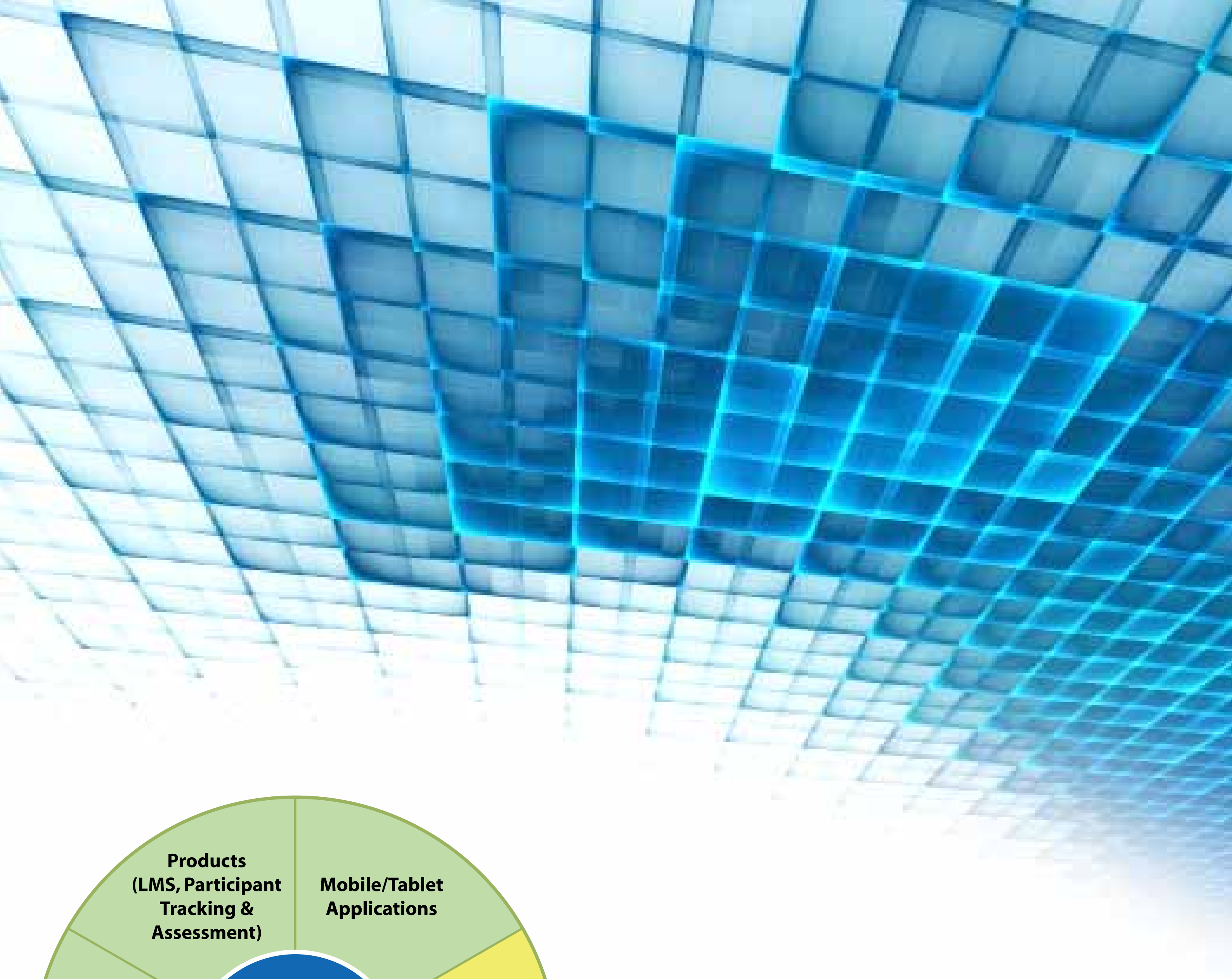
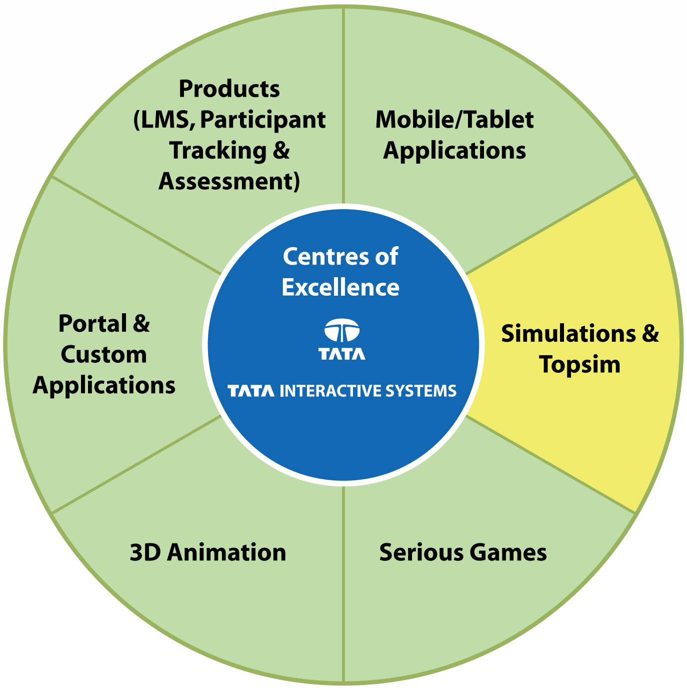


# ABSTRACTING A COMPLEX WORLD

***Nikhil Mishra** clarifies how to simulate complex situations for training in critical thinking and decision making.*




*The six 'Centres of Excellence' at TIS foster thought leadership and core expertise for differentiated products & service offerings. Videos from these Centres of Excellence are available at http://www.youtube.com/tatainteractivesys*

How do you train a trader to take cognizance of fluctuations in markets, changes in currencies and discern geo-political context before deciding to buy or sell? How can a sales professional be made aware of the consequences on sales performance, of factors such as sales processes, profit margins and stakeholders? Training your learner for such real-world tasks poses several challenges – context, relevance and engagement.

A dynamic learning solution to the above quandary is a simulation. Simulations focus on contextual decision-making, encourage learning in a low-risk environment, and offer the autonomy to explore various options. Placing learners at the heart of a simulated environment, with a challenging task to solve, helps them practice decision-making and experience consequences.

But what do you do when the environment you seek to simulate is highly complex? What if it involves interplay of numerous related factors ranging from business to leadership to infrastructure to geo-political influences? The solution lies in a model that replicates aspects of the intended environment.

**WHAT IS A MODEL?**

A model can be used to create an approximation of a real-world system or event – staying true to the essential precepts of the system. It may be a physical, mathematical or logical representation of the system. This model forms the basis of a simulation in which learners can navigate the learning landscape and take decisions.

To ensure that a model approximately replicates a system, you need to align it with your fundamental learning objectives, which go hand in glove with the business needs of the hour. The learning goals define the boundaries of the model and help you identify which parts of the system need to be studied and consequently, replicated.

Armed with insight of the system, you can abstract a description of reality to produce an early vision of the model and its desired outputs. The outputs will help identify the input variables that need to be fed into the model. Once both sets of variables have been established, the possible behaviour patterns and linkages in between need to be studied. The understanding of this dynamic and interconnected flow, also known as causality, can be articulated in the form of a Causal Loop Diagram (CLD). Thus, the model is a composite of: input variables, output variables and the interrelationships (causality).

**HOW DOES MODELLING WORK?**

Let us take a look at a logistics business that wants to create a simulation for a target audience of chief executives. The key focus is encouraging managers to take decisions, regarding multiple moving parts with complex linkages, from a holistic and multi-functional perspective.

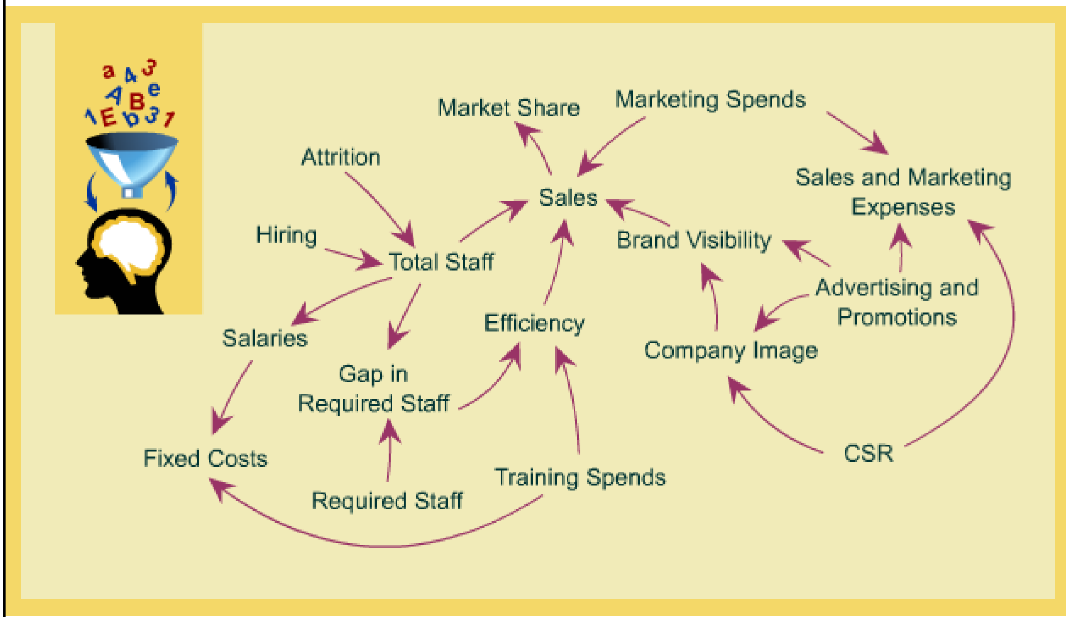
The model needs to be an abstraction of the processes and business at this organisation. This abstraction can be derived by conducting interactions with a diverse variety of stakeholders to reveal insights into different aspects of the business.

For example, the sales director may stress the role of a sales 'dream team' to expand global customer reach. Sales are also driven by brand visibility and awareness among customers, which are inextricably linked to marketing and advertising.

But what else constrains the model? Financial budgets, time to competence of new hires, impact of competition on product development and the sales force, sustainability, changing standards and expectations of the industry – all heavily influence the dynamics in this system and also need to be incorporated.

With learning objectives and the above factors clearly defined, you arrive at the number and end state of variable(s), which in turn provide a path to draw up meaningful causal relationships and dynamics. Brainstorming with stakeholders and the model developers may result in the following CLD. Note that this model only addressed one part of the entire system and to a certain level of abstraction. Adding more components and more granularity may only render the entire process more complex, expensive, time-consuming and in some cases, unrealistic.

CAUSAL LOOP DIAGRAM




*Causality is a dynamic and interconnected flow comprising input variables, output variables and their inter-relationships.*

**MODEL UNBOXING**

The final stages of model development involve populating the model with collected data. Complexity of any simulation model is influenced by the magnitude and depth of variables that need to be calculated and subsequently presented inside the simulation. This data is sourced from the real world and can be classified as follows:

- **Decision variable:** Variables with high impact and high risk to the system (staff salaries, when set lower than the industry average, adversely impact motivation and attrition)
- **Scenario variable:** Variables with high impact on the system but beyond the control of the learner (the average industry salary or impact from competition)
- **Intermediary variable:** Any variable other than decision and scenario, which bind the decision and reporting variables (units produced are a function of production staff and efficiency)
- **Reporting variable:** Variables indicating performance of a business unit, available to the learner after they take decisions.

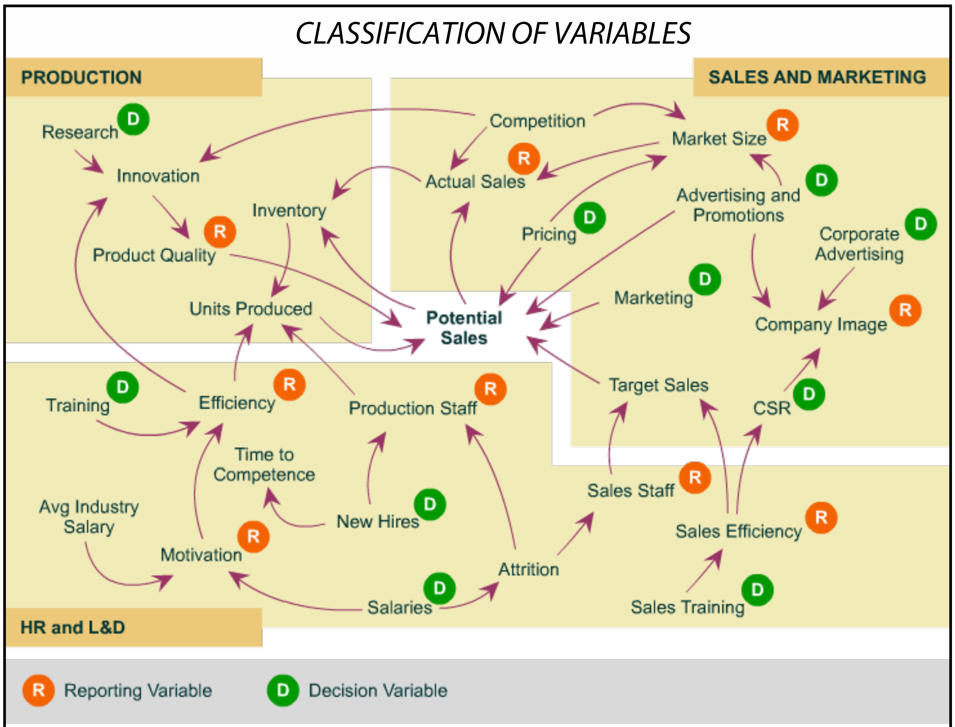
**DEVELOPING A MODEL**

Perhaps the most important step in developing the model is defining the system. At this stage, subject matter experts play a vital role in gleaning a deep understanding of the system and the myriad variables that determine its performance. Reviews can incorporate organisational insights existing in scenarios and case studies.

The consultative process that provides systemic insights can be demanding. Individuals working in a company for many years possess a mental model of their business's competitive environment, core performance levers, and challenges – and solutions to the same. This information is often tacit and unstructured. The abstraction and structuring of tacit information into variables, causality and relationships presents a significant challenge to modelling consultants.

As consultants probe deeper, the model may undergo several revisions to incorporate additional relevant data and relationships. This iterated model forms the basis for the computer-based simulation.

The simulation may use and produce system performance data in large quantities. Analysis of this data can promote an understanding of the rationale behind learners' decisions. Visual aids like graphs, information graphics and reports can be used to make this data more accessible.




*Classification of variables promotes a deeper perception of the sales drivers for a general management model at a manufacturing company.*

## DEPLOYMENT AND MODE OF DELIVERY

The mode of delivery of the final model-based simulation also influences the abstraction process. Running a simulation for a few thousand users in an online environment with no instructors can have serious design implications, versus running one in a classroom with 30-50 people. Location, space, scalability and variability must be considerations.

With computers getting smaller and tablets gaining market share, storage space, computing speed, and screen resolution also become important guiding factors in the abstraction process. Shelf life is another consideration vis-à-vis the dynamism of the model. Open-ended simulations with customisable features can evolve with time, unlike canned simulations that don't allow modifications to variables or relationships.

Thus, modelling a complex world involves a concerted team effort – subject matter experts, modellers, technical specialists and project managers – to define systems, create a model and develop and deploy a simulation. For the end-user, the learning is a sophisticated test of skills and an opinion forming, decision taking, immersive experience.

Abstracting a complex world
1. Identify your fundamental training needs
2. Analyse the system to be replicated
3. Ascertain the factors that influence the model
4. Define the inter-relationships

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