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Global foresight: Lessons from a scenario and roadmapping exercise on manufacturing systems

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ABSTRACT

Geographical dispersion, organisational and cultural differences, and the diversity arising from a large number of participants are all characteristics of international foresight exercises. In this paper, the authors develop four principles for the design and management of global foresight exercises building on the experience of designing and managing the Intelligent Manufacturing Systems (IMS) 2020 project. The first principle is *understanding interconnected innovation systems.* This principle ensures that participants position the foresight exercise and their own activities in a global context. The second principle is *responsiveness towards diverse languages and cultures*. This principle strengthens commitment and encourages learning and creative problem solving. The third principle is *capacity to reconfigure international networks.* This principle is about taking advantage of existing organisational structures and facilitates timely and efficient mobilisation of stakeholder communities. The fourth and last principle is '*glocal*' *impact orientation*. This principle ensures that foresight activities are connected to both local and international decision-making structures. Overall, due to the heterogeneity of global projects, all four principles must also be implemented in keeping with a scalable design approach.

1. Introduction

Mounting effective responses to many major societal challenges usually requires coordinated efforts that extend beyond regional and national boundaries [1]. In this context, any deployment of future oriented technology analysis (FTA) must be able to take into account trans-border, often global considerations. This paper addresses FTA and in particular foresight design and management in an international context. The aim is to draw lessons for international foresight processes on the basis of a specific international foresight project on intelligent and sustainable manufacturing systems.

Foresight has been applied at global and regional levels to support the design and implementation of policies and strategies. Examples range from the European Commission through the Framework Programmes and its Joint Research Centre, the OECD through its International Futures Programme, UNIDO through its Technology Foresight Initiative, the Asian-Pacific Economic Cooperation (APEC) Centre for Technology Foresight, the UK Foresight Horizon Scanning Centre, the Risk Assessment and Horizon Scanning (*RAHS*) programme in Singapore, among others. Many of the specific projects undertaken by these different organisations are well documented. However, less attention has been paid to the theory and

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practice of the design and management of international foresight processes. This article aims to begin filling the gap by analysing the authors' experience with an international foresight project. On the basis of this case study the authors outline what they consider to be the necessary preconditions and managerial approaches that are likely to be conducive to a successful international foresight project.

Projects of this kind are usually characterised by geographical dispersion, organisational and cultural differences, and the large number of diverse participants, each with different expectations and needs [2]. As a consequence it is essential to take these factors into account in the design and management approaches used for such projects. Section 2 examines the available literature on international foresight management and conceptualises design and managerial issues particularly relevant in the international context. Four principles for global foresight design and management are identified. The ways in which these have been dealt with in practice are outlined in Section 3 on the basis of a case study, an international FTA project addressing the future of intelligent manufacturing systems (IMS). Section 4 outlines the lessons learned from the authors' experiences in designing and managing the IMS 2020 project. The authors develop four principles that they believe should be taken into account when designing and managing an international foresight undertaking. Section 5 considers, on the one hand, how FTA projects like IMS hold out the promise of achieving better international coordination and joint preparedness for future grand challenges. While on the other hand, the complicated attributes of international foresight exercises necessitates careful consideration of relevant design and managerial challenges in order to take into account scale, culture, timing and institutional constraints. Section 6 summarises the main conclusions.

2. Global foresight design and management

The design and management of global foresight projects, like any significant international undertaking, calls for clarity, unity, integrity and coherence [3–5]. Further design requirements are introduced if the project aims to incorporate international research, innovation systems [6] and the diversity of stakeholders. Our contention is that these design requirements can be met on the basis of four guiding principles for global foresight. These principles build on the international foresight literature and our experiences with a global foresight exercise that is described in Section 3. The four principles are:

- Understanding interconnected innovation systems.
- Responsiveness towards diverse languages and cultures.
- Capacity to reconfigure international networks, and
- a 'glocal' impact orientation.

2.1. Understanding interconnected innovation systems

Before starting any foresight venture is important to have a clear idea of the system being analysed and related interconnected systems (e.g. social, technological, economic, environmental, political, value, cultural, among others) [6]. Managers of international exercises must also take into account the distinctiveness of local, regional and national sub-systems around the world. Such understanding may be supported by earlier research and available databases. At the same time, a spectrum of foresight methods can be applied to develop a better understanding of possible future developments of the systems under analysis [7].

In this context, examining system properties in the international context in which the exercise takes place supports the development of a common understanding of different, even diverging, viewpoints. This analysis promotes the shaping of joint objectives and the overall scope of the exercise. Hence, the further development of transnational research and innovation collaboration benefits from experiences with the vertical coordination of multi-layered research and innovation systems. The same is true with respect to the horizontal coordination between research and other policy areas. Both struggle with temporal coordination of policies [8].

Therefore, to enable an appropriate design, implementation and management of an international foresight exercise, the ability to shape a common path to follow becomes important. This should be built upon a collective vision, which considers the views and actions of involved individuals and their institutions, as well as resources which should be developed and mobilised. Such an achievement ensures ownership and that action is taken upon results. Gertler and Wolfe [9] corroborate this point by outlining that foresight processes should be seen as socially organised learning processes which involve learning by individuals, by organisations and by institutions. Moreover, the authors' claim that a collective vision should be shaped by building upon individual views, actions and interactions with larger institutional structures.

2.2. Responsiveness towards diverse languages and cultures

Diversity among global participants and their differing constituencies set a coordination challenge that calls for responsiveness towards all stakeholders' of an exercise [10]. Cultural differences, language barriers, institutional practices, regulatory frameworks, capacities and capabilities of participants to contribute as well as more practical difficulties, such as different time zones and geographical distances; all require prudent and balanced management [11].