Tools for Technical, Business & Consumer Analysis in AT Product Development:

Expanding the Need to Knowledge Model

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Need to Knowledge (NtK) Model

- ***Orientation*** – Actors in innovation process “need to know”: Problem/Solution; Methods/Outputs; Stakeholder’s roles; Goal in context of technology for socio-economic impacts.
- ***Integration*** – Product Development Managers Association (PDMA) New Product Development practices (implementation); Canadian Institutes of Health Research (CIHR) Knowledge to Action Model (communication).
- ***Validation*** – Stage-Gate structure populated with supporting evidence (1,000+) excerpts drawn from a scoping review of relevant academic and industry literature published since 1985.

NtK Model Utility

- Clarifies processes and mechanisms underlying technology-based Innovation, by integrating academic & industry literature.
- Establishes linkages between three distinct methods and their respective knowledge outputs for implementation/communication.
- Offers structure to sponsors & grantees for program/project planning, implementation, monitoring and evaluation.

Users requested more details on Technical & Business Analyses

- NtK Steps call for various types of analyses across all three Phases (R, D &P) and in all nine Stages, while Grantees are typically familiar with only a sub-set of them.
- Technical, Market and Customer analyses address three different yet equally critical issues for technological innovation so they must be planned and conducted.
- Time to supplement “what to do” Literature with “how to do” Tools .

Ireland/USA Partnership

- Dr. James Condron – Biomedical Engineer, Dublin Institutes of Technology.
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- Jennifer Flagg & Michelle Lockett, University at Buffalo, USA.

Five Competency Categories

- Electrical/electronic engineering tools: measurement systems, design and testing systems and mass manufacturing tools.
- Material science tools: required to make the choice for a particular manufacturing material or to examine the characteristics of a potential material.
- Mechanical engineering tools: encompasses the generation and application of heat and mechanical power and the design, production, and use of machines and tools.
- Business tools: such as quantifying customer requirements, benchmarking, marketing tools, business feasibility, process improvement and return on investment.
- Inclusive/Universal Design tools: to ensure that the widest possible audience will be considered in the design process, regardless of age, size, ability or disability.

Type/Range of Tools

Electrical Engineering	Material Science	Mechanical Engineering	Business Tools	Business Tools, Ct.	Universal Design
Digital Logic Design Software	Density Measurement	Computer Aided Design (CAD)	Affinity Diagrams	Information Technology	Anthropometry (Human size)
Electronics Simulation Software	Dynamic and Fatigue Testing System	Computer Integrated Manufacturing (CIM)	Analytic Hierarchy Process (AHP)	Internal Idea Capture System	Design Exclusion Calculator
Emissions Testing	Electrical Resistivity	Material Requirements Planning (MRP)	Beta Testing	IP Agreements	Design Guide for Aging and Disability (ISO Guide 71/ CEN/CENELEC Guide 6)
Home Printed Circuit Board Manufacturing	Finite Element Analysis Tool 1: ALGOR	Six Sigma	Brainstorming	Lead User Analysis	Inclusive Design Toolkit - Disability Simulators
Immunity Testing	Finite Element Analysis Tool 2: Ansys		Brand-Equity Analysis	Market Structure Maps	SWiFT 9:2012 Universal Design for Energy Suppliers
Industrial Printed Circuit Board Manufacturing	Hardness Measurement		Business Process Re-Engineering	Multiple-Attribute Decision Analysis	Transgenerational Tools
Measurement of inductance and capacitance	Heat Capacity		Clinical Trials	Net Present Value	Universal Design Product Evaluation Tools
Measurement of Voltage, Current and Resistance	Impact System		Competitor Benchmark Matrix	Netnography	
Pick and Place Machines	Pull Tester		Concept Testing	One on One Interviews (customer visit teams)	
Printed Circuit Board Design Software	Static Hydraulic System		Conjoint Analysis	Open Innovation	
Robotic Electronic Circuit Board Testing Equipment	Strain Measurement		Critical Path Analysis	Patent Mapping	
Safety Testing	Stress Measurement		Customer Idealized Design	Product Benchmark Matrix	
SPICE (Simulation Program with Integrated Circuit Emphasis)	Thermal Conductivity		Delphi Method	Quality Function Deployment	
	Thermal Expansivity		Empirical Methods for Feasibility Testing	Suh's Design Axiom	
	Toughness Measurement		Ethnography	Surveys	
			Failure Mode Effects Analysis (FMEA)	Team-Based Knowledge Work	
			Field Testing	Technology Road Map	
			Focus Groups	TRIZ	
			Human Performance Technology (HPT)	University Research Centers	
			Idea Generation (wildest idea, morphological analysis, metaphor use)	University-Based Industrial Extension Services	

Distribution of 79 Tools by Group

Competency Groups	Number of Tools	Number of Tools with Relevance to UD	Most Common NtK Stages and Steps Where Tools are Relevant
Electrical/Electronic tools	13	3	3.5- Conduct research Stage 5- Implement development plan Stage 6- Testing and validation
Material Science tools	15	2	2.2- Perform preliminary assessments 4.2- Propose draft solution 4.3- Outline preliminary business case 4.12- Identify features and specifications 7.1- Draft preliminary bill of materials 7.2- Develop materials plan
Mechanical Engineering tools	4	2	7.4- Develop production and capacity plan 7.5- Plan and schedule engineering 7.6- Plan and schedule tool and process design
Business tools	40	31	1.1 Assess needs from relevant stakeholders 1.2- Identify problem, audience, and context 1.3- Propose plausible solution 4.6- Initiate co-development practices 4.11- Gather and analyze customer needs 6.3- Test beta prototype with consumers in field
Universal Design Tools	7	7	2.2- Perform preliminary assessments 4.2- Propose draft solution 4.12- Identify features and specifications

Screen Image of Tool Summary

Home > Knowledge Base > Six Sigma: Toolbox entry

Six Sigma

Type: Process

Description: Six Sigma is a comprehensive business management strategy focused on reducing defects to help lower costs, save time, and improve customer satisfaction. It is typically employed by large companies with more than 500 employees, and may have to be adapted to create value in smaller organizations. It seeks to improve the quality of process outputs by identifying and removing the causes of defects (errors) and minimizing variability in manufacturing and business processes. It uses a set of quality management methods, including statistical methods, and creates a special infrastructure of people within the organization ("Black Belts", "Green Belts", etc.) who are experts in these methods. Each Six Sigma project carried out within an organization follows a defined sequence of steps and has quantified financial targets (cost reduction and/or profit increase). A variety of quality management techniques can be used together to implement a six sigma program, including check sheets, scatter diagrams, cause and effect diagrams, Pareto charts, flowcharts, histograms, and statistical process control to name a few.

Citation: Six Sigma. (2011). Retrieved from Wikipedia, http://en.wikipedia.org/wiki/Six_Sigma. AND Heizer, J. & Render, B. (2011). Operations Management. Pearson Education Inc., Upper Saddle River.

Advantages: Ensures that the process is working at its most efficient. Minimal waste and lower costs. Usually implemented company wide, which makes the process familiar across departments.

Limitations: Can be expensive.

Regulations: ASQ: The Global Voice of Quality

Groups: Management, Marketing, R&D, Engineering, Production, Accounting/Finance, Sales

Steps: 1.5, 2.2, 4.1, 4.7, 4.10, 4.11, 4.12, 4.13, 5.3, 6.3, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11, 8.2, 9.1

Free Resources

- iSix Sigma: New to Lean Six Sigma
- Lean 6 Society

Purchase Resources

- George, M., Rowlands, D. & Kastle, B. (2004). What is Lean Six Sigma? New York, NY: McGraw-Hill.
- Tuppas - Lean Six Sigma Software with Artificial Intelligence

NtK Model's Toolbox

Go to tools for Technical, Marketing and Customer Analyses

http://kt4tt.buffalo.edu/knowledgebase/model.php

NtK Model Publications

- Lane, J & Flagg, J. (2010) "Translating 3 States of Knowledge: Discovery, Invention & Innovation." *Implementation Science*, 5, 1, 9. http://www.implementationscience.com/content/5/1/9

- Stone, V. & Lane J (2012). "Modeling the Technology Innovation Process: How the implementation of science, engineering and industry methods combine to generate beneficial socio-economic impacts." *Implementation Science*, 7, 1, 44. http://www.implementationscience.com/content/7/1/44.

- Lane, JP (2012). The Need to Knowledge Model: An operational framework for knowledge translation and technology transfer. *Technology and Disability*, 24,187–192. http://iospress.metapress.com/content/f384n4gp042732gx/fulltext.html

- Flagg, J, Lane, J., & Lockett M. (2013) "Need to Knowledge (NtK) Model: An Evidence-based Framework for Generating Technology-based Innovations." Implementation Science, 8, 21, http://www.implementationscience.com/content/8/1/21

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