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Fail forward: Mitigating failure in energy research and innovation

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ABSTRACT

Almost three quarters of all innovation projects disappoint or fail. Instead of 'wasting' human and financial resources on energy projects that end up being terminated or ineffectual, this study offers a potential antidote coined the 'Origins of Failure in Energy Innovation' (OFEI) model. Based on participant observation and empirical field research in three case companies, the OFEI model is developed to identify inappropriate behaviors that cause energy research and innovation to fail. The OFEI model can be used to give failed (or failing) projects a second chance and the article concludes that identifying and mitigating individual and collective misbehaviors are needed throughout the entire innovation process. If the level of ambition is not reached, then project owners should identify, analyze, and mitigate misfit(s) in their projects – and try again. For all intents and purposes, they need to fail forward.

1. Introduction

As Fri and Savitz [1: p. 183] have written in this journal: "*Managing climate change will require massive innovation in many of the planet's major energy systems*". However, such transition and innovation face innumerable daunting challenges, ranging from conservatism and path dependency to a lack of proper incentives and behavioral or cultural bias [2–5]. There are, of course, a number of relevant case studies representing successful innovation projects; see, e.g., Würstenhagen et al. [6], Seebode et al. [7], McMichael and Shipworth [8], Di Lucia and Ericsson [9]. This line of research advances current understanding of successful initiatives, and the narratives of 'best practices' represent a typical tendency in the development of a 'normal science' [10]. However, this research tradition focuses only on one side of the innovation equation: success. To stretch the existing research frontier and move beyond what Sackett and Larsen [11] call the 'extension/replication' approach to research, scholars Lundvall [12] and Sovacool [13,14] have argued, in various ways, that we need to focus more of our efforts on the unpopular, yet more common, notion of failure. Here focus ought to be on disappointing or failed projects, since they represent an important research avenue with significant learning potential, and also one more likely to occur than success [15].

Indeed, focusing on failure reveals that there are a myriad of projects to learn from. Cooper and Kleinsmith [16] and Lindholm [17] determine that as much as 75% of all innovation projects fail or fall short of the level of managerial ambition set from the start. Some projects are shut down during R&D because of strict evaluation criteria, for instance [18], others are killed before commercialization because of market uncertainties [19], or they are commercialized only to disappoint [20]. Hence, a systems view representing both organizational internal and external perspectives on energy innovation is needed to mitigate the current level of disappointing or failing energy projects [21–23]. Grubler et al. [22: p. 1669–1670] argue: "*R&D initiatives that fail to incentivize consumers to adopt the outcomes of innovation efforts . . . risk not only being ineffective but also precluding the market feedback and learning that are critical for continued improvements in technologies*".

Consequently, a large amount of human and financial resources are still invested in innovation projects that disappoint or fail. According to Sovacool [13], these projects become 'orphaned' and attain the status of taboo for project teams and managers. This claim is corroborated by Teppo and Würstenhagen [24], since they have determined the important role of organizational culture and how this culture influences the outcome of energy innovation. Interestingly, it is argued that ignoring such failures and excluding them from the historical record do a disservice to the scientific community, because scholars see only a distorted picture of history, which may lead them to waste resources or replicate experiments that have already failed in other circumstances [25].

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To provide a potential antidote to anathema toward failure, this study aims to identify causes of failure and discuss how these might be mitigated within the context of energy innovation. Based on a longitudinal participant observation methodology, the author reports on three cases of disappointing or failed innovation projects. Empirical evidence is utilized to construct the '*Origins of Failure in Energy Innovation*' (OFEI) model, which represents a systems view on innovation management in relation to energy studies. The study advances research on how individual and/or collective misbehaviors causing the 'origins of failure' can be identified and how corrective actions can be undertaken to mitigate these inappropriate behaviors. The goal of the study is to demonstrate how corrective managerial actions can be used to increase the number of successful energy innovations by giving failed or failing projects a second chance.

If successful, the intention of the article (to reduce failure) could represent a sustainable approach to strategic, continuous innovation in the energy sector and thus address the concerns of Fri and Savitz [1] and Sovacool [13]. Before delving into a description of innovation and failure, four key concepts need to be defined. (1) Relying on OECD's Oslo Manual, *innovation* is defined as: "*the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations*" [26: p. 46]. (2) A *successful project* is defined as a project that lives up to the ambitions set from the start and perhaps even surpasses these ambitions. (3) A *disappointing project* is defined as a project that provides some valuable results but fails to live up to the level of ambition set from the start. (4) A *failed project* is defined as the unsuccessful endeavors of a project team where the project is shut down or become orphaned.

The article proceeds as follows. The first section describes relevant literature on innovation and failure. Subsequently, the methodological approach is explained. Following this is a section describing the cases used to inform the study. Then, the results are presented and the OFEI model is constructed. Finally, the contributions of the study are presented.

2. Failure and innovation

Because a multitude of factors influence the outcome of innovation projects directly or indirectly, the management of these projects is an extremely complex task [22]. Obviously, this is no surprise, because critical factors for success in innovation have been researched, discussed, and refined for decades (see, e.g., [27–30]). Despite the large amount of research being conducted, the vast majority of new innovation projects still end in disappointment or failure [1,13]. For this reason, this study seeks to understand the origins of failure and explain how these failures potentially can be mitigated to increase the probability of success.

2.1. Identifying failures: what to look for?

Bessant [15] establishes that failure is a unique source of learning which is ignored inappropriately in most organizations: "Few organizations get all their technology decisions right but many fail to reflect on their failures, with the risk that they may repeat the same mistakes in subsequent innovations" [15: p. 200]. This claim is supported by Sitkin [31], who emphasizes that failure is a powerful analytical tool: it is easier to identify and isolate the cause(s) of failure than the cause(s) of success in a project. Here, specific examples of an identified origin of failure could be the research of Suurs et al. [32], Wilson et al. [23], and GOS [33]. They all conclude that the energy sector's lack of incentives and focus on market adoption and diffusion still causes multimillion-dollar R&D projects to disappoint or fail. Hence, someone should react, because ignoring this fact will lead to new disappointing projects in the sector (which is most likely the case). Consequently, if the cause of failure is not identified until late in the project, e.g., as outcomes of commercialization or implementation of new technology, it will disappoint, as determined by the scholars previously cited. For this reason, it is imperative to understand how individual as well as collective actions and behaviors during the innovation process [30] cause a project to disappoint or fail. By delving into the social sciences, there is an array of theoretical constructs that describe and explain

Table 1
Theoretical constructs related to failure.

Construct	Explanation	References
Organizational mindlessness	"The application of yesterday's business solutions to today's problems, describing it as a state of reduced attention resulting from a tendency to rely on pre-existing distinctions, categories and routines"	[34: p. 152]
Functional stupidity	"Is organizationally supported lack of reflexivity, substantive reasoning, and justification. It entails a refusal to use intellectual resources outside a narrow and 'safe' terrain. It can provide a sense of certainty that allows organizations to function smoothly. This can save the organization and its members from the frictions provoked by doubt and reflection. Functional stupidity contributes to maintaining and strengthening organizational order"	[36: p. 1196]
Defensive routines	"(Organizational) defensive routines are actions or policies that prevent individuals of segments of the organization from experiencing embarrassment or threat. Simultaneously, they prevent people from identifying and getting rid of the causes of the potential embarrassment or threat. Defensive routines are anti-learning, overprotective, and self-sealing"	[59: p. 25]
Cassandra syndrome	When a decision-maker does not give sufficient attention to an expert's recommendations	[58]
Decision Problems	When a decision-maker assumes that s/he can make a 'good decision' instantly, e.g., by 'shooting from the hip' without scrutinizing and understanding relevant available data	[39]
Information Overload	When new information is not considered in the decision-making process because an abundance of complex information is already present	[40]
Knowledge sharing hostility	When a person does not inform the relevant audience about an important insight because of, e.g., fear, cultural issues, or bad relationships	[41]
Knowing-doing gap	When a problem is identified and the responsible people do not solve it even though they know how to do so. In short: failure to move from knowledge to action	[35]
Cognitive bias	Interpreting new information only in one's own favor to confirm one's own opinion or ignoring the information because of personal bias	[37]
Illusion of explanatory depth	When an individual (overconfidently) feels that s/he understands complex phenomena with far greater precision, coherence, and depth than s/he really does; this person is subject to an illusion – an illusion of explanatory depth	[38]

Source: Author's development.