

# PHRONESIM

## Organisation Simulation Capability Maturity Assessment

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# Why do we do Modelling and Simulation?

Deliver **more**, and **better**, products

- Develop New Product Technology
- Improve Product Capability and Functionality
- Optimise Product Performance across Attributes
- Deliver More Product Variants in the Same Time

Deliver products **faster**

- Develop and Deliver Product to Market Faster
- Reduce Failure Modes and Error States (Find issues earlier)
- Faster to Final Release and Sign-Off

Reduce **development costs**

- Improve Efficiency of the Product Development Process
- Reduce overall time and resources (Faster & fewer design cycles)
- Reduce or eliminate prototype build and testing

Reduce **product & operating cost**

- Minimise Complexity
- Optimise for Material and overall Product Cost
- Increase re-use and commonality
- Minimise Production and Operating Cost

Reduce error states:  
Improve product **quality**

- Improve Robustness to Real Use Noise Factors
- Reduce Quality Escapes and in-service failures
- Reduce Warranty Costs and Improve Customer Satisfaction

We use Modelling and Simulation to Deliver Product and Business Goals  
How Effective & Efficient is our M&S in Delivering these Goals? How do we know?

# Essential Elements for Modelling and Simulation

ESSENTIAL ELEMENT	DESCRIPTION
PROCESS	<i>Efficient</i> processes that define the simulation workflows and <i>aligned</i> to the overall development processes.
METHODS	<i>Capable</i> and <i>effective</i> methods to define how to model the specific physics required to deliver the product requirements.
TOOLS	<i>Capable</i> and <i>connected</i> tools to model the correct physics accurately.
MODELS	<i>Representative</i> and <i>accurate</i> models that reflect the latest design intent
DATA	<i>Reliable</i> and <i>accessible</i> technical data to define material properties, technical specifications, modelling parameters, and use cases.
PEOPLE & ORGANISATION	<i>Skilled</i> and <i>experienced</i> people with product knowledge and experience of the tools and methods, organised effectively to maximise collaboration and efficiency.
COMPUTE INFRASTRUCTURE	<i>Sufficient, reliable</i> and <i>flexible</i> computing infrastructure and resources to execute the complex and large scale simulations.



# Organisation Simulation Capability Maturity (OSCM)

Aspect	Key Criteria	Maturity Level				
		0	1	2	3	4
		Insufficient Poor Confidence Limited Coverage (<25%) Ad-hoc No Plan No KPI	Needs Reviewed Low Confidence Partial Coverage (25-50%) Partially Applied Actions Identified Improvement Started	Comprehensive Medium Confidence Established/Aligned (50-75%) Fully Applied Improvement Plan In progress - On track	Embedded High Confidence Fully Implemented (75-90%) KPI Monitored Actions Complete Goals Achieved	Systemic/Innovator Certification Level Governed (90-100%) Maintained Continuously Improved Futured
Strategy	Comprehensive Aligned		ASSESSMENT			Target
Process	Efficient Aligned			ASSESSMENT		Target
Methods	Modular Capable Validated			ASSESSMENT		Target
Models	Appropriate Representative Accurate Aligned Shared Planned Managed		ASSESSMENT			Target
Tools	Capable Connected				ASSESSMENT	Target
Data	Validated Traceable		ASSESSMENT			Target
People and Organisation	Ownership Skilled Certified			ASSESSMENT		Target
Computing Infrastructure	Capacity Flexibility				ASSESSMENT	Target

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# OSCM Assessment Process



Questionnaire



Sample Documents,  
Data and Metrics



Discussion  
Follow-up

Aspect	Key Issues	Maturity Level				
		1	2	3	4	5
Strategy	Strategic Alignment	Strategic Alignment	Strategic Alignment	Strategic Alignment	Strategic Alignment	Strategic Alignment
Process	Process Efficiency	Process Efficiency	Process Efficiency	Process Efficiency	Process Efficiency	Process Efficiency
Methods	Methodology	Methodology	Methodology	Methodology	Methodology	Methodology
Tools	Tool Integration	Tool Integration	Tool Integration	Tool Integration	Tool Integration	Tool Integration
Data	Data Quality	Data Quality	Data Quality	Data Quality	Data Quality	Data Quality
People and Organisation	Team Capability	Team Capability	Team Capability	Team Capability	Team Capability	Team Capability

Review and  
Assessment

Core Simulation Capability	Potential Opportunities
<b>Process</b>	Identify and address bottlenecks Reduce resources Improve speed Improve process robustness
<b>Methods</b>	Expand coverage and confidence Improve product performance Reduce testing. Reduce error states Modularise and improve automation
<b>Tools</b>	Align tools to needs Reduce complexity number and costs of tools Improve tool chain connectivity to improve quality and efficiency
<b>Models</b>	Improve quality Improve planning Improve sharing and re-use. Reduce duplication
<b>Data</b>	Improve data quality Improve data findability and useability Improve data traceability
<b>Organisation</b>	Improve collaboration and sharing Better align skills to current and future needs
<b>Compute Infrastructure</b>	Ensure appropriate capacity Ensure efficient flexibility

Improvement  
Opportunities

5 Key Stages to Assessment – Input required from Key Stakeholders

# Essential Elements Questions

Question Reference [RAG]	Include P/O/D?	Priority (1, 2, 3)	Criteria	Question	Documentation Evidence / Examples	KPI Metric	Question Response	Information Documents (Filename/Link/Location)
ME1	O		Methods Strategy	Is there a strategy document for implementation?	Strategy document Implementation Roadmap	No. Roadmap projects in progress & status		
ME2	D		Product Requirements	Are customer, product, and delivery requirements clearly defined and owned?	Requirement list and types Requirement management process	% Requirements Defined & Documented		
ME3	D		Method Coverage	Are Methods routinely defined, documented with clear ownership? How well do the current Methods cover Product Requirements?	Example Method Documents List aligning Methods to Requirements Target Method Coverage (%)	% Requirements with a Document (Coverage)		
ME4	D		Standards Best Practices	Have standards, conventions, and best practices for Simulation Methods been identified, defined, integrated and implemented?	Evidence of Stds, Conventions Evidence of integrated Best Practices	% Standards, Convs Incorporated % Best Practices Incorporated		
ME5	O		Method Development	Is there an agreed approach and process for method development, & documentation; (e.g; on the job, offline project, specialist team, outsourced, research, ....) ?	Development approach & organisation Development process documentation	Development process defined & managed? No. Methods / Projects in progress		
ME6	D		Method Quality	Is a Method Quality process or Verification and Validation process routinely implemented? Are Quality Best Practices integrated into Methods?	Quality, V&V process documentation Examples of Integrated Quality checks Examples of Application of V&V	% Methods with Integrated Quality % Methods Verified and Validated		
ME7	O		Method Confidence	Is a common objective Confidence Metric Used? Does Method Confidence achieve target? Simulation results presented with confidence interval	Definition of Confidence Rating Metric Examples Confidence Assessment Example of Results with Confidence	% Methods with Confidence Rating % Methods at target confidence		
ME8	O		Method Use	Are defined methods routinely used to conduct simulation? How are methods shared across the organisation?	Examples of Method project use Evidence of use across the organisation.	Number (%) of users using methods Number (%) Teams using methods Frequency of method use.		
ME9	D		Noise Factors	Do Methods take account of product, production, use, and environmental Noise Factors (NF)? How is this done?	Examples of incorporation of Noise Factors	% Methods incorporating Noise Factors		
ME10	D	2	Data Analytics	How are Data Analytics Methods used (e.g. for Data collection, cleaning, preparation, mining, analysis, modelling, validation, visualisation)?	Data Analytics Strategy Examples of application of Data Analytics	%Requirements supported by Data Analytics		

**Questions Cover**

- Process
- Methods
- Tools
- Models
- Data
- People
- Computing

**Supporting Information Selected**

**Supporting KPI / Metrics Data**

**Short Question Responses**

**Links to copy of example Documents**

Essential Element: Process

Question Reference (RAG): PS7

Topic: Process Efficiency

Question: Have process efficiency reviews been conducted (e.g. VSM)?

Info / Evidence/Metrics / Data : Efficiency processExample output

KPI Metric :

Column1:

Question Response:

Information Documents (Filename/Link/Location) :

Comment:

Respondent :

Date :

Note: Approx 70 Questions and Information Requests

Separate Question and Information requests file for each Team

# Typical Assessment Output

Essential Element	Topic	Organisation Capability Maturity Metric					OSCM	Overall Assessment	Opportunity
		0	1	2	3	4			
		Insufficient Poor Confidence Limited Coverage (<25%) Ad-hoc No Plan No KPI	Needs Reviewed Low Confidence Partial Coverage (25-50%) Partially Applied Actions Identified Improvement Started	Comprehensive Medium Confidence Established/Aligned (50-75%) Fully Applied Improvement Plan In progress - On track	Embedded High Confidence Fully Implemented (75-90%) KPI Monitored Actions Complete Goals Achieved	Systemic/Innovator Certification Level Governed (90-100%) Maintained Continuously Improved Futured			
Methods	Methods Strategy			✓			2	Method Strategy in Place. Improvement Plan in Progress	Introduce Governance and conduct regular strategy review.
	Requirements				✓		3	Requirements defined. Overall target defined . Variable team status.	Identify and prioritise gaps.
	Reqs with Methods			✓			2	50% Target Requirements with a Method	Identify target for Method confidence. Identify priority requirements requiring methods. Link to confidence metric.
	Standards Conventions			✓			2	50% Methods adopt internal standards.	Review Standards applicability to Methods. Identify gaps and concerns.
	Method Development		✓				1	Inconsistent process for Method Development	Agree consistent process for Method Development and verification. Roll out across all teams. Identify and prioritise requirement gaps for development. Agree a roadmap.
	Method Ownership		✓				1	Some Method Owners identified. Unclear Responsibilities of Method Ownership	Identify assign and communicate ownership for all methods.
	Method Quality		✓				1	25% with Integrated Quality Checks 50% Methods Verified and Validated	Agree a consistent approach to Method Quality including integrated quality checks. Align to verification process and confidence metric
	Confidence Metric		✓				1	25% with Confidence Rating, but variation in metric used. Some simply by peer review using High. Medium, low rating.	Review options and adopt a consistent Confidence metric for all virtual Verification Methods. .
	Confidence Achieved		✓				1	25% High Confidence	Conduct a review of confidence levels. Are these appropriate for the required purpose. Identify priority improvement requirements. Introduce confidence reporting with results.
	Method Use			✓			2	Good Method Usage. Some sharing but no central library or communication.	Introduce a register for methods including key parameters such as; description, purpose, scope, and confidence. Communicate new and updated methods to all stakeholders.
	Sharing Achieved				✓		3	No central Portal for Method sharing across teams	Conduct a review of sharing potential. Are methods developed to be suitable for multiple purpose
	Data Analytics	✓					0	No routine approach for use of Data Analytics for M&S Data Input or output.	Identify experts in the organisation. Review data availability. Conduct a review of opportunities from data analytics.
	Noise Factors			✓			2	Noise Factors considered for some Methods but not routinely integrated into process	Ensure a review of Noise Factors is taken into account for all methods. Identify those that may be significant. Consider sensitivity analysis to address these.



# Output - Organisation SWOT Highlights

Element	Strengths	Weaknesses	Opportunities	Threats
Process	Simulation processes well aligned to overall PD process	Simulation cycle time. Significant ad-hoc and manual processes	Efficiency review Automation	Complexity Faster Competitors
Methods	Well established methods to model many product requirements	Lack routine confidence metric Tool dependency	Apply confidence metric to all methods and results output.	Readiness to model new product technologies
Tools	Tools to address most physics	Tool landscape complexity Tool to tool connectivity	Reduce tool duplication	Tool obsolescence Maintaining customised code
Models	Well established local modelling processes	Duplication Lack of integrated quality checks	Modelling plan Increased sharing Increased automation	Change management
Data	Data library for some data	Overhead sourcing data Unverified data pedigree	Data Standards Data Management Data maturity metric	Unknown impact of poor data
People	Highly experienced and skilled	Lack of collaboration and knowledge sharing	Simulation community to share best practice	Loss of critical skills
Compute Infrastructure	Adequate capacity to support routine analysis	Increased future demand Inflexible	Use of cloud computing to support peaks	Resilience plan

Example Typical Initial SWOT

# Potential Opportunities from Maturity Assessment

Core Simulation Capability	Potential Opportunities
Process	Identify and address bottlenecks Reduce resources Improve speed Improve process robustness
Methods	Expand coverage and confidence Improve product performance Reduce testing. Reduce error states Modularise and improve automation
Tools	Align tools to needs Reduce complexity number and costs of tools Improve tool chain connectivity to improve quality and efficiency
Models	Improve quality Improve planning Improve sharing and re-use. Reduce duplication
Data	Improve data quality Improve data findability and useability Improve data traceability
Organisation	Improve collaboration and sharing Better align skills to current and future needs
Compute Infrastructure	Ensure appropriate capacity Ensure efficient flexibility

# Why Conduct an M&S Maturity Assessment?

- Assess **readiness** to achieve Business Goals
- Provides a metric to **quantify** current status for the core M&S elements
- **Assess** your organisation against key criteria
- **Identify** strengths, constraints, weaknesses, and opportunities affecting your M&S
- **Build** confidence in, and expand, your M&S capability
- **Maximise** collaboration and sharing
- **Improve** development efficiency and speed
- **Reduce** development, tool, and product costs
- **Target** and prioritise investment and improvement actions
- **Measure impact** and progress
- **Prepare** for changing future needs

# Steps in Building and Implementing a Strategy

Step 1 - Identify Goals

Step 2 - Get Organised  
Collaborate



Step 3 - Establish Needs &  
Requirements

Step 4 - Establish your  
Current Position

Step 5 - Gaps, Dependencies  
Improvement Options

Step 6 - Assess Risks  
Build a Business Case

Step 7 - Prioritise / Plan  
Allocate Resources/Budget

Step 8 - Agree Key Metrics  
Communicate

Step 9 - Establish a  
Governance Framework

Step 10 - Implement  
Monitor Adjust



# Steps in Building and Implementing a Strategy

#	Step	Specific Actions
1	Identify Goals	Business Goals, Product Objectives, Simulation Objectives and Targets
2	Get Organised	Strategy Champion, Stakeholders, Meeting Structure, Communication & Collaboration Channels
3	Establish Needs & Requirements	Regulation, Customer Reqts, Product Reqts, Process Reqts, Operations Reqts, Simulation Team Needs
4	Establish your current position	Conduct a Maturity Assessment Review Key Metric Status
5	Gaps, Dependencies, Improvement Actions	Review gaps to target. Root cause analysis. Identify improvement options and actions. Check interdependencies
6	Assess Costs Benefits and Risks Build the Business Case	Review action costs. Evaluate benefits. Establish Risks Build Business Cases and Scenarios. Consider Mitigations.
7	Prioritise, Prepare Plan Allocate Resources and Budget	Prioritise and decide improvement actions Identify and allocate skills and resources, and budgets.
8	Agree Key Metrics Communicate	Agree and implement overall and project specific metrics Implement communications
9	Establish a Governance Framework	Implement Governance
10	Implement, Monitor, Adjust	Initiate overall strategy initiative. Implement projects



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