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SE Implementation in Designing Electronic Blast Systems

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Overview

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Objective

Research Design, Limitations and Assumptions

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Introduction

- South Africa → a world leader in mining
- Mining environment is not short of engineering challenges, particularly electronic blasting systems.
- Mining operations → large and complex systems with geological risk, uncertainty and variability (Holton &Porter, 2012).
- New technologies and systems in mining operations → increase in operations life cycle phase, while the technology lifecycles are diminishing.
  - Result: Impact on Ops requirements and increase in LC costs

Introduction

- Lower global commodity prices → drive in efficiency of mining systems, including electronic initiation systems
- Systems engineering processes are entrenched within the development process, and organisations utilise the systems engineering without identifying as such because of a combination of ignorance and obscurity existing between the domains of project management and systems engineering management (Lemberger and Erasmus, 2014; Sharon et al., 2011).
- Challenges of improving efficiency in mining and more specifically electronic initiation system has benefited and can benefit further from systems engineering principles (Holton and Porter 2012).

Introduction

- In electronic blast systems, minimal research exists on the application of systems engineering principles and practices compared to that of ad-hoc, non-systemic approaches.

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Research Objective

- Electronic blast systems in mining operations need to meet the needs of the customer and must be inherently safe, robust, reliable, supportable, of high quality, cost-effective over total life-cycle of the product.
- Does a lack of formal systems engineering processes in the design and development of new and existing systems, lead to high risk of failure in the implementation of electronic blast systems? (Not answered in this paper)
- Preliminary investigation suggests that there is a lack of formal systems engineering processes being used in the design and development of new and existing electronic blast systems.
  - lack of proper initial planning and development of user requirements
  - Lack of considering the total lifecycle of the systems.
  - Risks are not fully assessed in the beginning, top down
  - Over time there is an exponential increase in lifecycle costs combined with a resource constrained environment → a high risk of failure in the implementation.
- This case study: **How well is systems engineering methods implicitly implemented in an organisation that designs and implements electronic blast systems?**

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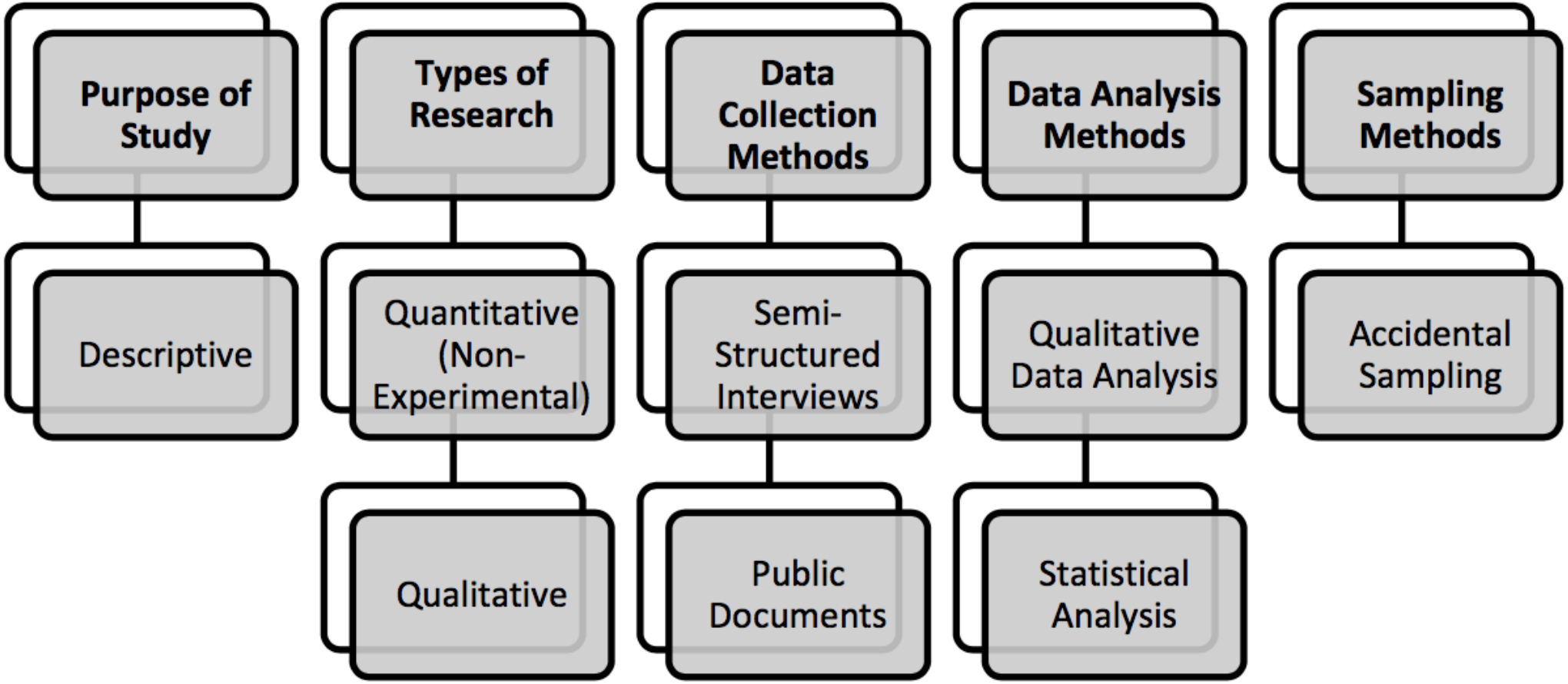
Limitations and Assumption

- The research will only be conducted at one player within the electronic blasting field, which is a significant portion of mining operations. Hence the results and conclusions may not be applicable to all EBS companies, nor the Mining Industry as a whole.
- The selected company has operations expanding over many continents, including USA, Chile, Europe, Indonesia and Australia, and is assumed to be a leader in its field on mining blasting especially in innovation and engineering design.
- This study of systems engineering and management at the EBS company will allows us to compare with good practices and see where the gaps are.
- It is not known whether systems engineering practice is being followed implicitly.

Research Design



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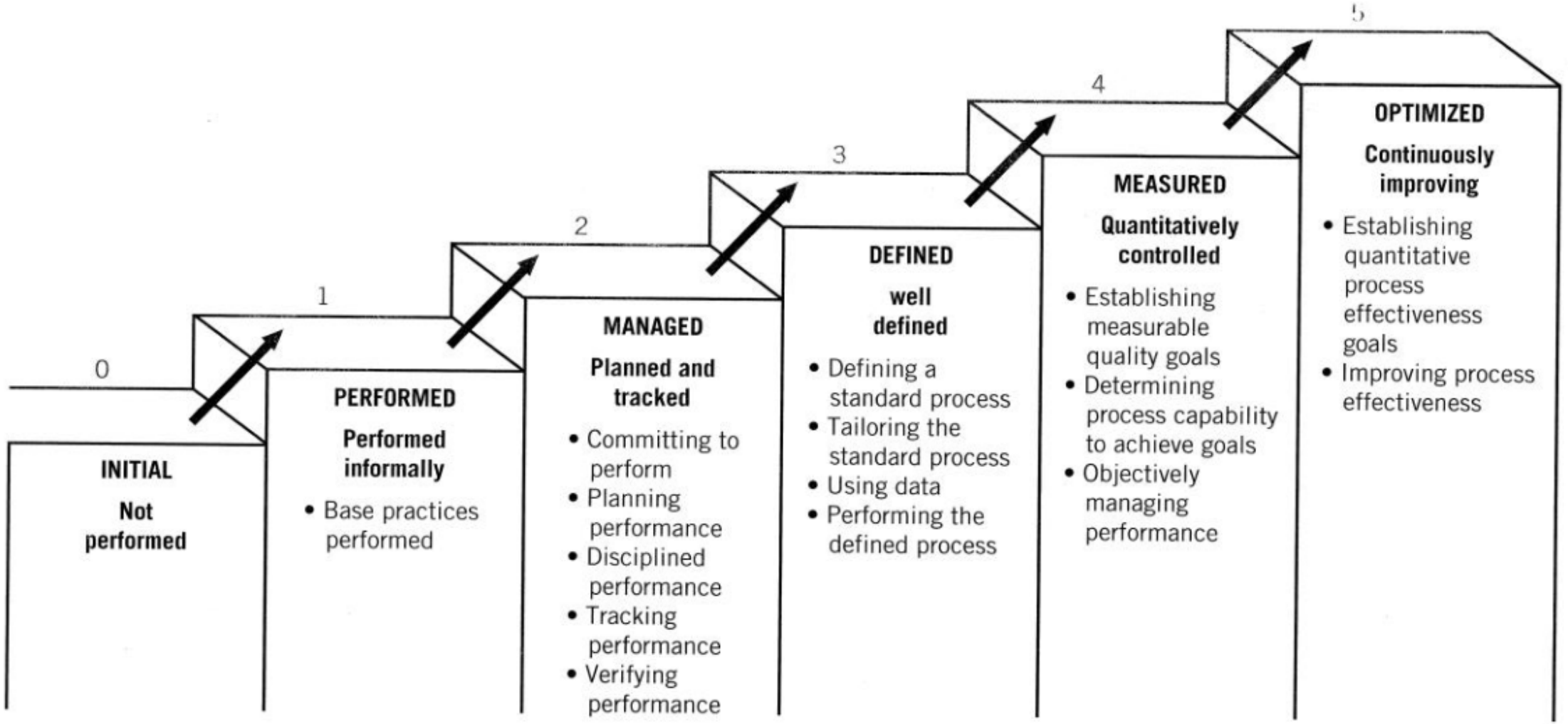
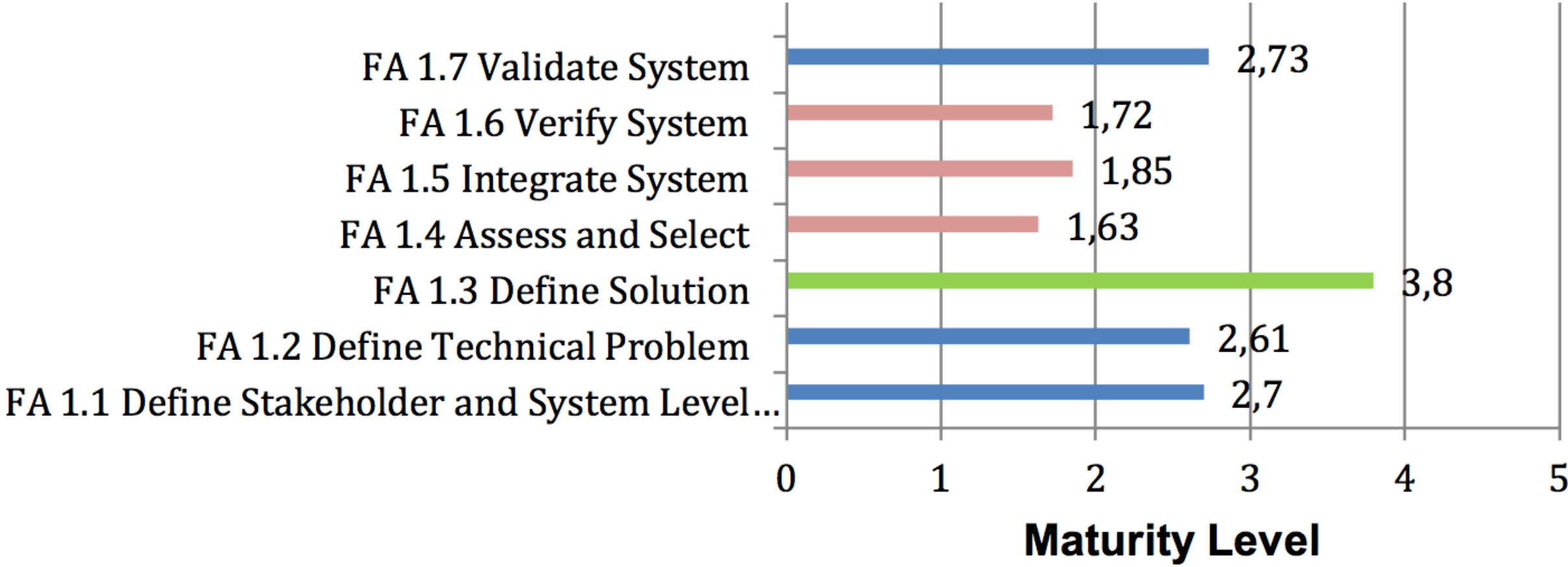
	Total Sample
Respondents	11
Departments *(*includes executive, marketing, production, project management, hardware, firmware and software)*	7
Engineering Experience*(average years)*	16,8
Electronic Blast Systems Experience*(average years)*	9,9
Electronic Blast Systems Experience*(maximum years)*	20
Electronic Blast Systems Experience*(minimum years)*	3
System Engineering Level*(%beginner)*	27,3%
System Engineering Level*(%intermediate)*	45,5%
System Engineering Level*(%advanced)*	18,2%
System Engineering Experience*(average years)*	7,1
Electronic Blast System Projects*(average number)*	8,4
Electronic Blast System Projects*(median)*	6

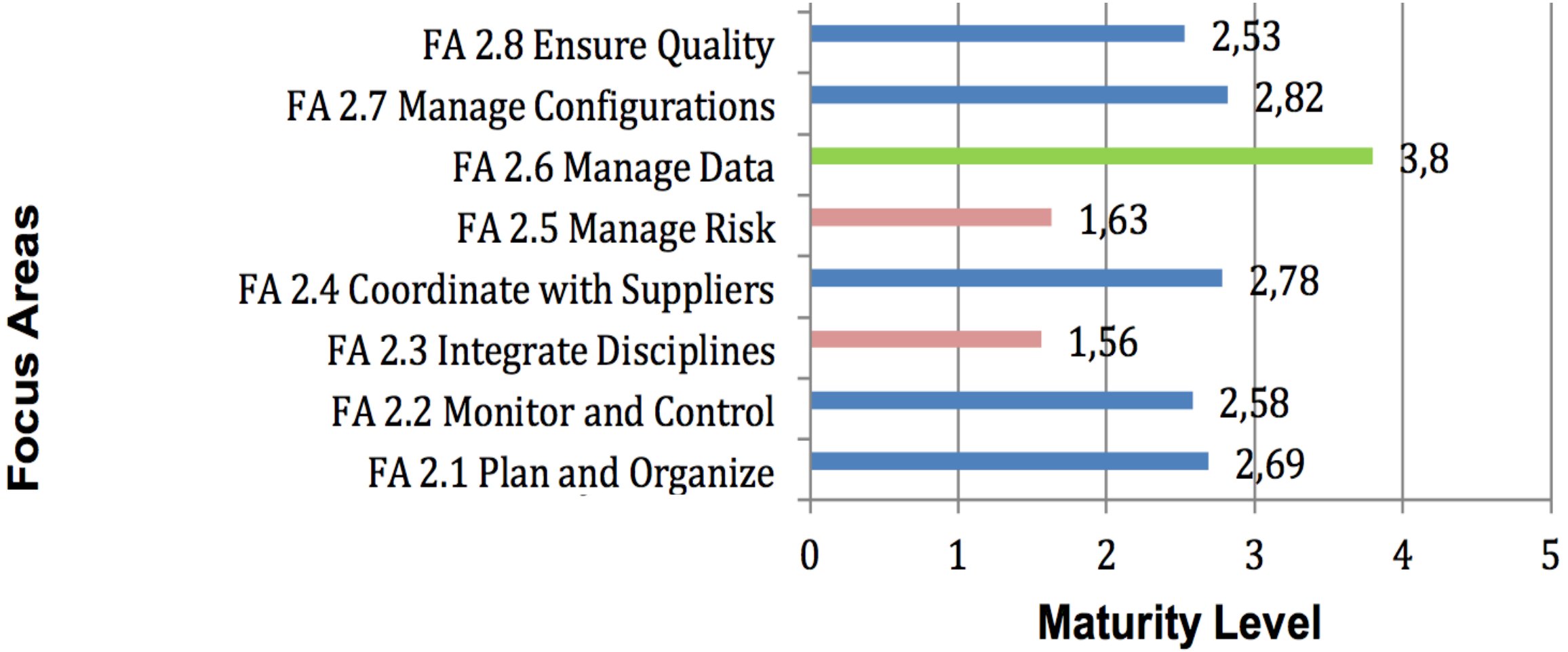
Systems Engineering Process Capability



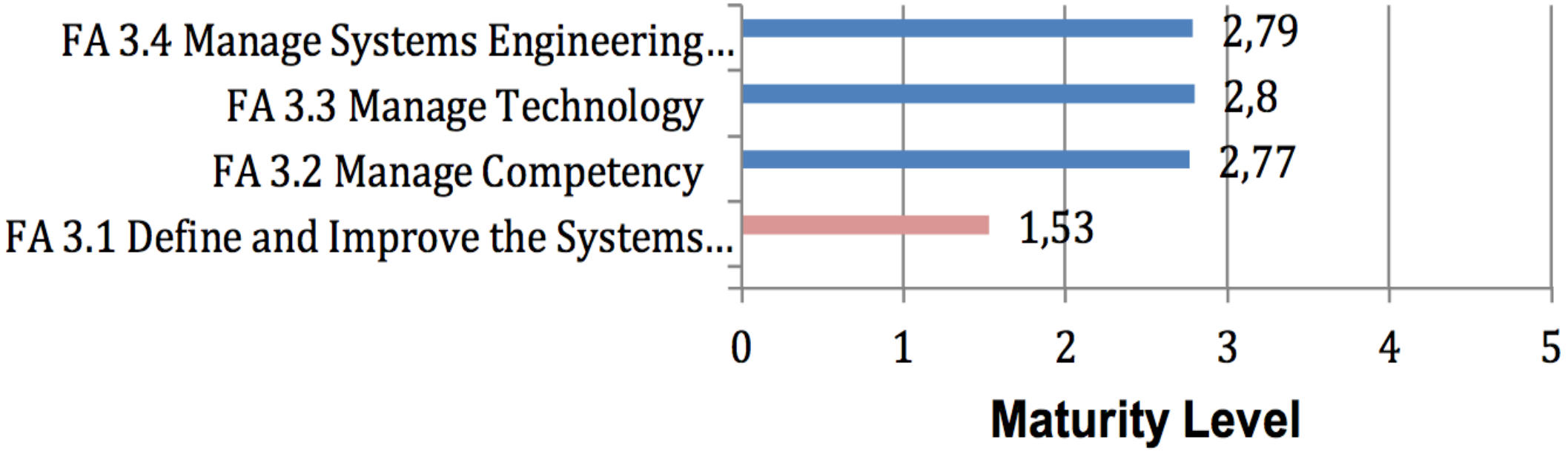
Technical Outputs



Management Outputs



Environment



Results

- Measurement using SECM model
  - Company is on maturity level of 2 with aspects on level 3 in all three focus-areas

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Conclusions and recommendations

- Most activities performed indicate that outputs are managed to a plan
- Some defined organisation processes used to plan and execute activities.
- Some activities performed ad-hoc
- Challenges of improving efficiency in electronic initiation (blast) system has benefited and can benefit further from further use of system engineering principles.

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