

# Assessing Critical Thinking Capabilities of Project Management Practitioners: A Progressive Model

Viddur Rakesh Dubrie<sup>a,Ψ</sup> and Kit Fai Pun<sup>b</sup>

<sup>a</sup> BPTT, Trinidad and Tobago, West Indies;  
E-mail: rakeshrakeshd@gmail.com

<sup>b</sup> Department of Mechanical & Manufacturing Engineering, The University of the West Indies, St Augustine, Trinidad and Tobago, West Indies; E-mail: KitFai.Pun@sta.uwi.edu

<sup>Ψ</sup> - Corresponding Author

(Received 28 October 2012; Revised 22 March 2013; Accepted 9 June 2013)

**Abstract:** Project managers and practitioners work with multiple people, and each person has his own unique thoughts, feelings, opinions and agenda. Equipping the critical thinking (CT) skills would improve one's abilities in managing projects. This paper reviews the CT theories, and derives a progressive model that assesses the CT competence of project management (PM) practitioners. A Delphi technique with convenience sampling was adopted, and a group of Project Management practitioners was invited to evaluate a facet of competency variables that are built into the model. Based on this pilot evaluation, the scores computed show a fair pragmatic determination on the level of CT competency among the practitioners participated in the study. Future research would validate the applicability of the model with empirical and experimental evidences in PM practices.

**Keywords:** Critical thinking, competency, level, project management

## 1. Introduction

Nowadays, the new knowledge economy places increasing demands on flexible intellectual skills, and the ability to analyse information and integrate diverse sources of knowledge in solving problems. Project managers and practitioners are often plagued with a litany of uncertainties (Dubrie, 2011). Critical thinking (CT) is a skill that enables one to analyse, evaluate, explain, and restructure his/her thinking, thereby decreasing the risk of adopting, acting on, or thinking with, a false belief (Hamby, 2007). The skill includes the ability to respond to materials by distinguishing between facts and opinions or personal feelings, judgments and inferences, inductive and deductive arguments. Adopting CT in project management (PM) would help practitioners acquire knowledge, improve the theories, and strengthen arguments. Cuizon (2008) contends that critical thinkers' traits would encourage them to raise vital questions and problems, and formulate results-oriented strategies. Such ability endorses solutions and testing of concurrent or sequential problems based on relevant criteria and standards.

According to the Critical Thinking Community (2009), there are three (3) main approaches used to assess CT skills. These are: 1) commercially available general knowledge standardised tests, 2) researcher designed assessments that capture aspects of critical thinking directly, and 3) teaching people to assess their own

thinking. Regardless of the mechanism used to assess CT skills, Illeris (2007) confers that no one approach is best, and but each has its limitations and merits.

CT is not limited to the one-off assessment of a statement for its correctness, but a dynamic activity in which critical perspectives on a problem develop through both individual analysis and a measurement of the usage of various sub-skills (Hamby, 2007). Recent studies supported the usefulness of building a model incorporating as much CT skills as possible within a specific context (Dubrie, 2011; Dubrie and Pun, 2013). A Delphi technique with convenience sampling was employed, and a group of invited PM practitioners was invited to participate in an evaluation of the model. This paper proposes a progressive model in assessing the level of practitioners' CT skills. This paper presents the main findings, and sheds lights on using the model as a facilitative tool for assessing one's CT competency.

## 2. Theories and Models of Critical Thinking

Critical thinking is the art of raising what is subconscious in one's reasoning to the level of conscious recognition. It should not be confused with being argumentative or being critical of other people (Dubrie, 2011; Dubrie and Pun, 2013). CT plays an important role in improving human processes in cooperative reasoning and constructive tasks. The CT process starts out with knowledge. Thinking starts with

knowledge, whether a little bit or a good understanding of the thinking topic (Quest, 2009).

Kuhn (1992) argues that the grounding of various theories and models rested on two distinct disciplines: philosophy and psychology. CT has been associated with philosophy. Resnick (1987) contends that CT summarises the nature of the philosophical contribution to thinking skills as promoting disciplined thinking. This is a means of guarding humans against their natural tendencies toward ego- or ethnocentric thinking, toward accepting fallacies and drawing inappropriate conclusions.

In contrast to philosophers, psychologists have drawn their ideas about CT largely from research in cognitive and developmental psychology and theories of intelligence (Halpern, 1993). According to Cuizon (2008), people view the nature of knowledge and respond to tasks requiring CT in four categories. These are: 1) Dualism - received knowledge, 2) Multiplicity - subjective knowledge, 3) Relativism - procedural knowledge, and 4) Commitment in relativism - constructed knowing.

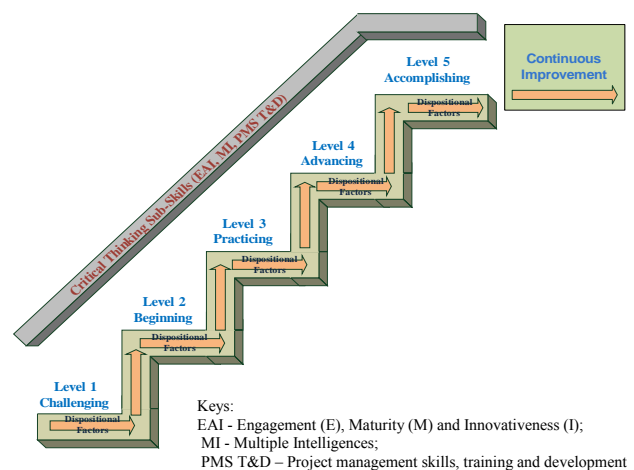
Several authors have discussed the integration of philosophy- and psychology-based theories. Ford (2009) argues that regardless of the model, be it scientific, be it conceptual, be it mathematical/statistical, the development involves an elaborative process. Some typical models integrating CT theories are:

- 1) Mental Model - Senge (2006) proposed a mental model that places CT into a multi-layered structure. The three aspects of this model form a spectrum from internal rationality (or coherence) to inter-subjective dialogue and then to correspondence with external reality. The concept of CT as internal or external dialogue forms a crucial bridge (Hamalainen and Saarinen, 2004).
- 2) Taxonomy Model - Bloom (1956) developed a classification of levels of intellectual behaviour in learning. This taxonomy contained three overlapping domains: cognitive, psychomotor, and affective. Within the cognitive domain, six levels (knowledge, comprehension, application, analysis, synthesis, and evaluation) are identified (Krathwohl, 2002).
- 3) CT and creative thinking model – Isaksen et al. (2000) describe CT as making and communicating connections to 1) think of many possibilities; 2) think and experience in various ways and use different points of view; 3) think of new and unusual possibilities; and 4) guide in generating and selecting alternatives. A six-stage problem-solving model was derived, including Mess Finding, Data Finding, Problem Finding, Idea Finding, Solution Finding, and Acceptance Finding.
- 4) Recognition/Meta-cognition Model – As advocated

by Cognitive Technologies Inc. (2004), the Recognition/Meta-cognition (R/M) model provides a general, systematic, and precise account of the CT processes. Proficient decision makers are able to recognise a large number of familiar situations, retrieve appropriate response(s), and act quickly and effectively on intuition.

### 3. A Model for Assessing CT Competency

Many recent studies (e.g., Dyer (2006); Richard and Elder (2009); Dubrie (2011)) adamantly examined the importance of using an appropriate model as a tool for measuring and benchmarking people's competence in CT skills. Dubrie (2011) argues that focus of measures is put on the core CT skills that are interdisciplinary and reflective of skills needed for PM practices. Dubrie and Pun (2013) argued that there has been a need for PM practitioners to initiate a paradigm towards progressive improvement. Build upon the literature review with empirical evidences, a model comprising five (5) progressive CT levels was proposed (see Figure 1).



**Figure 1.** The Five-Level Construct of the Progressive CT Model

The model shows a stairwell structure, to portray an ascending direction of movement. Several key elements in the five (5) levels have been identified, namely challenging, beginning, practicing, advancing and accomplishing. Figure 2 depicts the skeleton and scoring of respective levels of the progressive CT. These are:

#### Level 1: Challenging

At this lowest level, it categorised 'challenging' thinkers based on the scores (i.e., 0-20%) acquired from the test. They are largely unaware of 1) the determining role that thinking is playing, and 2) the ways that problems in thinking are causing problems in their lives.



	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
Sub-Skills, PMS T & D					
				Regular critique own plans	Articulates strength and weakness
			Seldom critique own Plans	High degree of intellectual humility	Consistent performance
		Begins recognition of Problems	Articulates strength and weakness	Effectively uses of strategies	Complex thinker
	Unawareness	Lack clear solutions	Frequent assessment of thinking	Deeper values	81 - 100 %
	Inconsistency	Unable to systemise efforts	Regular monitoring of thoughts	61 - 80 %	Systematically monitors thinking
	Misconceptions	Some degree of confidence	41 - 60 %	Develop good habits	Conscious and highly intuitive
	Poor thinker	21 - 40 %	Recognises problems	Actively analyse and evaluate	Actively analyse
	0 - 20 %	Take minimal charge	Begin to improve reasoning	Consistent high Level of thinking	Higher degree of understanding
	Dispositional Factors	Consistent problems	Impetus to take up challenges	Deeper level of thoughts	Fair minded
Failing attempts		Lack of systematic plans	Actively monitor thinking		
Lack of clarity		Deliberations			
Lack of knowledge					
					
	<b>CHALLENGING</b>	<b>BEGINNING</b>	<b>PRACTICING</b>	<b>ADVANCING</b>	<b>ACCOMPLISHING</b>

Figure 2. CT Model Characteristics, Indicators and Variables

The ‘challenging’ thinkers lack the ability to explicitly assess their thinking and improve it. The low scores indicate a lack of knowledge and engagement levels. They would encounter difficulties in recognising thinking as involving concepts, assumptions, inferences, maturity, implications, and points of view, clarity, accuracy, precision, relevance, and logicalness. Besides, they lack the ability to take charge of overall management (such as plan, organise, delegate and coordinate), long-term goals and external relationships.

**Level 2: Beginning**

The ‘beginning’ thinkers score within 21-40%. This score demonstrates their ability to takes up the challenge to begin to take explicit command of thinking across multiple domains. An increase in scores from the previous level will show recognition that they make initial attempts to better understand how they can take charge of and improve it. The “beginning” thinkers modify some of their thinking, but have limited insight into deeper levels of the trouble inherent in their thinking. They increase their dispositions in thinking of concepts, assumptions, implications, and points of view.

At the beginning stage, thinkers recognise the

standards for the assessment of thinking, and the need to internalise them deliberately. Hence, these thinkers would show some degree of intellectual confidence in reason. They would also have the evaluation, analysis and inference skills perseverance struggling with serious problems while yet lacking a clear solution to them.

**Level 3: Practicing**

The ‘practicing’ thinkers score between 41-60%, they have a sense of the habits to take charge of their thinking. They recognise that problems exist in their thinking, and are knowledgeable of what it would take to systematically monitor the role in their thinking of concepts, assumptions, inferences, implications, and level of engagement. Practicing thinkers recognise the need for systematic CT and internalisation into habits. Moreover, they have enough skill in thinking to critique their own plan for systematic practice, and to construct a realistic critique of their powers of thought.

**Level 4: Advancing**

Scoring between 61-80% indicates an active and successfully engagement in monitoring the role in their

advancing thinking of concepts, assumptions, inferences, implications, and levels of engagement. ‘Advancing’ thinkers establish good habits of thought, and actively analyse their thinking in the significant domains. These thinkers demonstrate knowledgeable of what it takes to regularly assess their thinking for clarity, accuracy, precision, relevance, and logicalness. Moreover, once scores are within this level, it indicates a desire to regularly critique their own plan for systematic practice, and improve it. At this stage, the scores show a high degree of intellectual humility in recognising and perseverance to actually develop new fundamental habits of thought based on deep values and the rational to recognise areas of inconsistency and contradiction.

#### Level 5: Accomplishing

At this level, the “Accomplishing” thinkers have systematically taken charge of their thinking and they intuitively assess their thinking for clarity, accuracy, precision, relevance, and logicalness. They show a high level of disposition, and have the ability to think through complex issues with judgment and insight. Scoring at the highest level of 81-100% they have deeply internalised the basic skills of thought. It shows a level of competency and accomplishment, and beyond this is the continuous improvement.

The “accomplishing” thinkers have an extensive experience and practice in engaging in self-assessment. They are actively analysing their thinking in the significant domains of their lives, and are also developing new insights into problems at deeper levels of thought. These thinkers understand the complex relationship between thoughts, emotions, drives and behaviour. Moreover, they effectively and insightfully articulate the strengths and weaknesses inherent in their thinking.

#### 4. A Pilot Study

A group of seven PM practitioners were invited to participate a pilot study and complete a questionnaire. A Delphi technique with convenience sampling was adopted. These practitioners were graduates of the Masters’ Programme in Project Management in the 2008 cohort at The University of the West Indies (UWI). They have been practicing PM in a wide range of public and private sectors organisations in Trinidad. Data were thus collected via the information inputted into the questionnaire from the participants.

The pilot study comprised the tests for 1) CT skills and sub-skills (including multiple intelligences (MI) and 2) CT dispositional factors (such as Engagement (E), Maturity (M) and Innovativeness (I)), and 3) PM skills, and PM training and development (PMS T&D) (as represented as the leading and lagging indicators on the model). Table 1 depicts the evaluation focuses of CT skills, sub-skills and dispositional factors. The test on elements of PM skills, training and development (T&D) rests on testing participants’ ability with respect to 1) Communication, 2) Negotiation, 3) Organise, 4) Planning, 5) Meeting objectives, 6) Solving problems, 7) Use of PM software, 8) Control management, 9) Conflict resolution, 10) Decision making, 11) Delegation, 12) Leadership, 13) Listening, 14) Ability to manage legal issues, and 15) Motivational skills. The results would be used to determine the level of CT competence of practitioners.

Scoring this model would be based upon the results acquired. Using a 5-point Likert scoring sheet to score the results, the five (5) levels of the model are to be divided equally based on 100 percent, with Level-1 ranges from 0-20%, Level-2 21-40%, Level-3 41-60%, Level-4 61-80% and Level-5 81-100%, respectively. The results would be used as part of a final assessment to determine if the practitioner’s CT ability direction is leading or lagging.

**Table 1.** Pilot evaluation focus of CT skills, sub-skills and dispositional factors

<b>CT skills and sub-skills</b>	
1) Analysis Skills	To test participants’ ability to interpret, reason, arrange, explain, correlate, breakdown, classify, infer and discover relationships
2) Inference Skills	To examine the ability of the participants in drawing conclusion from certain observed or supposed facts. This also assesses their ability to identify, draw reasonable conclusions and to consider relevant information
3) Evaluation Skills	To assess the participants’ ability in credibility of statements or other representations which are accounts or descriptions of a person's perception, experience, situation, judgment, belief or opinion. This also assesses their logical strength of the actual or intended inferential relationships among statements, descriptions, questions or other forms of representation
4) Multiple intelligences	To test participants’ ability with respect to i) Linguistic, ii) Logical-mathematical, iii) Musical, iv) Naturalistic, v) Bodily-kinesthetic, vi) Spatial, vii) Inter-personal, and viii) Intra-personal intelligences.
<b>CT dispositional factors</b>	
5) Engagement	To test the participants’ ability in their reasoning skills and confidence in solving problems and making decisions. This also assesses for communication skills and the ability to explain the reasoning process used to arrive at a decision or a solution
6) Maturity	To assess participants’ approach to problems, inquiry, and decision making with a sense that some problems are ill-structured and some situations have more than one plausible option
7) Innovativeness	To assess for their intellectual curiosity with challenges and seek for knowledge through research, reading, and questioning

## 5. Findings and Analysis

The pilot study acquired PM practitioners' views on evaluating the applicability of the progressive model. For instance, a practitioner gets an overall score of 60% in the dispositional test and 30% in the sub-skill test, this simply means that he/she is at a practicing level of thinking critically and his sub-skills are lagging behind. If practitioners guide themselves by improving on their CT sub-skills and dispositional factors, they would find themselves ascending in their level of thinking critically, and *vice versa*.

Table 2 summarises the collected data from the pilot study. Results show an overall score of 58.82%, which reflects a Level-3 on the model hence, portraying the stage of practicing CT skills. The participants demonstrated strengths in PM skills averaging 64.38%, with high scores in leadership, control management and conflict resolution.

However, the results also showed the weaknesses of PM practitioners in meeting their objectives, planning and decision-making. The scores were generally averaged in their disposition factors, with maturity skill being the strong area and engagement being their weaker area. As for the CT skills scores, results showed high scores in participants' musical and visual/spatial skills, but indicated an inadequacy in their level of analysis skills. Despite achieving a level-3 rating, many participants were in their right direction towards improving their CT skills.

Various factors, elements, indicators and variables of the model have been identified. The results show that most participants are in a practicing stage (i.e., Level 3), with an inclination to move higher based on the leading indicators. In Table 3, the results show a 71.43% leading indicator versus a 27.59% lagging indicator, suggesting an ascending direction of progress.

**Table 2:** Results from a Pilot Study on CT Assessment

CT Model Variables	Scores					Proficiency Rating
<b>CT Skills</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>100%</b>
Analysis skills	4	6	0	0	0	28.57%
Inference skills	0	8	3	8	0	54.29%
Evaluation skills	1	0	18	0	0	54.29%
Verbal/Linguistic	1	8	3	0	0	34.29%
Logical/ Mathematical	0	10	6	0	0	45.71%
Visual/Spatial	0	2	12	4	5	65.71%
Interpersonal	0	0	18	0	5	65.71%
Musical	0	2	0	24	0	74.29%
Naturalistic	1	6	6	4	0	48.57%
Body/Kinesthetic	2	0	15	0	0	48.57%
Intrapersonal	1	6	6	4	0	48.57%
<b>Mean Score</b>						<b>51.69%</b>
<b>CT Dispositions</b>						
Engagement	0	8	6	4	0	51.43%
Maturity	1	2	3	16	0	62.86%
Innovativeness	0	2	18	0	0	57.14%
<b>Mean Score</b>						<b>57.14%</b>
<b>Project Management Skills</b>						
Communication	0	0	3	24	0	77.14%
Negotiation	0	0	3	24	0	77.14%
Organise	0	0	21	0	0	60.00%
Planning	0	10	3	0	0	37.14%
Meeting objectives	0	0	3	4	0	20.00%
Solving problems	0	0	18	4	0	62.86%
Use of PM software	0	0	6	20	0	74.29%
Control management	0	0	0	28	0	80.00%
Conflict resolution	0	4	0	8	15	77.14%
Decision making	0	2	3	4	0	25.71%
Delegation	0	0	9	12	5	74.29%
Leadership	0	0	3	8	20	88.57%
Listening	1	4	9	12	0	74.29%
Ability to manage legal issues	2	0	0	16	5	65.71%
Motivational skills	1	0	3	16	5	71.43%
<b>Mean Score</b>						<b>64.38%</b>
<b>Maximum Attainable Score per participant</b>	<b>145</b>					
<b>Total Scores (7 participants)</b>	<b>15.00</b>	<b>80.00</b>	<b>198.00</b>	<b>244.00</b>	<b>60.00</b>	
<b>Mean scores per participants</b>	<b>2.14</b>	<b>11.43</b>	<b>28.29</b>	<b>34.86</b>	<b>8.57</b>	
<b>Total Score (Out of 100%)</b>	<b>58.82%</b>					

**Table 3:** Results for the leading and lagging factors in the pilot

Status	Lagging		Leading
	In progress	0	One or More Components
Participants Score (N=7)	7	21	70
Mean scores	7.14%	21.43%	71.43%

## 6. Conclusion

The paper contributes to the development of a proposed progressive model. Designed with a stairwell concept, the model comprises of five (5) levels showing the ascending and descending levels. Having specific demarcation/element/characteristics within each of its five (5) levels, this model serves as a benchmarking tool for practitioners in understanding their level of CT skills and progression.

In order to evaluate the applicability and conformity of the CT progressive model, a pilot study based on a group of invited PM practitioners was conducted. Results showed that the model carves the pathway for inquires and assessments on practitioners' academic background, their exposure to the work environment, training and developmental areas and general knowledge, to understand the underlying elements to make improvements.

The model incorporates the CT concepts specific to PM practitioners. It is anticipated that the model could be used as a tool for measuring and benchmarking CT skills of PM practitioners. There would have potential expansion of the CT model in measuring institutional PM performance in different industry sectors. Future research would be conducted with larger sample size and different organisations. Besides, empirical studies are needed to investigate the relationships between the variables that help assess the levels of practitioners' CT competency and evaluate the efficacy of the CT progressive model.

## References:

- Bloom, B.S. (1956), *Taxonomy of Educational Objectives*, Allyn and Bacon, Boston, MA.
- Cognitive Technologies, Inc. (2010), *The Recognition / Metacognition Model*, available at: <http://www.cog-tech.com/projects/RecogMetacog.htm> (accessed July 1st, 2010).
- Cuizon, G. (2008), *Traits of a Critical Thinker*, Creative Commons Publishers.
- Dubrie, V.R. (2011), *Measuring and Modelling Critical Thinking Skills: A Catalyst for Postgraduate Studies in Project Management*, Project Report, MSc in Project Management, The University of the West Indies, St Augustine, Trinidad and Tobago
- Dubrie, V.R. and Pun, K.F. (2013), "Assessing critical thinking skills of project management practitioners: an exploratory study", *The Journal of the Association of Professional Engineers of Trinidad and Tobago*, Vol.41, No.1, 2013, April/May, pp.35-42.
- Dyer, L. (2006), *Critical Thinking for Business Students*, Captus Press, Canada.
- Ford, A. (2009), *Modeling the Environment*, 2nd Edition, Island Press, Washington D.C.

- Halpern, D. (1993), *Thought and Knowledge: An Introduction to Critical Thinking*, Pearson Publishing, New Jersey.
- Hämäläinen, R. and Saarinen, E. (2004), *Systems Intelligence: Discovering a Hidden Competence in Human Action and Organisational life*, Helsinki University of Technology, Helsinki, Finland
- Hamby, B. (2007), *The Philosophy of Anything: Critical Thinking in Context*, Kendall Hunt Publishing, Dubuque Iowa.
- Illeris, K. (2007), *How We Learn: Learning and Non-learning in School and Beyond*, Taylor and Francis, New York.
- Isaksen, S.G., Dorval, K.B. and Treffinger, D.J. (2000), *Creative Approaches to Problem Solving*, 2nd edition, Kendall/Hunt, Dubuque, IA
- Krathwohl, D. R. (2002), "A revision of bloom's taxonomy: an overview", *Theory into Practice*, Vol.41, No.4, pp.212-218.
- Kuhn, D. (1992), "A developmental model of critical thinking", *Educational Researcher*, Vol.28, No.2, pp.16-26.
- Quest, T. (2012), *The Critical Thinking Process*. Available at: <http://library.thinkquest.org/29248/ctproc.html> (accessed July 5, 2012).
- Resnick, H. (1987), "Critical thinking skills and teacher education", *ERIC Digest*, Vol.1, pp.3-12.
- Richard, P. and Elder, L. (2009), *The Miniature Guide to Critical Thinking: Concepts and Tools*, Foundation Critical Thinking, Northern California.
- Senge, P.M. (2006), *The Fifth Discipline: The Art and Practice of the Learning Organisation*, New Edition, Doubleday, New York
- The Critical Thinking Community (2012), *Critical Thinking*, available at: <http://www.criticalthinking.org/page.cfm> (accessed June 21, 2012).
- Treffinger, D.J., Isaksen, S.G. and Stead-Dorval, K.B. (2005), *Creative Problem Solving: An Introduction*, Prufrock Press Inc.

## Authors' Biographical Notes:

Vidur Rakesh Dubrie is presently an activity planning functional scheduler at BPTT. Before joining BPTT, he has substantial work experience in construction, energy and public utility sectors for more than 10 years. Mr. Dubrie graduated in 2005 with a first degree in BSc Electrical Engineering from the University of Houston, and obtained an MSc degree in Project Management in 2011 with a distinction from The University of the West Indies, Trinidad and Tobago. He was the recipient of two awards for best overall research paper and top student in the 2011 graduating class. Mr. Dubrie was also a registered Project Management Professional accredited by the Project Management Institute.

Kit Fai Pun is presently a Professor of Industrial Engineering of the Faculty of Engineering and the Chair and Campus Coordinator for Graduate Studies and Research at The University of the West Indies. He is a Registered Professional Engineer in Australia, Europe, Hong Kong, and The Republic of Trinidad and Tobago. Professor Pun is a member of Caribbean Academy of Science and a Fellow/member of several professional bodies and learned societies. He is also the Chairperson of the Technology Management Council of the IEEE Trinidad and Tobago Section (2003-2013), and was the past chairman of the Mechanical and Industrial Division of the Association of Professional Engineers of Trinidad and Tobago (2004-2009). His research interests and activities include industrial engineering, engineering management, quality systems, performance measurement, innovation, and information systems.

■