A NEW ERA FOR MODEL RISK

THE ANALYTICS BOUTIQUE'S SERVICE OFFERING AND PLATFORM FOR MODEL RISK GOVERNANCE

APRIL 2020

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A TRUE NORTH PARTNERS company

True North Partners – unique consulting approach to the financial services industry

- True North Partners LLP is an independent consulting firm based in London, Frankfurt, Zurich and Johannesburg. We specialise in finance, risk and strategy and have extensive global experience and industry recognition in the financial services, risk management and finance communities

- We have a track record as an independent partnership since 2006. Our clients are leading financial institutions, predominantly in Europe, Middle East and Africa

- Our distinctive value proposition includes four key elements
  - Leading practice expertise and experience in risk and finance to develop, tailor and communicate superior solutions
  - Strong analytical grounding of our work, be that through financial, economic or statistical modelling
  - Senior on-the-ground presence to drive change at our clients, which ensures that we deliver real impact rather than just "PowerPoint concepts"
  - Tailored and award-winning advanced analytical software tools provided by our subsidiary firm THE ANALYTICS BOUTIQUE

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The combination of leading expertise in risk consulting and award winning software tools TNP and TAB create in-house solutions that are holistic and market-leading

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FINANCE | RISK | STRATEGY

True North Partners

- Independent consulting firm
- Focused on risk, strategy and finance themes
- Harnesses power of TAB software solutions with dedicated consulting expertise in banking

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The Analytics Boutique

- A wholly owned subsidiary of TNP
- Works closely with TNP to develop software solutions
- Focused on risk management and pricing software solutions

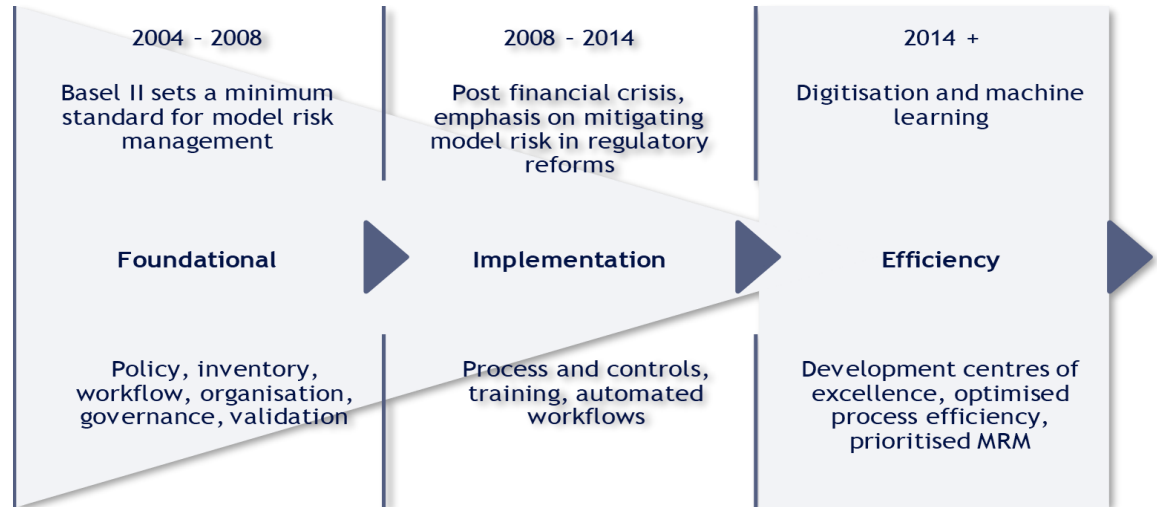THE AÑALYTICS BOUTIQUE

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Purpose of this presentation

- Provide overview of **the current status of model risk management practices** in the financial industry

- Present TNP's service offering including approaches and tools to overcome these challenges

- Introduces our Model Risk Platform and selected functionality
  - Model risk workflow
  - Reminders and alerts
  - Security and access control
  - Model evaluation capabilities
  - Forms for data capture
  - Model identification and document repositories
  - Materiality assessment
  - Risk scoring
  - Reporting functionality
  - Audit trail and governance
  - Model dependencies

Model risk – why now?

External drivers

- From as early as the 2000's, Model Risk Management (MRM) has featured on the regulatory agenda across the world; more recently, there has been an increased focus on model risk across the industry

- This is partly driven by current regulatory focus and the increased standardisation of Pillar 1 models which places a higher model risk for the industry as a whole

2004 – 2008	2008 – 2014	2014 +
Basel II sets a minimum standard for model risk management	Post financial crisis, emphasis on mitigating model risk in regulatory reforms	Digitisation and machine learning
Foundational	**Implementation**	**Efficiency**
Policy, inventory, workflow, organisation, governance, validation	Process and controls, training, automated workflows	Development centres of excellence, optimised process efficiency, prioritised MRM

Internal drivers

- Internally, FIs rely heavily on the results of models over and above the 'usual suspects' as e.g. regulatory capital

- Further internal model uses include pricing based on allocated economic capital, forecasting models, …

- More recently, IFRS 9 has significantly increased the model landscape

- The progression to machine learning types of models – to name just one new technology – add to the complexity of the models in use

Hence, there is an increased need to control model risk, manage the costs of its management and – given limited resources – to prioritise and route efforts if not 'streamline' the model landscape

As model risk management enters a new era, financial institutions – heavily relying on models – work on a broad range of aspects of model risk management

## Model risk management framework

1
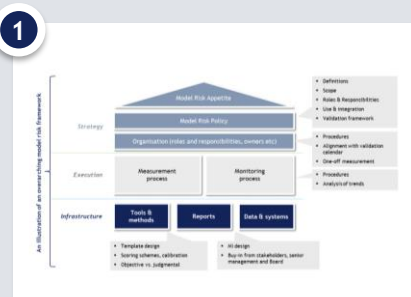
- A model risk management frame-work sets the scene for and coordinates all aspects of model risk management clearly assigning roles and responsibilities

- In addition to defining the relevant governance such framework has a normative effect e.g. as to support prioritising the required effort for model risk management, setting incentives for an adequate model landscape, allocating costs of model risk management as well as model risk capital to model owners

Model risk assessment & model risk MI

2
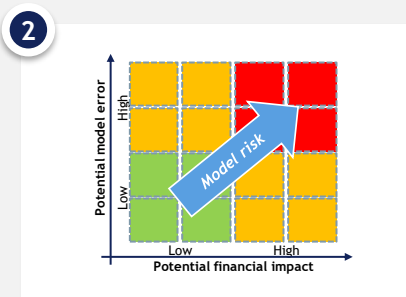
- A relative ranking of models according to model risk supports the organisation to prioritise the effort of model risk management and to implement 'proportionate' model validation

- Model risk is typically driven by two aspects: The likelihood of a model being erroneous as well as the materiality of a model

- The capitalisation / quantification of model risk is a second order question which we support clients in: Calcula-tion of overall capital and allocation

Model risk management & workflow tool

3
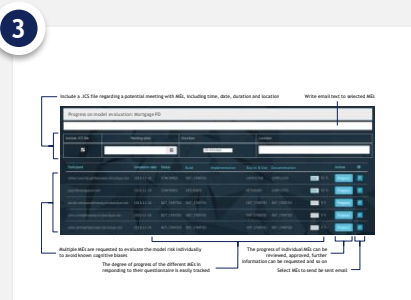
- A model inventory should be more than just a list of models

- It constitutes a tool to manage the lifecycle of each model as well as to manage the entire model landscape and support the MRM workflow

- Hereto, TNP provides clients with a tool for model risk assessment and model risk management

- In contrast to other commercial offering, the organisation has not to adapt to the tool: The tool will be tailored to the specific needs of and infrastructure at your organisation

Automation of model validation

4
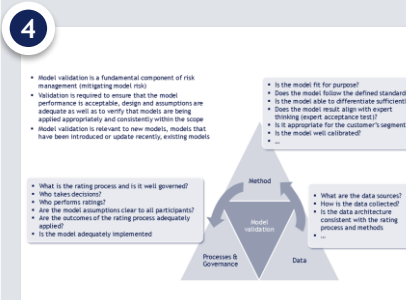
- Model validation constitutes a primary tool of model risk management and – to prioritise efforts in a world of constrained resources – needs to be proportionate to the relative risk and materiality inherent in a model

- TNP provides end-to-end validation frameworks as well as validation tools and conducts actual model validations

- Recently, automation of validation is one major enhancement of banks' validation approaches

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We have successfully designed and implemented robust frameworks for model risk management: TNP's proposition in model risk management (MRM)

Step 1: Get the 'basics' right and obtain buy-in

- **Objective** is to build the foundation for modern model risk management i.e. a model risk management framework coordinating required tasks and allocating roles and responsibilities

- **Deliverables:** 'Model' and 'model risk' definition, model risk appetite / tolerance, model universe and landscape, MRM scope, MRM policy and model inventory (web-based, bcbs239 compliant), MRM workflow, target operating model (TOM) for model risk management (governance team vs. validation team, organisation, remit, activities, interfaces to other functions, people and skill-set required)

Model lifecycle

Step 2: Put model risk management into practice

- **Objective** is to implement and roll-out robust MRM (incl. communication and training at group and BU level across jurisdictions)

- **Deliverables:** More detailed MRM policies, set-up of controls and check-points, definition of (sub-) processes, training of all stakeholders and (were required) automation of work-flows
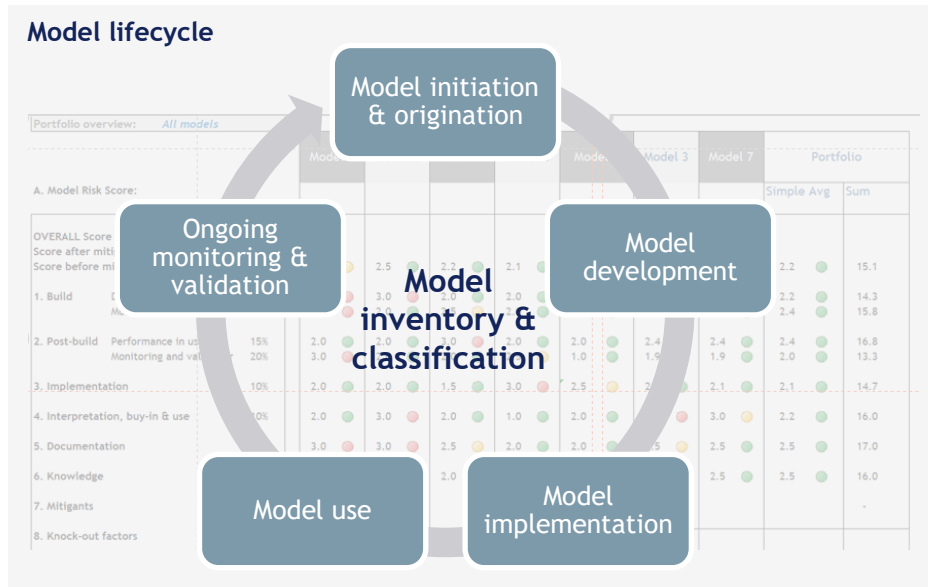
Step 3: Deriving value out of model risk management

- **Objective** is to extract value from the implemented MRM to increase comfort and trust in models relied upon in decision making and reporting as well as route / prioritise efforts

- **Deliverables:** Support in the establishment of centre of excellence in model development and validation (also across Group and jurisdictions), optimised resources management, full transparency on model quality and management actions

The ModelRisk View platform from The Analytics Boutique (TAB)

TAB is a wholly owned subsidiary of True North Partners. TAB has industry recognition in developing software solutions for risk management and pricing

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We are well recognised in the analytics industry for our award winning offerings in the operational risk management and stress testing space

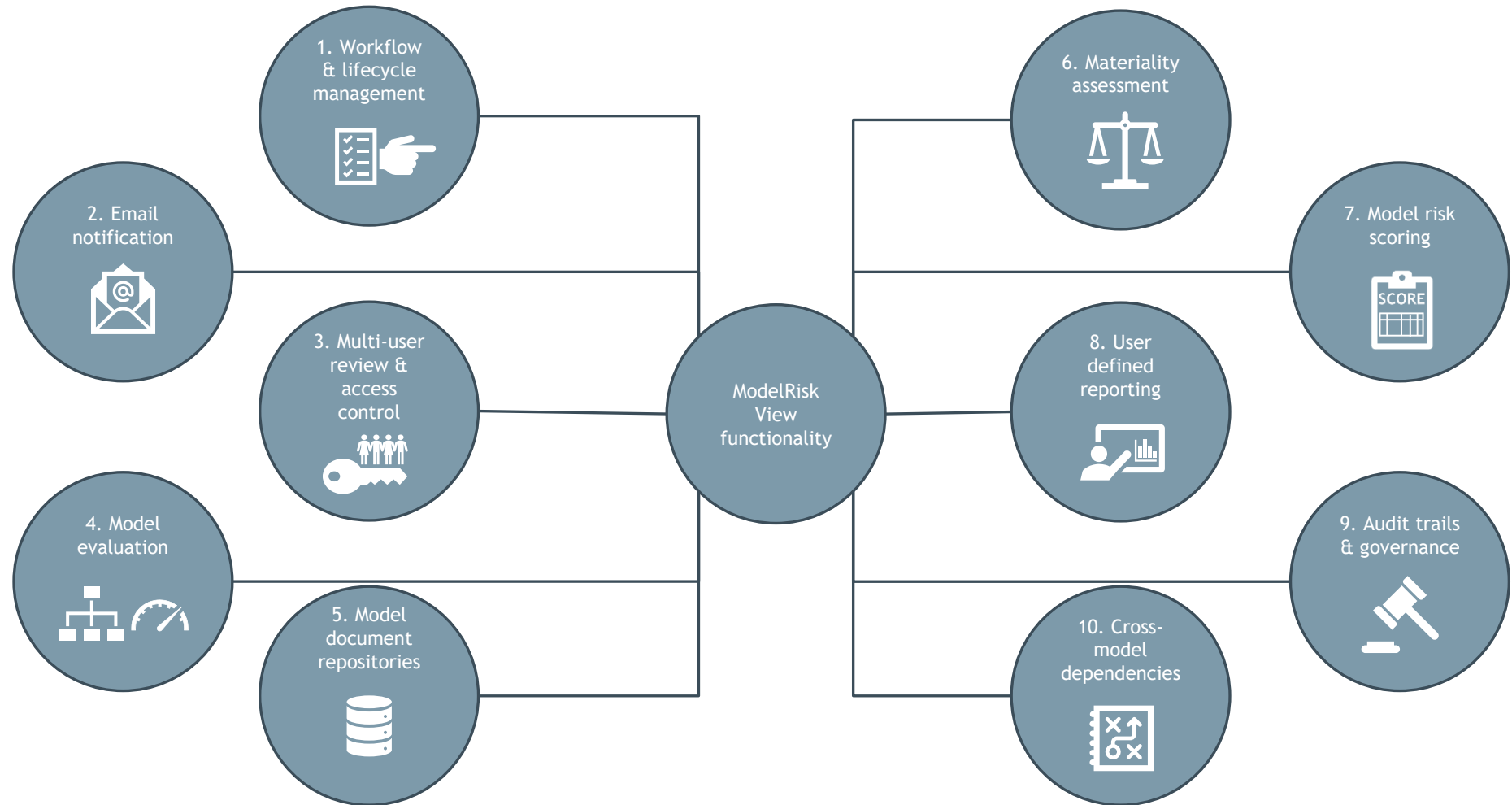2016 industry award recognition with 5 awards...and 5 awards in 2018/19

OperationalRisk Awards 2016 — Best overall product of the year

Risk Technology Awards 2018 Winner | The Analytics Boutique — Op risk modelling vendor of the year

OperationalRisk Awards 2016 — Best risk analytics tool

Risk Technology Awards 2018 Winner | The Analytics Boutique — Op risk scenarios product of the year

OperationalRisk Awards 2016 — Best stress testing product

Risk Technology Awards 2019 Winner | The Analytics Boutique — Op risk modelling vendor of the year

InsuranceERM Awards 2016/17 — Best analytics solution

InsuranceERM Awards 2018/19 — Best analytics solution

InsuranceERM Awards 2016/17 — Best stress scenario software

InsuranceERM Awards 2018/19 — Best operational risk solution

By Risk.Net (Risk Magazine)	By InsuranceERM

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Model RiskView has a comprehensive range of functionality that caters for holistic and efficient model risk management

1. Workflow & lifecycle management
2. Email notification
3. Multi-user review & access control
4. Model evaluation
5. Model document repositories

ModelRisk View functionality

6. Materiality assessment
7. Model risk scoring
8. User defined reporting
9. Audit trails & governance
10. Cross-model dependencies

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With the 'ModelRisk View' solution by The Analytics Boutique we provide a model inventory and workflow with high level MI dashboard and drill-down capabilities

Objectives: To evaluate and manage model risk (rating, capital) in an integrated solution supporting the MRM workflow. This includes the storage of model performance results, model documentation, automated reporting of model risk position and status of model in workflow.

Value-add: To obtain both, a high level understanding and detailed view of model risk in aggregate (e.g. capital) and individually (e.g. ranking), identifying drivers of model risk for active model risk management.

Market advantage: Flexible tool at low costs which adapts to your organisation, responsive support team.

Key features

Web based platform

Multiple users across model lifecycle with access controls

Audit trails & governance

Model inventory

Model workflow management

Captures cross model dependencies

Enable model risk evaluation

User defined reporting

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'Model Risk' Solution integrates the end-to-end model risk workflow management and allows effective management of the model life cycle

Definition of user-specific workflow(s) with different permissions to manage process end-to-end

Selected features

F2

The solution captures all required information for (e.g. criteria) and results of model performance monitoring and validation as e.g. reports, findings, remedy actions, responsibilities, …

F1

The tool provides a structured repository and audit trail for user requirements (e.g. by model owners, businesses), decisions made and information applied during model development (e.g. judgemental input) as well as model approval capturing all necessary material in a single repository which – in turn – can directly be assessed by validation team rather than 'sending around emails'

F4

Further workflow capabilities included:

➤ Model use: Sign-off for business to start model usage,
➤ Model training: Model training repository
➤ Model change requests: Log for observed challenges with model and business requests to modelling team

F3

Includes the capability for model risk assessment (ranking, capital) which can be tailored to the model risk assessment approach of the organisation: Model score and model materiality updated periodically based on drivers integrated in the required reporting of model risk e.g. vis-à-vis model risk tolerance on aggregate and individual level

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'ModelRisk View' solution assists the running of processes i.e. create reminders for model maintenance and model management tasks

F5

- The tool permits to create reminders for specific tasks in model maintenance and management
- Tasks can be directed to specific stakeholders in the model risk management chain
- These may include regular tasks as re-parameterization, re-calibration, validation…
- … but also specific tasks as e.g. mitigation actions from validations to the responsible stakeholders, …

Selected features

Description | Reminder

Number of daily reminders: 3

Subject: IFRS9 Model validation reminder   Start/End date: 09/01/2018 - 12/31/2020   Periodicity: 6 months ▼   Number of daily reminders: 5

Message: By now you should have started the IFRS 9 model validation

Sent to: P, Dinesh Kumar <Dinesh Kumar.P@sc.com>; Radhakrishnan, Gokulakrishnan <Gokulakrishnan.Radhakrishnan@sc.com>; Wang 3, Qing <Qing.Wang3@sc.com>; S1, Kumar <Kumar.S1@sc.com>

Subject: IFRS9 Model recalibration reminder   Start/End date: Periodicity: 1 year ▼   Number of daily reminders: 5

Message: By now you should have started the IFRS 9 model recalibration

Sent to: P, Dinesh Kumar <Dinesh Kumar.P@sc.com>; Radhakrishnan, Gokulakris...

	September 2018	
Su Mo Tu We Th Fr Sa		
		1
2 3 4 5 6 7 8		
9 10 11 12 13 14 15		
16 17 18 19 20 21 22		
23 24 25 26 27 28 29		
30		

ng <Qing.Wang3@sc.com>; S1, Kumar <Kumar.S1@sc.com>

Subject: IFRS9 documentation reminder   Start/End date: -   Periodicity: ▼   Number of daily reminders:

Message:

Sent to: P, Dinesh Kumar <Dinesh Kumar.P@sc.com>; Radhakrishnan, Gokulakrishnan <Gokulakrishnan.Radhakrishnan@sc.com>; Wang 3, Qing <Qing.Wang3@sc.com>; S1, Kumar <Kumar.S1@sc.com>

Access rights assist with the management and security of workflows and documentation where only selected users

Selected features

F6

- The tool permits to create access rights to different groups and individuals
- Access can be differentiated into:
  - Developer / admin rights
  - Read and write
  - Read only
- Access rights can be varied to include write access at selected points in the model workflow and/or life cycle
- Email notifications are sent to new users with the associated access rights highlighted

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Flexible creation of questionnaires for a detailed model risk evaluation as defined by the user

Questionnaire as seen by expert

Questionnaire definition functionalities

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'Model Risk' allows also multiple model experts (MEs) to assess the same model in terms of risk and provides progress of responses of participating expert

Include a .ICS file regarding a potential meeting with MEs, including time, date, duration and location

Write email text to selected MEs

Progress on model evaluation: Mortgage PD

Include .ICS file	Meeting date	Duration	Location
☑		30 minutes	

Participant	Completion date	Status	Build	Implementation	Buy-in & Use	Documentation	Actions	✉
rafael.cavestany@theanalyticsboutique.com	2016-11-30	CONFIRMED	NOT_STARTED		COMPLETED	COMPLETED	▮▮▮▮▮ 62 % Progress	✔
pepinferrari@gmail.com	2016-11-30	CONFIRMED	RETURNED		RETURNED	COMPLETED	▮▮▮▮▮ 62 % Progress	✔
daniel.rodriquez@theanalyticsboutique.com	2016-11-30	NOT_STARTED	NOT_STARTED		NOT_STARTED	NOT_STARTED	▮ 0 % Progress	✔
john.smith@theanalyticsboutique.com	2016-11-30	NOT_STARTED	NOT_STARTED		NOT_STARTED	NOT_STARTED	▮ 0 % Progress	✔
peter.white@theanalyticsboutique.com	2016-11-30	NOT_STARTED	NOT_STARTED		NOT_STARTED	NOT_STARTED	▮ 0 % Progress	✔

Multiple MEs are requested to evaluate the model risk individually to avoid known cognitive biases

The progress of individual MEs can be reviewed, approved, further information can be requested and so on

The degree of progress of the different MEs in responding to their questionnaire is easily tracked

Select MEs to send be sent email

User-defined model identification functionality allows for demarcating models from 'non-model' calculations

Selected features

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Powered by The Analytics Boutique V.28.4

Index   Model evaluation: Credit Risk

Document list	Scoring report	Action plan	Model identification

F8

- The solution has the capability to identify whether a calculation can be tagged as a model
- Model identification can be defined by the user according to the organisation's model risk policies, standards and definitions
- Non-models are kept in a different repository where they can be assessed if they qualify to be defined as a model at subsequent evaluation periods

Model categories

Show 10 ▼ entries

	Model name	Creation date
☐	Market Risk	2018-08-18
☐	Credit Risk	2018-08-22
☐	Operational Risk	2018-08-22
☐	Liquidity risk	2018-10-15

Previous 1 Next

F7

- ModelRisk View allows for users to upload model documents for all models in the organisations universe
- Different versions of the same model document can exist with the latest version always on top
- The document repository is has search capability making it easy for users to find documents associated with a certain portfolio, model type etc.

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User-defined model identification functionality allows for demarcating models from 'non-model' calculations

Selected features

It contains a decision tree to determine whether a model can be really consider a model or just a minor local calculation process

Please enter all models in your business area. Models are defines as: "…a quantitative method, system, or approach that applies statistical, economic, financial, or mathematical theories, techniques, and assumptions to process input data into quantitative estimates. A model consists of three components: ☐ an information input component, which delivers assumptions and data to the model; ☐ a processing component, which transforms inputs into estimates; ☐ and a reporting component, which translates the estimates into useful business information. The definition of model also covers quantitative approaches whose inputs are partially or wholly qualitative or based on expert judgment, provided that the output is quantitative in nature."

Divisions: [SME Banking]

Model name	Severity	Frequency	
1 - Correlation calculation model	▼	▼	Is this a model? ☑: Yes

Has the calculation been categorised by this decision tree during the current review period?
◉ Yes ○ No
Are the outputs used directly in business decision-making and/or used for reporting OR used as input(s) in models directly used for decision-making and or/reporting?
◉ Yes ○ No
Can a person without specialist skills apply simple logic and/or computation to accurately state the outcome in one or two steps when viewing the inputs?
◉ Yes ○ No
Is there uncertainty around the accuracy of the inputs and outputs of the model?
◉ Yes ○ No
Is the calculation used regularly / repeatedly?
◉ Yes ○ No
Are the outputs quantitative in nature and not wholly expert driven?
◉ Yes ○ No

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All documents used or captured such as methodology documents, validation reports, etc. are consolidated into a document repository report

Main document characteristics are automatically documented, including model category, model name, document version, document date, etc.

Model categories

Show 10 ▼ entries   Search: [   ]

#	Model id	Version	Document Status	Category	Model name	Date	Risk type level 1	Model type	Materiality	Region	Name	Description	Actions
1	161	1	Final	Market Risk	Balance Sheet Management	2019-02-28					Risk scoring factors v1.xlsx	Risk scoring	Download
2	160	3	Final	Market Risk	VaR	2019-02-28					Model Data v4.xlsx		Download
3	162	3	Final	Credit Risk	Retail credit cards IRB PD model	2019-04-05		IRB models	Medium		Model Document Inventory v2.xlsx		Download
4	163	3	Final	Credit Risk	Retail credit cards IRB PD model	2019-04-05		IRB models	Medium		Guide scenarios.docx		Download

Showing 1 to 4 of 4 entries   Previous [1] Next

User-defined model materiality evaluation allows to classify models based on their materiality and potential impact

Selected features

Model materiality evaluation

Model type:	Economic capital ▼
Financial exposure:	30000000
Scope of use:	Yes ▼
Reliance:	No ▼
Materiality:	Medium

F9

- The tool allows for integration of a model materiality framework as defined by the organisation
- A user can complete a set of questions and the defined model materiality algorithm (may be a simple set of questions containing thresholds and categories) will assess the associated materiality rating

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User defined scores can be defined based on different aspects of the model such model complexity, model maturity, overall model riskness

Selected features

It is posible to define as many scores as required with the weight of each question with in the score and report such score in a specific dashboard

The MRM platform is able to provide user defined reports and dashboards in an easy and intuitive way so that the organisation can track both model risk and efficiency across the model lifecycle

MRM Reporting functionality

User-defined charts

Drag and drop configuration of charts

No programming required

Updates dynamically as new data is added

Ability to have multiple dashboards for different user-types

Ability to download to Excel

Reporting on the model process and efficiency – time taken to develop, validate and approve models, costs per model etc

Multiple chart / table options

Track model risk and model efficiency

SSA provides a flexible dashboarding functionality that permits multiple dashboards defined by users

1 Information is captured by users on MRM forms and stored in a database

2 Pull information from database and create tables and charts as required using integrated reporting module

3 Graphs are grouped into dashboards

4 Multiple dashboards can be created
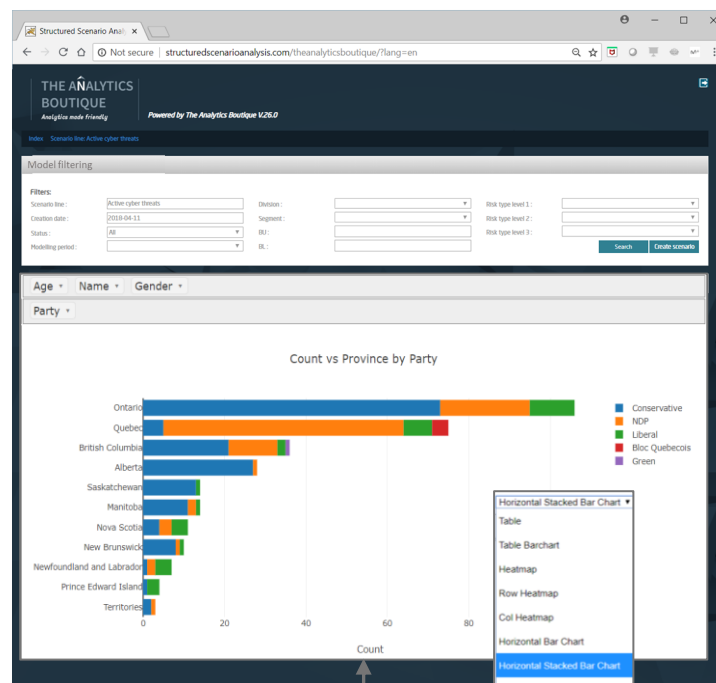
Multiple options available for representation

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Extensive information about which user activity gained accessed / created / altered workflows and their components provides comfort for audit and governance structures

It shows the workflow of model dependencies such as other models calculating parameters for the actual model, in a visual format

Thank you.

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