Name | Data driven culture |
| Context | This process covers the organizations shared values and mission statements depicting the data driven decision making. |
| Purpose | The purpose of the OSP5 process is to create decision making processes based on data, analytics and related set of fact-based systems to attain better strategic intelligence capability. |
| Outcomes | The outcomes of this process include:<br>a) process or business performance always measured in metrics;<br>b) the metrics comprise of leading and lagging indicators;<br>c) quantitative analysis is encouraged with possible statistical correlations;<br>d) possible big data analytics initiatives or projects are discussed and explored on problem or opportunity areas during reviews;<br>e) quick wins or successful initiatives on big data analytics should be rewarded and communicated;<br>f) a framework for piloting ideas exploring big data analytics for current processes or new areas of business should be rolled out (similar to a Kaizen framework in many organizations). |

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## 6.3 Competency development processes

Tables 6 to 9 contain the relevant processes related to competency development:

— Table 6: CDP1 Workforce planning;

— Table 7: CDP2 Capability development;

— Table 8: CDP3 Functional knowledge;

— Table 9: CDP4 Capability renewal.

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**Table 6 — CDP1 Workforce planning**

| | |
|---|---|
| ID | CDP1 |
| Name | Workforce planning |
| Context | This process covers the talent forecasting and resource estimation of the organization for executing big data analytics projects and initiatives. |
| Purpose | The purpose of the CDP1 process is to arrive at plans to ensure availability of workforce and other resources for executing big data analytics projects and initiatives. |
| Outcomes | The outcomes of this process include:<br>a) identify future leaders in big data analytics;<br>b) align relevant responsibilities and craft succession plans in critical roles;<br>c) recruit the right talent. |


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**Table 7 — CDP2 Capability development**

| | |
|---|---|
| ID | CDP2 |
| Name | Capability development |
| Context | This process covers the empowerment and training of employees of the organization for executing big data analytics projects and initiatives. |
| Purpose | The purpose of the CDP2 process is to support people throughout the organization to achieve their plans, objectives and targets through capability enhancement. |
| Outcomes | The outcomes of this process include:<br>a) understand and develop the underlying capabilities of the organization;<br>b) evaluate the set of results achieved to improve future performance and provide sustainable benefits to all their stakeholders;<br>c) recognize their efforts and achievements in a timely and appropriate manner |

**Table 8 — CDP3 Functional knowledge**

| | |
|---|---|
| ID | CDP3 |
| Name | Functional knowledge |
| Context | This process covers the identification and deployment of industry domain workforce as part of the big data analytics teams at all levels. |
| Purpose | The purpose of the CDP3 process is to encourage the BDA leaders to learn quickly and rapidly respond with accountability in their individual enhanced role. |
| Outcomes | The outcomes of this process include:<br>a) encourage stakeholders to participate in activities that contribute to the wider acceptance to big data analytics initiative across the organization;<br>b) use approaches to understand, anticipate and respond to the different needs and expectations from big data analytics implementation team;<br>c) promote a culture which supports the generation of new ideas and new ways of thinking to encourage innovation though big data analytics. |

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**Table 9 — CDP4 Capability renewal**

| | |
|---|---|
| ID | CDP4 |
| Name | Capability renewal |
| Context | This process covers identification, analysis and understanding of external indicators, such as global and local economic, market or societal and technology trends, which can affect the organization and translate these into potential future scenarios for big data analytics initiative. |
| Purpose | The purpose of the CDP4 process is to use a structured approach for generating and prioritizing creative ideas and allocating resources to execute them innovatively within appropriate timescales with updated tools and techniques of big data analytics. |
| Outcomes | The outcomes of this process include:<br>a) identify, evaluate and develop new and emerging technology portfolio to improve the agility of organization;<br>b) establish and manage learning and collaboration networks to identify opportunities for creativity, innovation and improvement in technology and human resources. |

## 6.4 Data management processes

Tables 10 to 13 contain the relevant processes related to data management:

— Table 10: DMP1 Data identification;

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