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## Quantifying Detection Probabilities for Proliferation Activities in Undeclared Facilities

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International Safeguards is currently in an evolutionary process to increase effectiveness and efficiency of the verification system. This is an obvious consequence of the inability to detect the Iraq's clandestine nuclear weapons programme in the early 90s. By the adoption of the Programme 93+2, this has led to the development of Integrated Safeguards and the State-level concept. Moreover, the IAEA's focus was extended onto proliferation activities outside the State's declared facilities.

The effectiveness of safeguards activities within declared facilities can and have been quantified with respect to costs and detection probabilities. In contrast, when verifying the absence of undeclared facilities this quantification has been avoided in the past because it has been considered to be impossible. However, when balancing the allocation of budget between the declared and the undeclared field, explicit reasoning is needed why safeguards effort is distributed in a given way.

Such reasoning can be given by a holistic, information and risk-driven approach to Acquisition Path Analysis comprising declared and undeclared facilities [1]. Regarding the input, this approach relies on the quantification of several factors, i.e. costs of attractiveness values for specific proliferation activities, potential safeguards measures and detection probabilities for these measures also for the undeclared field.

In order to overcome the lack of quantification for detection probabilities in undeclared facilities, the authors of this paper propose a general verification error model. Based on this model, four different approaches are explained and assessed with respect to their advantages and disadvantages: the analogy approach, the Bayes approach, the frequentist approach and the process approach. The paper concludes with a summary and an outlook on potential future research activities.

[1] Listner, Canty, Rezniczek, Stein, and Niemeyer. „Approaching Acquisition Path Analysis Formally - Experiences So Far.” In: Proceedings of the INMM Annual Meeting. 2013.

### Country or International Organization

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