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BASEL II

Operational Risk Management

Process Assessment Model

Version 1.00

GRIF PROJECT
Basel II – Operational Risk Management:
Process Assessment Model

COMMISSION de SURVEILLANCE
du SECTEUR FINANCIER
LUXEMBOURG

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1   Introduction

1.1 Operational Risk in Financial Sector

Reference: « Sound Practices for the Management and Supervision of Operational Risk »
from Basel Committee (February 2003)

Deregulation and globalisation of financial services, together with the growing sophistication of financial technology, are making the activities of banks and thus their risk profiles (i.e. the level of risk across a firm's activities and/or risk categories) more complex. Developing banking practices suggest that risks other than credit, interest rate and market risk can be substantial. Examples of these new and growing risks faced by banks include:

- If not properly controlled, the greater use of more highly automated technology has the potential to transform risks from manual processing errors to system failure risks, as greater reliance is placed on globally integrated systems;
- Growth of e-commerce brings with it potential risks (e.g., internal and external fraud and system security issues) that are not yet fully understood;
- Large-scale acquisitions, mergers, de-mergers and consolidations test the viability of new or newly integrated systems;
- The emergence of banks acting as large-volume service providers creates the need for continual maintenance of high-grade internal controls and back-up systems; and
- Growing use of outsourcing arrangements and the participation in clearing and settlement systems can mitigate some risks but can also present significant other risks to banks.

The diverse set of risks listed above can be grouped under the heading of "operational risk", defined by the Basel Committee on Banking Supervision as "the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events".

1.2 Process Reference Model

Reference: ISO/IEC 12207:1995/FDAM 1:2002 (E) page 2

This framework provides a Process Reference Model in accordance with the requirements of ISO/IEC 15504-2. A Process Reference Model provides definitions of processes described in terms of process purpose and outcomes, together with an architecture describing relationships between the processes. It does not represent a particular process implementation approach nor does it prescribe a risk management system/software, methodology or technique. Instead the reference model is intended to be tailored by a bank based on its business needs and its areas of application. The reference model's purpose and outcomes are indicators demonstrating whether the banks' processes are being achieved. These indicators are useful to process assessors in order to determine the capability of a bank's implemented process and to provide source material to plan organizational process improvement.

Operational Risk Management processes are described in this paper in terms of achievements of defined Purposes and Outcomes describing processes a bank can use to manage the operational risks. The reference model is also used to provide a common basis for different models and methods for Bank Process Assessment, ensuring that the result of the assessment can be reported in a common context.

1.3 PRM List of processes

BANK

PRIMARY
Operational Risk Processes

Basic Operational Risk Analysis (BORA)
BORA.1 Operational Risk Identification
BORA.2 Operational Risk Assessment

Basic Operational Risk Operation (BORO)
BORO.1 Operational Risk Mitigation/Control
BORO.2 Operational Risk Monitoring

Operational Continuity Mgt (OCM)

Outsourcing Risk Management (ORM)

ORGANIZATIONAL
Operational Risk Processes

Management (MAN)
MAN.1 Organizational Alignment
MAN.2 Organizational Management

Process Improvement Mgt (PIM)
PIM.1 Process Establishment
PIM.2 Process Assessment
PIM.3 Process Improvement

SUPPORTING Operational Risk Processes

Configuration Management (CONF)

Internal Review (REV)

Historical Loss Data Management (HLDM)
HLDM.1 Historical Loss Data Collection
HLDM.2 Measurement

2 Description of processes

2.1 Foreword

The strategy defined in the process outcomes characterizes the mission statement:
- Goal
- Mission of the process
- Awareness of the people involved in the process.

The strategy of the Operational Risk Management project helps to define the tools (e.g. software, working practices) to use in the different processes, the links required between them and the goal to reach.

2.2 BORA Basic Operational Risk Analysis

2.2.1 BORA.1 Operational Risk Identification

Process ID	BORA.1
Process Name	**Operational Risk Identification**
Process Purpose	The purpose of the Operational Risk Identification process is to identify operational risks inherent in all material products, activities, processes and systems of the bank. NOTE 1: The successful implementation of Operational Risk Identification process is paramount for the subsequent continuation of a viable operational risk management process. NOTE 2: The scope of operational risk identification process must cover all the bank's organisation i.e. in all the bank's activities and all the bank's establishments; NOTE 3: Self-or risk-assessment, risk indicators, analysis of problems occurred and measurement are some possible techniques used by banks for identifying operational risk. These techniques may highlight the existence of "new" risks or increased risk exposure.
Process Outcomes	As a result of successful implementation of Operational Risk Identification: 1. an operational risk identification strategy is developed, including the principles of how operational risk is to be identified, according to the size, the sophistication, the nature and the complexity of the bank's activities; NOTE 1: Policy outlining the bank's approach to identify operational

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<table>
<tr><td></td><td>risk must be defined;</td></tr>
<tr><td></td><td>2. context in which bank work is identified, analyzed and understood;</td></tr>
<tr><td></td><td>3. the most important core business activities for the bank, where no disruption is allowed, are identified and analyzed;</td></tr>
<tr><td></td><td>4. internal and external factors that could adversely affect the achievement of the bank's objectives are identified and analyzed; and</td></tr>
<tr><td></td><td>5. the possible new risks are identified before new products, activities, processes, systems or major changes are introduced.</td></tr>
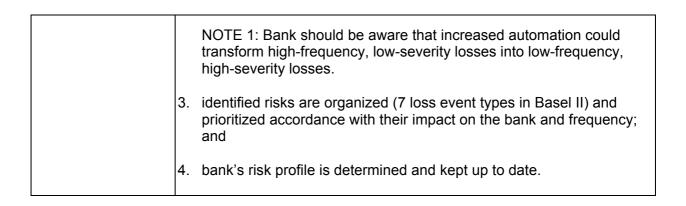</table>

2.2.2 BORA.2 Operational Risk Assessment

Process ID	BORA.2
Process Name	Operational Risk Assessment
Process Purpose	The purpose of the Operational Risk Assessment process is to qualitatively assess identified operational risks.
	NOTE 1: The assessment process outcomes need to be validated through comparison to actual internal loss experience, relevant external data and appropriate adjustments made.
	NOTE 2: The output of the bank's internal operational risk assessment system must be an integral part of the processes of operational risk mitigation and monitoring.
	NOTE 3: Self or risk assessment, risk mapping, risk indicator are some possible useful assessment indicators and; measurement and scorecards are possible techniques used by banks for assessing operational risk.
Process Outcomes	As a result of successful implementation of Operational Risk Assessment:
	1. a operational risk assessment strategy is developed, including the principles of how operational risk is to be assessed, according to the size, the sophistication, the nature and the complexity of the bank's activity;
	NOTE 1: an operational firm-assessment policy outlining the bank's approach to assess operational risk must be defined.
	2. bank is aware of the loss exposure (qualitatively) of each identified risk on its business;

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NOTE 1: Bank should be aware that increased automation could transform high-frequency, low-severity losses into low-frequency, high-severity losses.

3. identified risks are organized (7 loss event types in Basel II) and prioritized accordance with their impact on the bank and frequency; and

4. bank's risk profile is determined and kept up to date.

2.3 BORO Basic Operational Risk Operation

2.3.1 BORO.1 Operational Risk Mitigation/Control

Process ID	BORO.1
Process Name	**Operational Risk Mitigation/Control**
Process Purpose	The purpose of the Operational Risk Mitigation/Control process is to mitigate the assessed operational risks and to manage operational risk impact. NOTE 1: Severity and impact of a loss event on bank's business is only reduced if the Operational Risk Mitigation/Control process and Operational Risk Monitoring process are successfully implemented. NOTE 2: The results of Measurement process should be useful for the effectiveness of this process. In AMA, it's mandatory NOTE 3: The output of the bank's internal risk assessment system must be an integral part of the process of controlling the banks operational risk profile.
Process Outcomes	As a result of successful implementation of Operational Risk Mitigation/Control: 1. an operational risk mitigation and control strategy is developed, including the principles of how operational risk is to be mitigated and how its realization is to be control, according to the size, the sophistication, the nature and the complexity of the bank's activity; NOTE 1: an operational firm-mitigation policy outlining the bank's approach to mitigate operational risk must be defined. 2. the existing option to mitigate risk are analysed and, for each risk, the most in accordance with bank's strategy is chosen; NOTE 1: it's possible to apply more than one option for a specific

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operational risk.

NOTE 2: existing options are:
- acceptance: risk is retained by the organisation.
- transfer: transferring, partially or totally, the risk to another organisation (insurance is an example).
- control: reducing the likelihood and/or consequences of the risk.
- stop/reduction business activity: deciding to not carry on the proposed activities due to risk being unacceptable or finding another alternative that is more acceptable.

3. changes in bank's organization and activities to mitigate risks are planned and implemented in accordance with bank's risk profile;

NOTE 1: Segregation of duties and minimization of potential conflict interest is an major change to mitigate operational risks

NOTE 2: Risk mitigation tools or program can be used to reduce the exposures to, or frequency, high severity low-losses which may occur as a result of such events (low frequency high-severity). However, risk mitigation tools are complementary to, rather than a replacement for, thorough internal operational risk control.

4. residual risks resulting from mitigation actions are identified to ensure the day-to-day tracking of those risks;

5. a risk achievement control policy is developed and communicated to all people involved in bank's operational activities; and

6. corrective actions are performed when a risk is under way and the performance of these actions are tracked until risk is completed.

2.3.2 BORO.2 Operational Risk Monitoring

Process ID	BORO.2
Process Name	**Operational Risk Monitoring**
Process Purpose	The purpose of the Operational Risk Monitoring process is to provide, in a timely manner, relevant information to ensure effectiveness of operational risk management. NOTE 1: The output of the bank's internal risk assessment system must be an integral part of the process of monitoring the banks operational risk profile. NOTE 2: The output of measurement process should be useful to monitoring activities efficiency. In AMA, it's mandatory

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Process Outcomes	As a result of successful implementation of Operational Risk Monitoring:
	1. an operational risk monitoring strategy is developed, including the principles of how operational risk is to be monitored, according to the size, the sophistication, the nature and the complexity of the bank's activity;
	2. monitoring information (e.g. risk indicators) are identified, collected, recorded and updated;
	NOTE 1: When thresholds are directly linked to these indicators an effective monitoring process can help identify key material risks in a transparent manner and enable the bank to act upon these risks appropriately.
	3. information contained in the reports and the frequency of reports are suitable regarding the profile of the recipients;
	4. conditions in which special reports (e.g. urgency, alert) must be issued quickly as well as procedure to generate and convey them are defined; and
	5. the reporting of information to all people concerned by operational risk management is performed.
	NOTE 1: Board of directors, senior management and business unit management should be kept informed of loss experiences and material operational losses to enable the bank's overall operational risk profile and to support proactive management of operational risk.
	NOTE 2: Reports should be analysed with a view to improving existing risk management performance as well as developing new risk management practices, policy and procedure(PIM processes).
	NOTE 3: Reports generated by or for supervisory authorities should likewise be reported internally to senior management and board of director where appropriate.

2.4 OCM Operational Continuity Management

Process ID	**OCM**
Process Name	**Operational Continuity Management**
Process Purpose	The purpose of the Operational Continuity Management process is to support the overall Business Continuity Management process by

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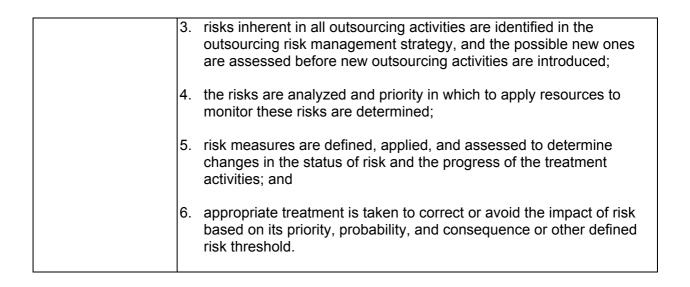|	
	ensuring that the required operational facilities can be recovered within required, and agreed, business timescales. *(Ref. OGC Service Delivery § 7.1.2 Goal)*
Process Outcomes	As a result of successful implementation of the Operational Continuity Management: 1. an OCM strategy is developed and OCM project development and control structures are defined; 2. Business Impact Analysis (BIA) is performed to identify bank's dependence on technology, its Infrastructure and any external providers of support services; 3. the likelihood that a disaster or other serious service disruption will actually occur is determined; NOTE 1: This is an assessment of the level of threat and the extent to which an organisation is vulnerable to that threat. 4. the OCM plan is defined, developed and periodically tested; and 5. the effectiveness of the OCM plan is guaranteed and tested.

2.5 ORM Outsourcing Risk Management

Process ID	**ORM**
Process Name	**Outsourcing Risk Management**
Process Purpose	The purpose of the Outsourcing Risk Management process is to identify, manage and mitigate the operational risks specific in outsourcing activities. NOTE 1: A bank's use of third parties does not diminish the responsibility of the board of directors to ensure that the third-party activity is conduced in a sound and safe manner and compliance with applicable laws.
Process Outcomes	As a result of successful implementation of Outsourcing Risk Management: 1. appropriate outsourcing risk management strategy is defined and implemented, in accordance with bank's risk profile; 2. all subcontractors are identified, their risk management system are analyzed, and contracts (SLA) are established with selected subcontractors;

	3. risks inherent in all outsourcing activities are identified in the outsourcing risk management strategy, and the possible new ones are assessed before new outsourcing activities are introduced;
	4. the risks are analyzed and priority in which to apply resources to monitor these risks are determined;
	5. risk measures are defined, applied, and assessed to determine changes in the status of risk and the progress of the treatment activities; and
	6. appropriate treatment is taken to correct or avoid the impact of risk based on its priority, probability, and consequence or other defined risk threshold.

2.6 MAN Management

2.6.1 MAN.1 Organizational Alignement

Process ID	MAN.1
Process Name	Organizational Alignment
Process Purpose	The purpose of the Organizational Alignment process is to enable the operational risk management processes needed by the bank to ensure the execution of mission critical activities, to be consistent with its business goals and its risk profile.
Process Outcomes	As a result of successful implementation of the Organizational Alignment: 1. a new strategic vision, which include operational risk management, is developed; 2. the process framework is identified and defined that include a set of operational risk processes needed to achieve the business goals of the bank; 3. a strategy is defined for process definition, implementation and improvement; and support is provided to enable this strategy; 4. the bank's mission, core values, visions, goals and objectives are made known for all employees; 5. individuals in the bank share a common vision, culture, and understanding of the business goals to empower them to function effectively; and

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	6. each individual in the bank understands their role in achieving the goals of the business and is able to perform that role.

2.6.2 MAN.2 Organizational Management

Process ID	MAN.2
Process Name	**Organizational Management**
Process Purpose	The purpose of the Organizational Management process is to establish and perform operational risk management practices, during the performance of the processes needed for ensuring the execution of mission critical activities, that are consistent with the business goals of the organization. NOTE 1: operational risk management processes must be implemented in a business context and to be effective, require an appropriate organizational environment NOTE 2: In practice, the Committee recognizes that the audit function at some banks (particularly smaller banks) may have initial responsibility for developing an operational risk management program. Where this is the case, banks should see that responsibility for day-to-day operational risk management is transferred elsewhere in a timely manner.
Process Outcomes	As a result of successful implementation of the Organizational Management: 1. the bank will invest in the appropriate management infrastructure; 2. the best practices are identified to support the implementation of effective operational risk management; and 3. provide a basis for evaluating the achievement of bank business goals based on these risk management practices.

2.7 PIM Process Improvement Management

2.7.1 PIM.1 Process Establishment

Process ID	PIM.1
Process Name	**Process Establishment**
Process Purpose	The purpose of the Process Establishment process is to establish a suite of bank's standard processes for operational risk management as they apply to the banking activities.
Process Outcomes	As a result of successful implementation of the Process Establishment: 1. a defined and maintained standard set of processes are established, along with indication of each process's applicability; 2. the detailed tasks, activities and associated work products of the standard process are identified, together with expected performance characteristics; 3. a strategy for tailoring the standard process is developed in accordance with the needs of the bank's department; and 4. information and data related to the use of the standard process for specific bank department exist and are maintained.

2.7.2 PIM.2 Process Assessment

Process ID	PIM.2
Process Name	**Process Assessment**
Process Purpose	The purpose of the Process Assessment process is to determine the extent to which the bank's standard processes for operational risk management contribute to the achievement of its business goals and to help the bank focus on the need for continuous process improvement.
Process Outcomes	As a result of successful implementation of the Process Assessment: 1. information and data related to the use of the standard process for specific bank department will exist and be maintained; 2. the relative strengths and weaknesses of the bank's standard processes are understood; and

	3. accurate and accessible assessment records are kept and maintained.

2.7.3 PIM.3 Process Improvement

Process ID	PIM.3
Process Name	**Process Improvement**
Process Purpose	The purpose of the Process Improvement process is to continually improve the bank's operational risk management effectiveness and efficiency thought the processes used and aligned with the business need.
Process Outcomes	As a result of successful implementation of the Process Improvement: 1. commitment is established to provide resources to sustain improvement actions; 2. issues arising from the bank's internal / external environment are identified as improvement opportunities and justified as reasons for change; NOTE 1: information sources providing input for change may include: process assessment results, internal audits, bank's effectiveness / efficiency. 3. analysis of the current status of the existing process is performed, focusing on those processes from which improvement stimuli arise, resulting in improvement objectives for the process being established; NOTE 1: the analysis may include process assessment. 4. the improvement objectives are prioritized, and consequent changes to the process are defined, planned and implemented; 5. the effects of process changes implementation are monitored, measured and confirmed against the defined improvement goals; 6. knowledge gained from the improvement is communicate within the bank; and 7. the improvements made are evaluated and consideration given for using the solution elsewhere within the organization.

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2.8 HLDM Historical Loss Data Management

2.8.1 HLDM.1 Historical Loss Data Collection

Process ID	**HLDM.1**
Process Name	**Historical Loss Data Collection**
Process Purpose	The purpose of the Historical Loss Data Collection process is to collect and maintain the integrity of relevant loss data, and make them available to concerned processes. NOTE 1: For AMA, the tracking of internal loss data is an essential prerequisite to development and functioning of a credible operational risk measurement system
Process Outcomes	As a result of successful implementation of the Historical Loss Data Collection: 1. a historical loss data collection strategy is developed, including the principles of how loss data is to be managed, according to the size, the sophistication, the nature and the complexity of the bank's activity; 2. loss events and information collected about these loss events are specified; 3. all loss data generated by bank's process are collected, and the completeness and consistency of the loss data is ensured; NOTE 1: A bank must have documented procedure for assessing the on-going relevance of historical loss data. 4. loss data can be mapped in 8 business lines (defined in Basel II) and made available for relevant processes; and NOTE 1: on demand of national banking supervisors, a bank must be able to map its internal loss data with Basel II categories. 5. storage and handling of the internal loss data are controlled.

2.8.2 HLDM.2 Measurement

Process ID	**HLDM.2**
Process Name	**Measurement**

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Process Purpose	The purpose of the Measurement process is to determine regulatory capital requirement, based on a formal and quantitative understanding of operational risks and their related losses. NOTE 1: A bank's risk measurement system must be sufficiently 'granular' to capture the major drivers of operational risk affecting the shape of the tail of loss estimates. NOTE 2: An effective way of making good use of this information is to establish a framework for systematically tracking the frequency, the severity and others relevant information on individual loss events. NOTE 3: The output of the bank's internal risk measurement system must be an integral part of the processes of monitoring and mitigating/controlling the bank's operational risk profile.
Process Outcomes	As a result of successful implementation of the Measurement: 1. a measurement strategy is developed, including the principles of how operational risk is to be measured, according to the size, the sophistication, the nature and the complexity of the bank's activity; NOTE 1: an operational firm-measurement methodology and policy outlining the bank's approach to measure operational risk must be defined. NOTE 2:The Basel Committee is not specifying the approach or distributional assumptions used to generate the operational risk measure for regulatory capital purpose. NOTE 3: a bank needs to have a credible, transparent, verifiable and documented approach for weighting the internal data, external data, scenario analysis and others factors. This weighting must be documented and well reasoned. NOTE 4: a bank must have a systematic process for determining the methodologies used to incorporated data (e.g. scaling qualitative adjustments, or informing the development of improves scenario analysis). 2. internal loss data and loss data generated and/or communicated by others banks are identified, and the relevance of the loss data is ensured; NOTE 1: external loss data should include all information that would help in assessing the relevance of the loss event for other banks. NOTE 2: external loss data should include information on actual loss amounts, the scale of business operations where the event occurred, the causes of the loss events and the circumstances of the loss events. NOTE 3: a bank must have a systematic process for determining the situations for which external data must be used. The conditions and practices for external data must be reviewed and documented.

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3. the bank risk assessment is more forward-looking and reflect directly the quality of bank's control and operating environments;

4. loss data are used to perform operational risk measures which provide an objective basis for supporting Basic Operational Risk Analysis group (BORA) and regulatory capital requirement measurement;

   NOTE 1: A bank must demonstrate that its operational risk measure meets a soundness standard comparable to that of the internal ratings-based approach for credit risk (ie comparable to a one year holding period and a 99,9 percentile confidence interval).

   NOTE 2: a minimum five-year observation period of internal loss data is required whether the internal loss data is used directly to build the loss measure or validate it. But the first time, a three-year historical data windows is acceptable.

   NOTE 3: The sensitivity of a bank's risk estimates to changes in the factors need to be well reasoned.

5. internal loss data can be mapped in 8 business lines and 7 loss event types (defined in Basel II) and made available for relevant processes; and

   NOTE 1: on demand of national banking supervisors, a bank must be able to map its internal loss data with Basel II categories.

6. storage and handling of the external loss data are controlled;

2.9 CONF Configuration Management

Process ID	CONF
Process Name	Configuration Management
Process Purpose	The purpose of the Configuration Management process is to ensure the integrity of all operational services and infrastructure components, with their associated documentation; and to provide an information service to facilitate the effective and efficient identification, assessment, control of operational risks.
Process Outcomes	As a result of successful implementation of the Configuration Management: 1. a configuration management strategy is developed;

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	2. a configuration management system is implemented in accordance with defined strategy;
	3. configuration item (CI) are identified, selected, classified, labelled, assigned, linked as appropriate and baselined during the all life cycle (comparison point);
	NOTE 1: Configuration item should include systems, people, internal processes, associated documentation and all material useful for operational risk management.
	4. modifications of the configuration items are controlled;
	5. modifications are made available to affected processes;
	6. all current and historical data (status) associated to configuration items are recorded, documented, reported and kept available;
	7. the completeness and consistency of the configuration items are under control and verified; and
	8. storage and handling of configuration items are controlled.

2.10 REV Internal Review

Process ID	**REV**
Process Name	**Internal Review**
Process Purpose	The purpose of the Internal Review process is to independently determine compliance of selected procedures and processes with the requirements, plans and agreement, as appropriate.
Process Outcomes	As a result of successful implementation of the Internal Review: 1. an internal review strategy is developed and implemented; 2. compliance of selected activity work products and/or processes with requirements, plans and agreement is determined according to the internal review strategy; NOTE 1: Areas of potential conflicts of interest should be subject to careful independent review. 3. the conduct of reviews by an operationally independent, appropriately trained and competent staff are performed; 4. problems detected during an review are identified and communicated

	to those responsible for corrective action, and resolution; and
	5. knowledge gained from the process review is communicated within the bank.

3 Process capability indicators for level 1 to 4

3.1 Foreword

This section presents the process attribute indicators (PAI's) related to the process attributes associated with capability levels defined in part 2 of ISO\IEC 155504. PAI's are the indicators of process capability and are the means of achieving the capabilities addressed by the considered process attributes. Evidence of PAI's supports the judgment of the degree of achievement of the process attribute.

The following of this section is a modified and trimmed version of the section 6 in part 5 of ISO\IEC 15504. The indicators related to capability level 5 which are not relevant for assessment of Basel II requirements, have been deleted. And, in a general way, the indicators related with others capability levels have been reviewed and modified to match the requirements and the vocabulary of Basel II framework.

So, we're going to describe the process attribute indicators for the 7 attributes included in the capability dimension for level 1 to 4.

Level 0 does not include any type of indicators, as it reflects a non-implemented process or a process which fails to partially achieve any of its outcomes.

NOTE In the next paragraphs, 15504-2 process attribute definitions and attribute outcomes are identified with italic font.

3.2 Level 1: Performed process

3.2.1 PA 1.1 Process Performance Attribute

The process performance attribute is a measure of the extent to which the process purpose is achieved. As a result of full achievement of this attribute:

> *a) the process achieves its defined outcomes.*

3.2.1.1 Generic Practice Indicator for PA 1.1

> **GPI 1.1.1 Achieve the process outcomes**. Ensure the achievement of the process outcomes through the performance of base practices that produce work products.

3.3 Level 2: Managed process

The previously described *Performed process* is now implemented in a managed fashion (planned, monitored and adjusted) and its work products are appropriately established, controlled and maintained.

The following attributes of the process demonstrate the achievement of this level:

3.3.1 PA 2.1 Performance management attribute

The performance management attribute is a measure of the extent to which the performance of the process is managed. As a result of full achievement of this attribute:

> *a) objectives for the performance of the process are identified;*
>
> *b) performance of the process is planned and monitored;*
>
> *c) performance of the process is adjusted to meet plans;*
>
> *d) responsibilities and authorities for performing the process are defined, assigned and communicated;*
>
> *e) resources and information necessary for performing the process are identified, made available, allocated and used;*
>
> *f) interfaces between the involved parties are managed to ensure both effective communication and also clear assignment of responsibility.*

3.3.1.1 Generic Practice Indicators for PA 2.1

GPI 2.1.1 Identify the objectives for the performance of the process. Performance objectives may include – (1) quality of the artefacts produced, (2) process cycle time and (3) resource usage.

Performance objectives are identified based on process requirements.

Assumptions and constraints are considered when identifying the performance objectives.

GPI 2.1.2 Plan the performance of the process to fulfil the identified objectives.

Plan(s) for the performance of the process are developed.

Responsibilities, commitments and authorities to perform the process are defined, assigned and communicated.

Key milestones for the performance of the process are established.

Schedule is defined and aligned with the approach to performing the process.

Process work product reviews are planned.

Responsibilities and authorities to verify process work products are defined and assigned.

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GPI 2.1.3 Monitor and control the performance of the process.

The process is performed according to the plan(s).

Process performance is monitored to ensure planned results are achieved.

Appropriate actions are taken when planned results are not achieved.

The plan(s) are adjusted, as necessary.

Rescheduling is performed as necessary.

GPI 2.1.4 Allocate and use resources to perform the process according to plan.

The human and infrastructure resources necessary for performing the process are identified, made available, allocated and used.

The information necessary to perform the process are identified and made available.

The responsibilities are allocated to, and accepted by human resources.

The necessary infrastructure and facilities are identified and made available.

GPI 2.1.5 Manage the interfaces between involved parties.

The individuals and groups involved in the process performance are determined.

Responsibilities of the involved parties are assigned.

Interfaces between the involved parties are managed.

Communication is assured between the involved parties.

3.3.2 PA 2.2 Work product management attribute

The work product management attribute is a measure of the extent to which the work products produced by the process are appropriately managed. As a result of full achievement of this attribute:

> *a) requirements for the work products of the process are defined;*
>
> *b) requirements for documentation and control of the work products are defined;*
>
> *c) work products are appropriately identified, documented, and controlled;*
>
> *d) work products are reviewed in accordance with planned arrangements and adjusted as necessary to meet requirements.*

NOTE 1 Requirements for documentation and control of work products may include requirements for the identification of changes and revision status, approval and re-approval of work products, and the creation of relevant versions of applicable work products available at points of use.

NOTE 2 The work products referred to in this clause are those that result from the achievement of the process outcomes.

3.3.2.1 Generic Practice Indicators for PA 2.2

GPI 2.2.1 Define the requirements for the work products.

The requirements for the work products to be produced are defined.

Quality criteria of the work products are identified.

Appropriate review and approval criteria for the work products are defined.

GPI 2.2.2 Define the requirements for documentation and control of the work products.

Requirements for the documentation and change control of the work products are defined. Various degrees of control may be appropriate depending on the specific aspects of the work products. Specific identification may be necessary when traceability is a requirement.

Dependencies between work products are identified and defined.

GPI 2.2.3 Identify, document and control the work products.

The work products are documented and controlled in accordance with requirements.

The work products to be controlled are identified.

The work products are controlled.

The work products are made available through appropriate access mechanisms.

The revision status of the work products may readily be ascertained.

Change control is established for controlled work products.

GPI 2.2.4 Review and adjust work products to meet the defined requirements.

Work products are reviewed and approved according to defined requirements.

Work products are reviewed according to planned arrangements.

Issues arising from work product reviews are resolved.

3.4 Level 3: Established process

The previously described *Managed process* is now implemented using a defined process capable of achieving its process outcomes

The following attributes of the process demonstrate the achievement of this level:

3.4.1 PA 3.1 Process definition attribute

The process definition attribute is a measure of the extent to which a standard process is maintained to support the deployment of the defined process. As a result of full achievement of this attribute:

> *a) a standard process, including appropriate tailoring guidelines, is defined that describes the fundamental elements that must be incorporated into a defined process;*
>
> *b) the sequence and interaction of the standard process with other processes are determined;*
>
> *c) required competencies and roles, for performing a process are identified as part of the standard process;*
>
> *d) required infrastructure and work environment for performing a process are identified as part of the standard process;*
>
> *e) suitable methods for monitoring the effectiveness and suitability of the process are determined.*

NOTE 1 A standard process may be used as-is when deploying a defined process, in which case tailoring guidelines would not be necessary.

3.4.1.1 Generic Practice Indicators for PA 3.1

GPI 3.1.1 Define the standard process that will support the deployment of the defined process.

A standard process is developed that includes the fundamental process elements.

The standard process identifies the deployment needs and deployment context.

Guidance and/or procedures are provided to support implementation of the process as needed.

Appropriate tailoring guideline(s) are available as needed.

GPI 3.1.2 Determine the sequence and interaction between processes so that they work as an integrated system of processes.

The standard process's sequence and interaction with other processes are determined.

Deployment of the standard process as a defined process maintains integrity of processes.

GPI 3.1.3 Identify the authorities, roles, responsibilities and competencies for performing the process.

Process performance authorities, roles and responsibilities are identified.

Process performance competencies are identified.

GPI 3.1.4 Identify the required infrastructure and work environment for performing the process.

Process infrastructure components are identified (facilities, tools, networks, methods, etc).

Work environment requirements are identified.

GPI 3.1.5 Determine suitable methods to monitor the effectiveness and suitability of the process.

Criteria for process effectiveness and suitability are defined.

Methods for monitoring the effectiveness and suitability of the process are determined.

Appropriate criteria and data needed to monitor the effectiveness and suitability of the process are defined.

The need to establish the characteristics of and/or trends in the process is considered.

The need to conduct internal audit and management review is established.

3.4.2 PA 3.2 Process deployment attribute

The process deployment attribute is a measure of the extent to which the standard process is effectively deployed as a defined process to achieve its process outcomes. As a result of full achievement of this attribute:

> *a) a defined process is deployed based upon an appropriately selected and/or tailored standard process;*
>
> *b) required roles, responsibilities and authorities for performing the defined process are assigned and communicated;*
>
> *c) personnel performing the defined process are competent on the basis of appropriate education, training, and experience;*
>
> *d) required resources and information necessary for performing the defined process are made available, allocated and used;*
>
> *e) required infrastructure and work environment for performing the defined process are made available, managed and maintained;*
>
> *f) appropriate data are, collected and analysed as a basis for understanding the behaviour of, and to demonstrate the suitability and effectiveness of the process, and to evaluate where continuous improvement of the process can be made.*

NOTE 1 Competency results from a combination of knowledge, skills and personal attributes that are gained through education, training and experience.

3.4.2.1 Generic Practice Indicators for PA 3.2

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GPI 3.2.1 Deploy a defined process that satisfies the context specific requirements of the use of the standard process.

The defined process is appropriately selected and/or tailored from the standard process.

Conformance of defined process with standard process requirements is verified.

GPI 3.2.2 Assign resources and information to deploy the defined process.

The required resources and information are made available, allocated and used.

Required roles, responsibilities and authorities are assigned and communicated.

GPI 3.2.3 Ensure necessary competencies for performing the defined process.

Appropriate competencies for assigned personnel are identified.

Suitable training is available for those deploying the defined process.

GPI 3.2.4 Provide adequate process infrastructure to support the performance of the defined process.

Required infrastructure and work environment is available.

Organizational support to effectively manage and maintain the infrastructure and work environment is available.

Infrastructure and work environment is used and maintained.

GPI 3.2.5 Collect and analyse data about performance of the process to demonstrate its suitability and effectiveness.

Data required to understand the behaviour, suitability and effectiveness of the defined process are identified.

Data are collected and analysed to understand the behaviour, suitability and effectiveness of the defined process.

Results of the analysis are used to identify where continual improvement of the process can be made.

3.5 Level 4: Predictable process

The previously described *Established process* now operates within defined limits to achieve its process outcomes.

The following attributes of the process demonstrate the achievement of this level:

3.5.1 PA 4.1 Process measurement attribute

The process measurement attribute is a measure of the extent to which measurement results are used to ensure that performance of the process supports the achievement of relevant process performance objectives in support of defined business goals. As a result of full achievement of this attribute:

> *a) process information needs in support of relevant business goals are established;*
>
> *b) process measurement objectives are derived from identified process information needs;*
>
> *c) quantitative objectives for process performance in support of relevant business goals are established;*
>
> *d) measures and frequency of measurement are identified and defined in line with process measurement objectives and quantitative objectives for process performance;*
>
> *e) results of measurement are collected, analysed and reported in order to monitor the extent to which the quantitative objectives for process performance are met;*
>
> *f) measurement results are used to characterise process performance.*

NOTE 1 Information needs may typically reflect management, technical, project, process or product needs.

NOTE 2 Measures may be either process measures or product measures or both.

3.5.1.1 Generic Practice Indicators for PA 4.1

GPI 4.1.1 Identify process information needs, in relation with business goals.

Business goals relevant to establishing quantitative process measurement objectives for the process are identified.

Process stakeholders are identified and their information needs are defined.

Information needs support the relevant business goals.

Process measurement objectives to satisfy defined process information needs are defined.

GPI 4.1.2 Establish quantitative objectives for the performance of the defined process, according to the alignment of the process with the business goals.

Process performance objectives and related work product characteristics are defined in accordance and explicit relation to business goals.

Process performance objectives are verified with organizational management and process owner(s) to be realistic and useful.

GPI 4.1.3 Identify product and process measures which support the achievement of the quantitative objectives for process performance.

Detailed measures are defined to support monitoring, analysis and verification needs of process and work product goals.

Measures to satisfy process measurement objectives are defined.

Algorithms and methods to create derived measurement results from base measures are defined, as appropriate.

GPI 4.1.4 Define responsibilities and establish infrastructure to collect product and process measures.

Data collection mechanism is created for all identified measures.

Frequency of data collection is defined.

Responsibilities for data collection are defined, for example at project, process and organizational levels.

Verification mechanism for base and derived measures is defined.

GPI 4.1.5 Collect product and process measurement results through performing the defined process.

Required data is collected in an effective and reliable manner.

Measurement results are created from the collected data within defined frequency.

GPI 4.1.6 Use the results of the defined measurement to monitor and verify the achievement of the process performance objectives.

Analysis of measurement results is performed within defined frequency.

Statistical or similar techniques are used to quantitatively understand process performance and capability within defined control limits.

Trends of process behaviour are identified.

3.5.2 PA 4.2 Process control attribute

The process control attribute is a measure of the extent to which the process is quantitatively managed to produce a process that is stable, capable, and predictable within defined limits. As a result of full achievement of this attribute:

> *a) suitable analysis and control techniques where applicable, are determined and applied;*
>
> *b) control limits of variation are established for normal process performance;*
>
> *c) measurement data are analysed for special causes of variation;*
>
> *d) corrective actions are taken to address special causes of variation;*

e) control limits are re-established (as necessary) following corrective action.

3.5.2.1 Generic Practice Indicators for PA 4.2

GPI 4.2.1 Determine analysis and control techniques, appropriate to control the process performance.

Process control analysis methods and techniques are defined.

Selected techniques are validated against process control objectives.

GPI 4.2.2 Define parameters suitable to control the process performance.

Standard process definition is modified to include selection of parameters for process control.

Control limits for selected base and derived measurement results are defined.

GPI 4.2.3 Analyse process and product measurement results to identify variations in process performance.

Measures are used to analyse process performance.

All situations when defined control limits are exceeded are recorded.

Each out-of-control case is analysed to identify potential cause(s) of variation.

Assignable causes of variability are determined.

Results are provided to those responsible for taking action.

GP 4.2.4 Identify and implement corrective actions to address assignable causes.

Corrective actions are determined to address each assignable cause.

Corrective actions are implemented to address assignable causes of variation.

Corrective action results are monitored.

Corrective actions are evaluated to determine their effectiveness.

Process control limits are re-calculated to reflect process changes and corrective actions.