The State of the Entrepreneurial State: Empirical Evidence of Mission-Led Innovation Projects around the Globe

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Abstract: This paper reviews theoretical rationales for mission-oriented innovation policy and provides an empirical overview of extant 28 papers and 49 cases on the topic. We synthetize varieties of mission formulations, actors involved, and characteristics of missions described as more or less failed or successful. 59 percent of the studied missions are still ongoing, 33 percent are considered successful and 8 percent as failures. 67 percent of the studied missions have taken place in Europe, 24 percent in North America and 8 percent in Asia. The majority of innovation projects referred to as missions do not fulfill the criteria defined by the OECD. Results suggest that missions related to technological or agricultural innovations are more often successful than broader types of missions aimed at social or ecological challenges. Challenges regarding the governance and evaluation of missions remain unresolved in the literature. We find no case that contains a cost-benefit analysis or takes opportunity cost into account.

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Introduction

Industrial policy has experienced a renaissance over the past decade (Juhász et al. 2023; Aghion et al. 2023). Ideas of an *Entrepreneurial State* and a *Mission Economy* are currently permeating policy departments, notably in Europe, as the concepts are put into practice and rolled out across the globe. A mission is best understood as an encompassing endeavor seeking transformational change with large potential societal benefits; missions span several sectors and are tightly linked to regulatory bodies (see, e.g., OECD 2021).

Much effort has been invested into deepening our theoretical and conceptual knowledge of mission-led growth and state entrepreneurship. But the state of our knowledge about their effects is still incomplete, not to say entirely uncertain. Researchers and policymakers increasingly look to probe the logic behind the mission "organisms" by studying the empirics of missions, their contents, and outcomes.

To begin with, we have no established empirical operationalization of what a mission really is. What types of missions have been conducted and in which contexts? How are those missions deployed, by whom, with what constellation of actors, and what have the outcomes been thus far?

We are not aware of a systematic review of the empirical literature on the subject, hitherto. There are indeed few empirical evaluations or studies of how missions are designed and executed (cf. Essén et al. 2022; Kantor and Whalley 2023). Crucially, we seem to know little about when missions are more or less likely to work as intended. In response to these gaps in the literature, we provide an empirical overview of 49 concluded or ongoing missions from around the world. We synthetize varieties of mission formulations and policy tools attached to such missions and critically discuss what precise characteristics that may qualify them as missions. We then analyze characteristics of missions depicted as more or less failed or successful, and compile policy recommendations and future research recommendations on mission-oriented innovation policy. In pursuing this endeavor, we also provide a database for overview of articles on the subject.

Methods and Literature Overview of Missions

To examine documented mission-oriented innovation policies that have been launched and analyzed, we conduct a policy mapping exercise (Burgess et al. 2007; Kivimaa and Kern 2016). We make use of international academic databases such as EBSCO, ABI-INFORM, and Google Scholar. The result is a compilation of missions from various continents to aid analysis of missions. Key terms include "missions*", "mission-oriented*", "mission innovation*" and related terms.

Considering that mission-oriented innovation policy is a relatively recent term that is gaining popularity, we expected to find a sizable number of papers on the subject. However, most of the papers that we identify through systematic search are purely conceptual. We scanned reference lists, including in conceptual and methodological papers, to identify papers containing descriptions of missions, and conducted wider internet searches for "grey" literature (policy reports, evaluations, non-peer-reviewed articles, etc.).

Departing from reference papers, including Mazzucato's publications and corresponding reviews, we searched through citations using a snowball technique. We did not

perform tailored searches for any specific large-scale government initiatives (e.g., the U.S. Marshall Plan). We screened all our identified papers for available empirical data.

In the following, we include all papers that use some sort of empirical data in describing missions. Altogether, we found 28 papers containing descriptions of 49 unique missions. The data encompass both first-source information, such as interviews conducted with agents involved in specific missions, and secondary data, including archival records related to past missions.

We added key data from all these publications to a comprehensive spreadsheet, available in an online Appendix (Batbaatar et al. 2023). Some papers include a case study of a single mission while others encompass several missions. Papers covering several missions were bifurcated so that each row in the spreadsheet contains a single mission. Our analysis covers 49 missions in total.

From the identified studies, we extracted and coded key information about each mission into the spreadsheet. Each row contains a paper and mission, and each column reflects one form of information about the mission. If a paper contains several missions, and therefore features the same overarching future research recommendations, research question, and discussion points, then they are bundled together in one column in the online Appendix. The spreadsheet table is to be read from left to right.

The studies are numbered in column A. Column B numbers the mission cases, which are then described in column C. The study and mission case numbers simply reflect the order at which the studies were added to the spreadsheet. Column D contains the geographical setting of the mission. If a mission spanned more than one country, all countries are listed. The period during which the mission is studied is recorded in column E. If a mission is still ongoing, the year listed denotes the period covered by the study in question. Column F contains the key research questions posed. The reasons for studying the missions vary, e.g., to assess the practical implication of missions, to provide recommendations for agents involved in specific missions, or to study how a mission unfolds in terms of collaboration, governance, and outcomes.

The columns "Mission Description" (column C) and "Grand Challenge" (column G) describe specific sectors or contexts of the missions analyzed. The Grand Challenge column states either the Grand Challenge that the mission aims to address or the mission's desired outcome. Some missions contain time-bound and quantifiable elements (e.g., "80 percent reduction of green-house gas emissions by 2050") ,while others simply state the success of a specific aspect as their goal, without explicitly defining success (e.g., "contribute to transformative change in Norway"). In column H it is indicated whether a study explicitly utilizes the term "missions" (Yes/No).

Column I describes more precisely how the mission was studied. In most papers different agents involved in the respective missions were interviewed while historical missions utilized press releases, government archives, and other publicly available information.

The main findings from each mission as reported in the studies are presented in column J and the authors' policy recommendations are summarized in column K. The degree of success of the mission (column L), was coded based on the mission descriptions as "Success", "Failure", or "Ongoing." The final two columns in the online Appendix contain suggestions for future research (column M) and for missions in general (column N).

Results

In this section we summarize key findings. We begin this section with an overview of the missions in our selection, their geography, and core contents. An initial observation is that there appears to be no such thing as an "average" mission. The span is considerable in terms of durability, level of ambition, and available policy tools. Hence, a swift overview is in order.

Mission types and settings

The missions reviewed span a diverse set of sectors, geographic locations, as well as levels of ambition more generally. Several of the historical, often successful, missions were motivated by wartime needs (Agarwal et al. 2021). Missions aiming to generate scientific advances and applications, particularly pertaining to biotechnology and medicine, are also common (Essén et al. 2022; Prochaska and Schiller 2021; Grillitsch et al. 2019; Grundy et al. 2023). Several missions have been aimed at infrastructure and solutions to transportation problems such as in Singapore (Quirapas Franco et al. 2018), Sweden (Edquist and Zabala-Iturriagagoitia 2012), Finland (Kivimaa and Rogge 2020), and the United States (Reinecke 2022).

A rather large number of more recent missions target environmental sustainability, and CO_2 emissions (Kivimaa and Kern 2016), renewable energy (Brett et al. 2023) paludiculture (Ziegler 2020), clean energy (Tosun et al. 2023), nutrient recycling (Nylén et al. 2023), and circular food systems (Begemann and Klerkx 2022). Other missions are aimed at addressing social equality and inclusion: children's perspectives and democratic competence (Thøgersen 2022), inclusion in the mobility sector (Kivimaa and Rogge 2020), and quality of life of older people (Fisher et al. 2018). One mission addresses how government defense funding spurs general economic growth (Deleidi and Mazzucato 2021), while other missions are aimed at economic and innovative collaboration across borders (Cappellano and Makkonen 2020; Tosun et al. 2023).

When we compare the identified missions to accepted definitions of missions, the term has clearly been liberally used in both the academic and policy literatures. Our review reveals that most of the projects referred to as missions do not live up to OECD's (2021) definition. According to this definition, missions are "measurable, ambitious, and time-bound targets that have the potential to become significant vehicles for important societal change." Moreover, missions must carry potential benefits for many, extend across several fields, both scientific and institutional-regulatory, and have technological "general purpose" characteristics so that discoveries can be widely exploited (Nelson 2011). Few of the 49 missions adhere to these defining characteristics.

Several missions are formulated as traditional innovation policy goals without measurable outcomes, or time-bound targets, such as "Establish a vital and innovative biotechnology landscape" (Prochaska and Schiller 2021), "Develop new forms of flexible automation in the footwear industry for the region to be a leading producer in the world" (Foray 2018), or "Bring transformative effects from science and research in Finland" (Kivimaa and Rogge 2020). Yet other missions are formulated in terms of "directional" statements of broad social or economic goals, but similarly tend to lack measurable and time-bound targets, such as "Increase children's influence in childcare facilities" and "Support children's democratic competences" (Thøgersen 2022). Some missions are formulated as "grand challenges" but lack

explicit targets, e.g., "Reduce deforestation and CO_2 emissions" (Olbrei and Howes 2012) and "Curb traffic congestion rates" (Quirapas Franco et al. 2018).

The heterogeneity of projects (public, private, or public-private) framed as missions in our analysis highlights a significant gap between how missions are envisaged and motivated and how the term mission is used in practice to motivate a highly diverse set of innovation policies. The topics identified in the above examples from the 49 reviewed missions can all be classified under the rubric "innovation policy", broadly construed, although some of the missions should rather be classified as social policy or regional policy more broadly.

Types of mission deployment

The majority of the 49 missions (29 cases or 59 percent) are described as ongoing, 33 percent as successful while eight percent are deemed to have failed. Two-thirds of the missions (33) were launched in Europe, followed by 14 in North America (24 percent), four in Asia (8 percent), while the three remaining missions were launched in Latin America.[1]

As shown in *Figure 1*, the mission cases covered a wide range of sectors/purposes: environmental sustainability (27 percent, 13 cases), public sector concerns (20 percent, 10), medicine (16 percent, 8), ICT (14 percent, 7), energy (8 percent, 4), transportation (8 percent, 4), and agriculture (6 percent, 3).

Figure 1. Missions by sector.
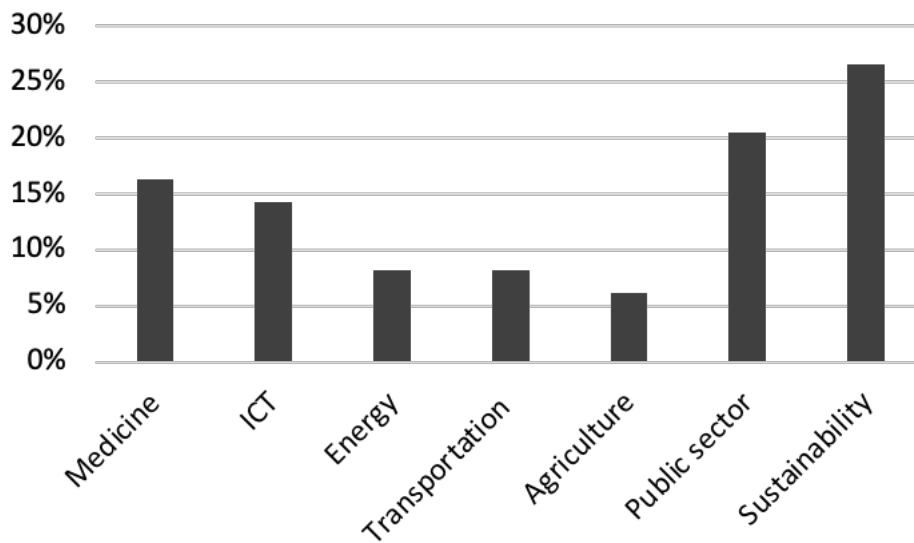
Mission launch date and duration

Most missions analyzed to date in the literature are historical missions launched during or after the Second World War, or from the 1990s onwards when the concept of mission innovation started to become popularized. The peak around 2010 and subsequent drop likely indicates that missions initiated after 2010 simply have not yet been as frequently analyzed.

A necessary mission criterion is *time-boundedness* (Mazzucato 2021). However, our summary of the 49 mission cases shows that only about half of these missions (25 cases)

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[1] Some missions such as the production of Covid-19 plasma and the green revolution in agriculture took place in more than one region. Therefore, the sum of the regional shares exceeds to more than 100 percent.

stipulate a deadline for mission completion. Hence, some missions are likely "perpetually ongoing" or otherwise associated with an uncertain duration. Most ongoing missions that have an associated due date are set to be completed during the next decade, in 2050 at the latest. Four missions analyzed failed to reach the initially agreed deadline. With close to half of all missions not having any deadline at all, and several missions extending their deadline as this was approaching, it is hard to gauge the overall magnitude of missions completed by the set deadline. This may be related to a problem identified in the conceptual literature: difficulties in deciding when a failed mission should be terminated ahead of the original plan (Larsson 2022).

Governance and actors involved in missions

In the missions studied, many are initiated by academics or industry experts who raise concerns and garner attention from public sector agents (Agarwal et al. 2021). However, the majority of missions analyzed were directed primarily by the respective national government (69 percent, 34), such as Singapore's traffic congestion mission (Quirapas Franco et al. 2018). In these cases, some were administered by a committee or agency created temporarily to execute the mission (14 percent, 5). Such "working groups" include the UK Climate Change Committee (Kivimaa and Kern 2016) and the U.S. Office of High-Speed Ground Transportation (Reinecke 2022). Around 22 percent (11) were governed by a specialized innovation agency. Although these innovation agencies are part of the national government, they are distinguished from the national government for higher level of responsibility of the missions as opposed to other missions that are otherwise more prone to changes in the administration. Such innovation agencies include Academy of Finland (Borrás and Schwaag Serger 2022), Vinnova in Sweden (Essén et al. 2022), Netherlands Enterprise Agency (Janssen 2021), and the United Kingdom's Research Councils in collaboration with Innovate UK (Deleidi 2020). At times, mission governance is delegated by the government to another actor such as an innovation agency. This may be done to ensure that different missions do not compete with one another (Kivimaa and Kern 2016; Grillitsch 2019).

In some instances, the constellation of actors features agents from the public, private and academic sectors (Agarwal et al. 2021; Foray 2018), a governance mode frequently stressed in the conceptual literature (Mazzucato 2021; OECD 2021).

Interestingly, the historical missions in Mexico and Southern Asia that brought on the green revolution in agriculture experienced the inverse effect, where the government agents raised concerns regarding agriculture and world food supply to private sector agents, notably the Rockefeller and Ford Foundations, which became the primary responsible bodies for the governance of the mission (Wright 2012).

The mission targeting forest preservation and reduction of CO_2 emissions in Indonesia, based on funding from the Australian government, was incrementally dismantled and can now be described as a failure (Olbrei and Howes 2012). By contrast, historical missions funded by and implemented by the Rockefeller Foundation to enhance agricultural efficiency in developing countries were successful (Wright 2012).

An OECD study with 227 respondents from different mission-driven innovation programs worldwide reported that funding primarily came from state funds (30 percent), followed by the EU (13 percent) (Hanson et al. 2022). The fact that the initiative and problem

formulation are created centrally has several advantages (clear locus of control, prerequisite for long-term funding, direct governance). On the other hand, centralization increases the risk that some important perspectives or potential approaches are overlooked (Mazzucato 2021). There is also a risk that top-down missions get stuck in the existing institutional structure rather than challenging prevailing institutions, a feature frequently stressed as an important component of missions. Thus, missions easily become sensitive to changing political priorities.

In one case the mission arena consisted of 42 parties (Wesseling and Meijerhof 2021). However, when analyzing the constellation of actors involved in each mission, it is difficult to precisely identify the number of agents. The more distinct the actors are, the more ways a mission can be interpreted as a success (Agarwal et al. 2021). We will return to this point in the discussion of how to interpret successful missions.

Leadership and institutional entrepreneurship in missions

One way to understand the leadership complexities involved is by considering a mission's geographic reach. If the mission is dealing with a global problem, it stands to reason that its implementation should often transcend national borders. Particularly for cross-border or cross-regional missions, but also more generally, institutional leadership in addressing bureaucratic and legal challenges is the key issue. Remember, the team executing a mission should have the authority to wield the necessary regulatory power over the problem at hand.

How to exercise power in the international arena is of course a long-standing problem in many more areas, from conflict resolution to infrastructure. When one large state was the change agent—as in, e.g., the Apollo Program—this can work, subject to the previously discussed requirements.

A considerable number of missions in the collection apply a regional and cross-regional focus on grand societal challenges that, in our view, clearly belong at a higher geographic and governance level. Some papers in the collection do address the functioning of innovation and entrepreneurship in the face of geographic barriers or cross-border regional development (Cappellano and Makkonen 2020). Geographically delineated missions include reaching net-zero emissions in different Swedish regions (Brett et al. 2023) or to develop Covid-19 Plasma in six different countries (Grundy et al. 2023). International collaboration in the form of foreign aid is also noted in a few missions (Olbrei and Howes 2012; Wright 2012).

One cross-national mission revealed that while policymakers could fly back and forth between Washington State in the U.S. and Canada, scientists could not easily move and collaborate across borders (Cappellano and Makkonen 2020). These legal-administrative problems posed restraints on the mission and strained its leadership. Similar issues could emerge in relatively integrated cross-national missions, such as those spanning national borders in the European Union (Edquist and Zabala-Iturriagagoitia 2012). Clearly, optimal geographic area of missions appears to be an issue in urgent need of academic study.

Several missions lacked national leadership and change agents, especially large-scale cross-border missions launched in the European Union (Tosun et al. 2023). Several of the studies stress the importance of middle managers who shoulder the main responsibility in implementing missions, which points to talent management as a crucial component for missions to be successful (Thøgersen 2022; Nylén et al. 2023; Kivimaa and Rogge 2020).

Evaluating Missions

Nelson (2011, p. 684) argues that "one cannot learn from experiments if one does not have ability to identify, control, and replicate effective practice." Among the 49 mission projects analyzed, very few include formal evaluations of effectiveness, and none include a cost-benefit assessment. At present, there simply does not appear to exist a solution to the problem of evaluation. We begin by considering what the evaluations are based on, and what they can and cannot do.

Learning from a selected sample

By necessity, this is a "small n" field, with few studies of few projects. The material presented in this paper is subject to certain selection bias. While we systematically included studies according to the above criteria, this in and of itself does not guarantee an exhaustive or representative list of missions in the wider sense. Most notably, survivor bias is likely to have skewed our selection towards missions that survived for some period.

The papers made use of historical and archival data to understand the missions, and so selection of missions is determined by data availability. Since successful and surviving missions benefited from data collection and media attention, our collection likely overstates the true success rate of missions.

Recall that one of the features of missions is high risk, wherein the governing agent of a failed mission is likely to attract negative media attention and result in overall organizational dejection. Consequently, there are grounds for governing agents of missions to attempt to downplay unsuccessful missions, or unsuccessful aspects of otherwise successful missions. The data presented elsewhere in this volume indicate that government agencies do so systematically (Björnemalm et al. 2024) and an important avenue for further research is to seek a fuller understanding of the extent and nature of forgotten or downplayed failures if we are to learn from such failures (Denrell 2003).

It is also useful to keep opportunity costs in mind. Missions are designed as directional innovation processes, intended to "tilt the playing field." But little attention has been paid to ideas and solutions that were *consciously* put aside in cases where the playing field was tilted. What would have been the offshoots of those solutions? Addressing such counterfactual questions remains a fundamental issue in the scientific analysis of mission-oriented innovation policy (Bloom et al. 2019).

With authorities acting as main funders and backers in mission-oriented projects, there are no market mechanisms to inform when a project has realistically passed its due date. In our analysis of mission progress among the missions analyzed in this paper, at least four have been extended beyond their original target date. Missions that were delayed include manufacturing of the X2000 train in Sweden (Edquist and Zabala-Iturriagagoitia 2012) and the failed mission surrounding high-speed passenger rail in the U.S. (Reinecke 2022). Moreover, the agricultural mission in relation to the Green Revolution in Southern Asia experienced delays despite having achieved its agricultural developments (Wright 2012). It is certainly also the case that many projects of this size should probably be aborted long *before* their due dates.

Do we have reason to be hopeful that credible evaluation methods may emerge? To begin with, it is of course correct that missions must at the very least be concrete. But even in the case of something concrete, like "cutting carbon emissions by 50 percent in ten years", a

myriad of problems remains to be dealt with. Even if this is a national target, for an accurate evaluation in the broad sense we would need to have ideas about both direct and indirect effects of the policy, including opportunity costs imposed on seemingly unrelated sectors.

Existing methods of policy evaluation are not equipped to deal with these problems. To conduct a cost-benefit analysis, for instance, we need measurable costs (Prest and Turvey 1965). For smaller projects where alternatives are easier to identify, these methods represent a pragmatic way forward. This is hardly the case for the Mission Economy. To summarize, it is difficult to identify systematic answers to the following key questions: How do we identify the right missions to pursue? How do we assess the importance of the problems and means forgone by our answer to the first question?

Mission types, risks of failure, and mission capture

In our analysis of failed and successful missions, historical and contemporary missions that center around technological or agricultural innovations stand out as more successful than broader missions, aimed at social or ecological challenges. This distinction has also been highlighted in the conceptual literature on mission-oriented innovation policy. It has been argued that missions aiming for faster scientific and technological advancement and missions targeting societal challenges are different in key dimensions (Kuittinen et al. 2018; OECD 2021; ESIR 2017).

The distinction helps us understand why picking missions is so difficult. OECD (2021, p. 35) notes: "When selecting the challenge to be addressed, governments thus face a trade-off: The challenge must be broad enough to engage a broad set of actors across policy fields and sectors without 'picking winners' (i.e., be overly prescriptive in terms of potential solutions), but sufficiently concrete and well-defined so that it provides strong orientation and is 'actionable'." This challenge plays into how stakeholder groups and strategies are identified and put into action. OECD (2021) warns against resulting "mission capture" because someone in charge of a mission must identify and rely on established communities and stakeholders. Often, these communities relate to incumbents in key sectors that tend to avoid transformational agendas involving reshuffling established economic positions (Mazzucato 2021). This risk is present independently of any malicious intent among incumbents.

Incumbents can be incentivized to play an active role in transformation and aid in creating momentum for the transition (Kivimaa and Kern 2016). The study of Danish healthcare frontline workers reveals how incumbents can adapt to new mission aims and methods of working at different paces (Thøgersen 2022). However, our analysis also illustrates how incumbents, intentionally or unintentionally, can tend to gravitate back to the old regime (Begemann and Klerkx 2022). We regard the latter as an effect of status quo bias inherent in most "governed" systems, including systems of innovation.

Finally, lobbyists may also serve as powerful constituents for innovation directionality. The case of the Kalimantan Forests and Climate Partnership between Indonesia and Australia reflects such a case where a project with an initial ambitious aim to reduce deforestation and CO_2 emissions is incrementally downscaled over time until it resembles a simple demonstration project, with significant project delays, internal conflicts, and lack of transparency (Olbrei and Howes 2012).

Discussion

Our overview of the literature and analysis of 49 historical and contemporary missions show that a wide array of policy programs aimed at technological, social, or environmental improvement are united under the umbrella term *missions*. We can only speculate why this is the case. It is possible that policymakers find it convenient to "rebrand" ongoing policy programs as missions to gain increased attention, funding, and capabilities. A similar logic has been long noted in international relations and policy studies (Meseguer and Gilardi 2009; Sebhatu et al. 2020) as well as in research or "management fashions" in the private sector (Abrahamson 1996). In light of this material, and in our view, it is reasonable to ask whether there is a buzzword component involved in determining what is called a mission.

It could also be the case that scholars re-label past policy programs with transformative outcomes—such as the green revolution in Mexico and Southeast Asia—as missions, despite the lack of explicit mission formulations (Wright 2012). If this mechanism is meaningful, we should recall what we said about selection issues above. It means that today's academics and policymakers are likely oversampling success stories when we learn about missions through case studies.

If policy makers, practitioners and researchers mean different things when using a term that is becoming increasingly central in growth and innovation policy, then in and of itself that must be considered a problem.

The term *definition* deserves a much more central place in the study of mission-oriented innovation policy. Strictly speaking, if a project does not aim to be revolutionary, but rather incrementally adding to what is already there, it does not fulfill the criteria for a mission as specified by OECD (2021). A mission must also span several sectors and be "general-purpose" in its potential private sector applications. Our results show that a considerable portion of the missions studied do not fulfil the criteria for being labelled as missions. It would be desirable to have an agreed-upon terminology in the literature, where a mission is used in its "revolutionizing and game-changing way." There is a pertinent parallel here to the discussion in entrepreneurship research about the precise meaning of that term (Henrekson and Sanandaji 2014).

In our view and to sum up, missions suffer from three overarching weaknesses that have not yet been fully addressed in the literature.

First, it is still not clear how to best pick or operationalize missions. Previous overviews (Kuittinen et al. 2018; OECD 2021; ESIR 2017) as well as our analysis, suggest that those that build on technological or agricultural innovations seem to succeed more often than broader types of missions aimed at social or ecological challenges. Nelson (2011) reasoned that technological missions tend to have clearly defined parameters and can be approached with scientific methods while sociological or ecological missions reflect deeper elements of human and organizational behavior. Projects like the Apollo Program aiming to land a man on the moon, that in terms of the interpretation of their success are less influenced by social factors, tend to have higher success rates. However, closely defined technological missions may certainly fail as was the case with the Metroliner mission challenges launched during the same time and in the same region as the Apollo mission (Reinecke 2022). Despite sharing technological and governmental context with the Apollo mission, the Metroliner mission failed

in its push for high-speed passenger rail in the United States. Evidence is emerging that *mission governance* is a perilous task for a myriad of reasons. What constitutes successful governance, when, where, and under what circumstances, are urgent issues for future research.

Second, we have not generated ways to systematically evaluate mission successes and failures. At this point, any effort to evaluate a mission may be likened to assessing a moving and undefined target. We must also consider that opportunity costs are not only likely to be sizable; they also arise in incredibly complex ways.

Third, it is inherently difficult to make a flesh-and-blood person accountable for the failure of a mission, which greatly increases the risk that an unproductive, or even destructive, project is initiated, as well as supported past its due date. A firm that is hijacked by a bad idea suffers financially. A state that is hijacked by a bad idea is unlikely to suffer by any parameters it cares about. It might even find parameters by which it appears successful and tout its success.

In his book *The Moon and the Ghetto* (Nelson 1977), Richard Nelson asks how it came to be that humankind managed to put a man on the moon but could not teach ghetto kids to read. It is of course a hopeful proposition that resources and political willpower are the missing pieces, as embodied in the call for missions. But when Nelson reflected on his book almost 35 years later (Nelson 2011, p. 685), he recalled that a central argument of the book, and something he still considered central to things we could not do, was "not so much political, as a consequence of the fact that, given existing knowledge, there were no clear paths to a solution." With problems where the "what to do" is reasonably straightforward, where it is obvious who the experts are, where we can draw on already well-developed knowledge in science and private enterprises, and where there is currently a lack of critical mass, missions may work in theory. The question is how many problems of significant importance fit those criteria.

Contrary to the Apollo or Manhattan projects, it is unlikely that one technological solution will take us past the global warming scare (Mowery et al. 2010). High degrees of complexity lower the likelihood that a mission can solve the problem. Alas, those are the kind of missions that we are steering against. If we allow our states to take on these issues, they risk failing in more ways than one.

If missions are going to work, we believe that the following four points need to be urgently addressed. First, we need better tools to select missions and to distinguish them from other large-scale innovation policies. These tools must inform us about whether an area is likely to produce general purpose technologies. Second, how do we address the implications of a mission's geographic boundaries, whether regional or global? Third, how do we assign the appropriate due date associated with a mission and how do we know when to switch off the lights? Fourth, in an evolutionary economy, how can we understand the foregone value of those solutions eliminated by a mission that has won political and bureaucratic support?

As this review highlights, the quality of research on missions is plagued by the fact that the cases are not randomly selected, they are usually selected among the winners and success cases. Many missions lack an explicit end point, and if they have one, it is often postponed. We therefore remain uninformed about the success rate of innovation missions.

Conclusions

In this paper we review the empirical literature on mission-oriented innovation policy and identify 49 mission-oriented initiatives. 59 percent of these initiatives are still ongoing, 33

percent are described as successful, and 8 percent are described as failures. Two-thirds of the missions reviewed were instituted in Europe, followed by 24 percent in North America, eight percent in Asia, and six percent in Latin America. More than one quarter of the missions concerned environmental sustainability, followed by public sector concerns, medicine, ICT, energy, transportation, and agriculture.

By analyzing the characteristics of these initiatives more closely, we find that initiatives referred to as missions are no different from traditional goals of innovation policy or social/regional policy, and rarely meet OECD's criteria for an innovation mission. We find the cases reviewed to be lacking when it comes to, e.g., common understanding, an integrated and coherent vision, clear, measurable, and time-bound goals, and milestones, which in turn would enable follow-up and evaluation. Our review also shows that only half of the missions had laid down a deadline for the mission's completion.

While the theoretical literature has emphasized that missions should ideally be sufficiently general and span many fields in order to accomplish institutional-regulatory, scientific and commercial advances with potential for broad ranging spillovers (Nelson 2011), our review shows that almost none of the missions we have identified fulfill these criteria in a satisfactory way.

None of the 49 mission evaluations included a cost-benefit analysis or an attempt to assess opportunity costs. This calls into question the standard by which 33 percent of the missions were rated as "successful."

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Appendix: Studies in the Literature Review

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