HOW TO NURTURE AND DEPLOY RAILWAY SAFETY INSPECTOR COMPETENCIES IN THE RAILWAY INDUSTRY: A PLAN FOR THE 4TH INDUSTRIAL REVOLUTION (4IR)

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INTRODUCTION

The Aim: This article aims to share a process that was followed in developing a formal qualification for railway safety inspectors in South Africa. 'Baby Boomers', who have accumulated wealth of experience in the railway industry in past decades, have recently been exiting the industry; mainly through retirement. The recently developed Railway Safety Inspector (RSI) curriculum aims to equip railway safety inspectors (RSIs) with a formal qualification with a view to building capacity in the inspectorate and to close the lacuna left by the 'Baby Boomers'.

Project Approach: A multidisciplinary working group across the railway industry in South Africa was assembled to solicit their opinions on the purpose of the project as well as develop a qualification for practising and future inspectors. This project was initiated, and continues to be nurtured, by the Railway Safety Regulator (RSR). **The Outcome:** The outcome of the consultations was that, in the rule-based environment, mentoring was a natural process when sheltered employment was a norm, thus the retention of employees was not a challenge as opposed to the current environment; where the new employment contract cannot guarantee any job security.

Recommendation: We propose that reputable and accredited training providers should further develop and sustain the RSI qualification and that through a periodic curriculum review process we will respond appropriately to emerging fourth industrial revolution (4IR) opportunities and

challenges by employing a systems approach in order to avoid the temptation of distinctly compartmentalising railway knowledge when we manage a railway system.

Keywords: Railway Safety Management, Railway Safety Inspectors, Curriculum Development, Safety Culture & Sustainability.

1. BACKGROUND AND HISTORY OF THE DEVELOPMENT PROCESS OF A RAILWAY SAFETY INSPECTOR (RSI) CURRICULUM

The RSR of South Africa, subsequent to internal and external consultations with railway industry participants, identified a need for a more formal approach to competency development of RSIs. The team that worked on the project defined a Railway Safety Inspector candidate as *someone with relevant railway experience, a bachelor's degree or a diploma in engineering; or some other recognised safety related qualification plus either an engineering professional registration or a professional registration in their discipline of study.*

In addition, if such candidates are to be employed by the RSR as inspectors, they will first have to be appointed as such by the Chief Executive Officer (CEO) of the RSR who will consider their *suitability* for this kind of appointment, as mandated by, and stipulated in, the National Railway Safety Regulator (NRSR) Act, No.16 of 2002, as amended (the Act).

In the absence of a formal qualification for RSIs, a CEO of the RSR appoints any *suitably qualified* persons as RSIs. It is hoped that a training and competency-based curriculum for RSIs will assist by clarifying the *suitability* of prospective candidates for the RSI job; and that it will also assist in further developing requisite RSI skills in order to meet the requirements of a changing railway environment or landscape, mainly in so far as safety is concerned.

Moreover, it is hoped that such a curriculum will assist in responding appropriately to disruptions that could arise from the 4IR.

Whilst it is recognised that a railway SMS which; according to the Act, must be in conformity with the *form* and *content* as determined by the RSR, and which is developed in consultation with the industry partners; should remain a guiding tool and regulation philosophy for all railway safety practitioners in South Africa. However; it is still deemed useful to have a formal qualification to guide the training approach and skills development regime for RSIs, in order to appropriately deal with any identified operational safety challenges in the era of 4IR disruptions and opportunities.

2. THE PURPOSE OF THE PROPOSED RSI CURRICULUM

Considering what has now been described in section 1 above, the overarching purpose of the proposed curriculum is therefore to achieve the following four objectives:

a) To prepare a learner to operate as a *suitably* qualified RSI whilst performing duties such as; inspection of railway operations, auditing a railway SMS and investigating railway occurrences, in order to effectively promote and monitor the enforcement of safety compliance and continuous improvement of safety in the rail environment in accordance with prescribed standards and legislation.

Briefly*, a qualified learner; with good theoretical knowledge and practical experience, will be able to:*

b) Inspect railway operations in accordance with prescribed standards and legislation.

c) Audit a SMS in accordance with prescribed standards and legislation.

d) Investigate railway occurrences in accordance with prescribed standards and legislation.

## 3. IMPACT OF ECONOMIC CONSIDERATIONS ON SAFETY PRIORITIES

Considering that the purpose of a SMS is to ensure that organisations achieve their business objectives in a safe manner, it is therefore critical that the impact of economic realities, such as budgetary constraints and economic pressures, on operational safety imperatives is considered. Justification for a shift away from safety vigilance could be that; *we seem to be doing well for now* despite our limited investment on safety programmes such as training and skills development. Unfortunately, if; and when this attitude, sets in, an organisation becomes complacent for as long as set targets are being met. While there may be valid reasons to justify this view, in the long run it becomes increasingly difficult to nurture a culture of safety vigilance and organisational competency, as it can be seen with the Columbia Shuttle Accident illustrated in Figure 1.
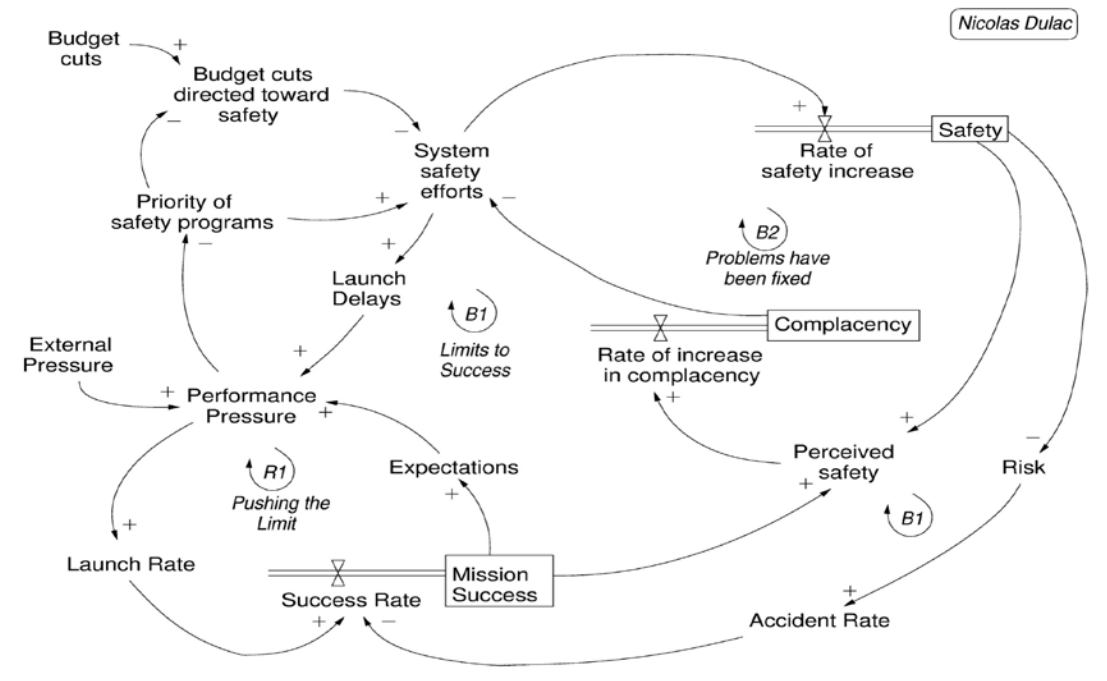
Figure. 1: Simplified System Dynamics Model of Columbia Accident[1]

[1] Nicolas Dulac, a Ph.D. student at MIT, created this model for Prof NG Leveson, Professor of Aeronautics and Astronautics, and Engineering Systems, also at MIT.

Whilst the Columbia accident has been widely cited by authors, it continues to be a relevant case study; especially for developing economies. Budget cuts (-ve) in this case study are viewed to be compromising the increase (+ve) in system safety efforts. Safety programmes, including skills development programmes, should not be compromised in exchange for achieving annual performance targets, be it revenue targets or otherwise; as that could increase the level complacency and thus have a negative impact on safety. Reduced (-ve) efforts towards system safety initiatives such as training could have a negative impact on organisational safety sustainability efforts as illustrated in Figure 2 "Every system safety engineer is well aware of the peculiarity of this field wherein the more successful one is in preventing accidents and incidents, the more others are convinced that the safety engineering efforts were not needed"[1]. The railway community should also take a leaf out of the Titanic disaster. Lifeboats is but one of numerous contributing factors to the disaster, including legislation, design changes, budget changes, schedule changes, rivet hammering method changes, schedule pressures, compliance, radio priorities, fatigue and chance.
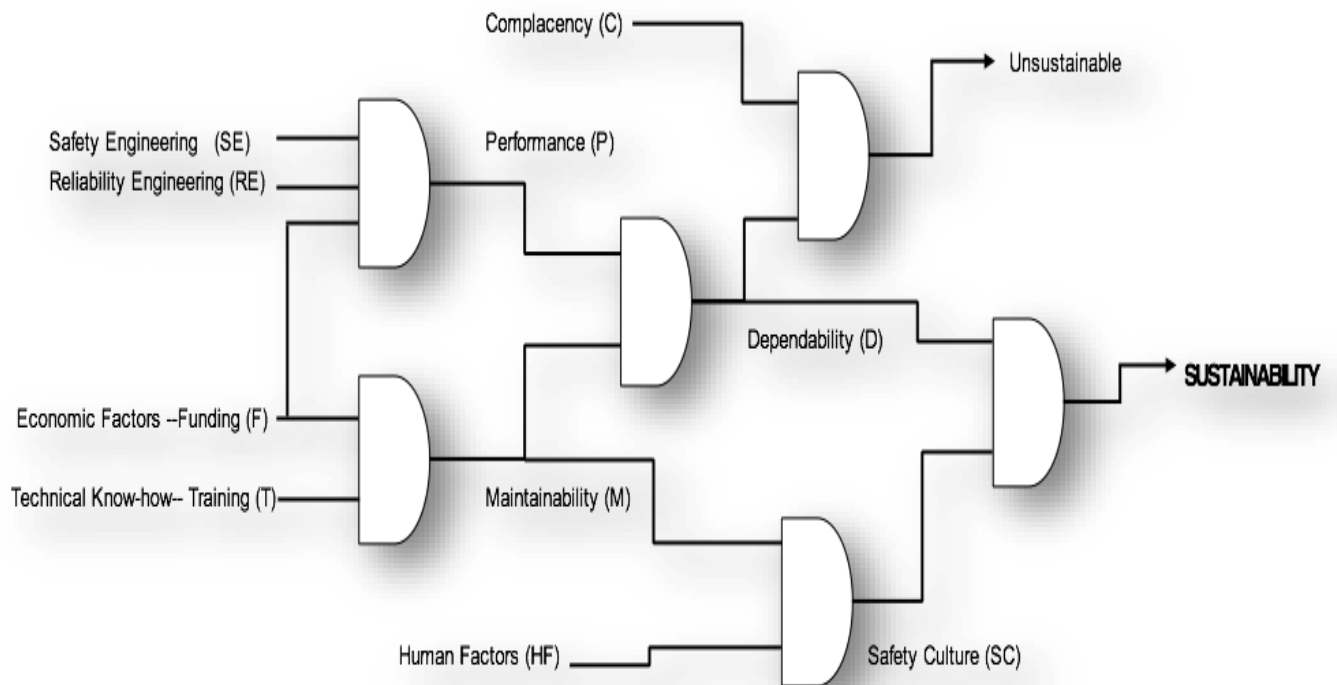
Figure. 2 Simplified Framework for Development and Sustainability of Railway Safety Inspector Qualification *(Source: P Sopazi)[2].*

The understanding is that SE is not the same as RE, but both (SE) AND (RE) must play a positive role in ensuring good technology performance, provided there is adequate funding for the project. For readers who may be unfamiliar with the principle of AND gates, a simplified explanation is given in the next paragraph.

A negative response means 'No' {i.e. (-ve) =0 = No}. A positive response means 'Yes' {i.e. (+ve) = 1 =Yes}. In other words, both (SE) AND (RE) must be positive. If all answers to the inputs are positive (Yes =1) then the output will be realised. Otherwise, if either SE or RE, or both are negative (No =0), then the output will not be realised. The same principle applies to all the other inputs and outputs. The outputs in turn become inputs to the next AND gate or gates, and again the same 'gate' principle applies. However, to ensure that a railway technological system is maintainable (M), appropriate technical training (T) must take place. These factors can ensure that there is dependability in the system, at least for a while. However, the South African experience

has highlighted that if the human factors issues for the people working in safety critical roles are not appropriately and well managed, system integrity is compromised, and safety culture efforts are negatively impacted.

While a system may be dependable (D), at least in the beginning, its eventual non-dependability, alongside poor human factors (HF) management, would result in a poor safety culture (SC) and thereby have a negative impact on its sustainability. Similarly, if a culture of complacency (C) develops and takes root, then eventually a system that once was dependable would ultimately be unsustainable.

4. RSI DEVELOPMENT PROCESS, FRAMEWORK AND PHILOSOPHY

The RSR team followed a process that entailed stages of the RSI Curriculum Development; guided by the framework proposed in Figure 2, and under careful consideration of the dynamics highlighted in Figure 1, and in collaboration with the Transport Education Training Authority (TETA) and the Quality Council for Trades and Occupations (QCTO). During a Pre- Scoping meeting hosted by the RSR and jointly facilitated with the QCTO, the following were achieved:
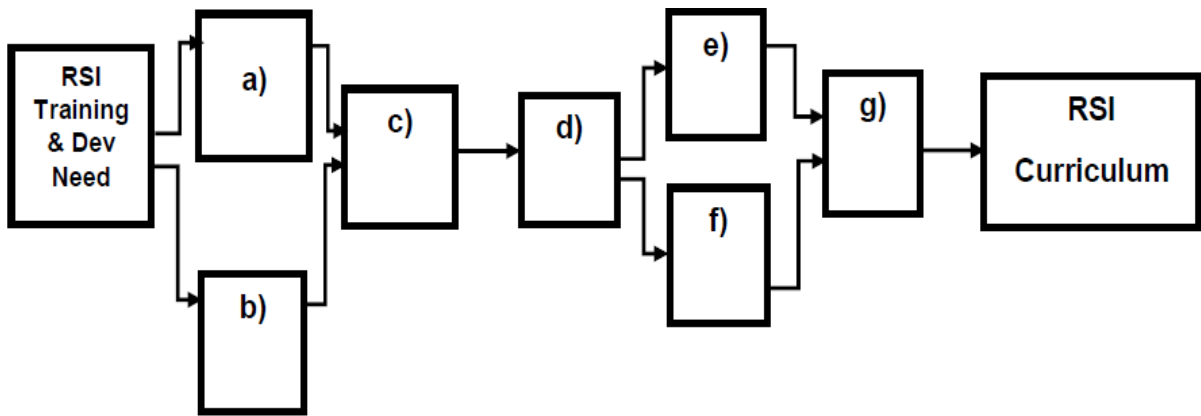
Figure 3: Activity Diagram for RSI Development *(Source: P Sopazi)[3].*

a) **Feasibility Study & Rationale for the Qualification:** To assess the need and availability of budget, time and expertise for the qualification development and explain what it seeks to address. This was explored and drafted in advance by the RSR team and then endorsed by a community of expert practitioners (CEPs) at the Pre-Scoping meeting.

b) **Learners & Trainers:** To assess availability of users for the qualification and prospective training providers. This was facilitated by the QCTO.

c) **Development Quality Partners (DQP)**: To assess availability of Partners to ensure quality checks during development. The TETA was nominated and appointed as a DQP.

d) **Assessment Quality Partner (AQP):** To assess availability of Partners post development. TETA was nominated and appointed as an AQP.

e) **Community of Expert Practitioners (CEPs):** To assess availability of curriculum developers and training material developers, including curriculum review to ensure relevance in the changing environment and align it with future requirements and the current Fourth Industrial Revolution (4IR) disruptions and opportunities.

f) **Funding Considerations & Learning Material Development**: To assess availability of funds to sustain qualification development and training for ultimate sustainability.

g) **Process Verification & Registration:** To verify followed process. National Qualifications Authority to recognise and register the qualification.

5. Concluding Remarks & Recommendations

The authors of this article, both of whom were directly involved with this project, conclude that in order to meet the future requirements, while appropriately attending to the 4IR discourse, the following will need to be key considerations:

a) *Strong partnerships with key participants.*
   Experience gathered during this project confirms the value of having a committed team of community expert practitioners (CEPs) and such value cannot be overstated.

b) *Budget cuts due to Economic Realities and Considerations could greatly compromise railway safety.*
   The Columbia Shuttle Accident model and illustration should be a lesson for the future.

c) *Sustainability of Safety Management efforts depends on various initial and secondary inputs.*
   This is illustrated in Figure 2. In this illustration it is implied that, a process leading to sustainability must be managed carefully until the end. Otherwise, good *initial* inputs with outputs (*secondary inputs*) which become inputs to subsequent processes are not a guarantee for success and if they are not managed and monitored carefully; they could result in complacency and thereby, fail to lead to ultimate sustainability, as can be seen in Figure 2.

d) *Values scanning for the strategic management team.*
Organisation values should be scanned periodically in order to assess how top management responds to the training needs of employees during strategic planning.

A schedule similar or better than the one proposed in **Annexure 1** could assist managers to better manage progression from a trainee to a suitably qualified inspector. It could also be used for continuing professional development (CPD) of all appointed railway safety inspectors.

Registration Status, Entry Requirements, Next Step:

Registration Status: Currently, the RSI curriculum is registered with the South African Qualifications Authority (SAQA) under the National Qualifications Framework (NQF) since February 2018 for a period of 5 years (07 February 2018 – 07 February 2023) as an NQF Level 6 Qualification (330 credits) which is equivalent to an Advanced Occupational Certificate or Diploma.

Entry Requirements: NQF Level 4 (i.e. High School Exit Level Certificate) with Mathematics and Physical Science and a minimum of 3 years of relevant work experience in the railway environment (or related environment).

Next Step: The next step is the development of learning material which must be reviewed periodically in order to sustain the RSI programme as well as align it with future 4IR benefits while addressing associated disruptions. See also **Annexure 1** below, for a role that employers could play to assist with RSI training. **Articulation options**: Advanced Diploma in Safety Management (*vertical*) and Diploma in Safety Management (*Horizontal*).

Furthermore, it is hoped that this qualification will contribute positively towards the professional development of railway safety inspectors and in managing their progression from traineeship (as trainees) to *suitably* qualified, experienced and competent safety practitioners. Finally, it is hoped that the international railway community will propose a plan for the 4IR; citing this study as the basis for future discourse on RSI training.

6. ACKNOWLEDGEMENTS

7. REFERENCES AND BIBIOGRAPHY

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Annexure 1: A Proposed and Simplified Example of RSI Training and Monitoring Schedule for a Period of 24 Months.

Month	Induction	Audits & Task Observe	Inspection		Investigation		Permit Assessment	Technology Reviews	Monthly Training Sessions based on RSI Courses				Submit Monthly/Quarterly /Annual Reports	Feedback	Assessment
		Audit Team Member	Task Observe	Inspection Team Member	Task Observe	Investigation Team Member	Task Observe		Training	Training	Training	Training			
1	X(1)	1	x	1		X	1	x	1	1	1	1	X	X	X	X
-		1	x	1		X	1	x	1	1	1	1	X	X	X	X
24		1	x	1		X	1	x	1	1	1	1	X	X	X	X

--Role of the Employer to Assist with RSI Training--