Methodological Challenges and Institutional Barriers in the Use of Experimental Method for the Evaluation of Business Incubators: Lessons from the US, EU and China

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Abstract-**Despite their worldwide adoption by policy makers as the Holy Grail for entrepreneurship and business development, the effectiveness of business incubation programs remain elusive, primarily plagued by untenable evaluation methods. This paper develops an in-depth analysis on those methodological and institutional factors that prohibit the use of theoretically sound solutions such as the Experimental Method in evaluation practice.**

I. INTRODUCTION

Business incubators are intended to guide starting enterprises through their growth process with a nurturing environment and hence reflect a strong endeavor to promote innovation and entrepreneurship with dedicated policy interventions [1, 2]. However, so far there has been little solid evidence available to ratify the effectiveness of business incubators and most researchers agree that the existing literature is seriously plagued by methodological, theoretical and empirical limitations in the process of evaluating the performance and impact of business incubators [3-5]. Yet since the 1980s, the interest, confidence and investment scale in associated programs continue to soar, not only in industrialized countries such as the U.S. and Western Europe but also in industrializing and emerging countries like China and Brazil [6-8].

While an enormous amount of land, money and human resources have been poured into the incubator industry, public concerns about the effectiveness of incubators and on the soundness of those methods devised to evaluate incubators are increasing as well. One of the main responses has been a series of nationwide surveys of the incubator industries, which were conducted in mid 1990s and sought to quantify the average capacity and the output of incubators with a selected array of metrics. The results of these surveys, which unexceptionally praised the impact of incubation on business formation and growth, soon became highly cited in the annual reports of responsible agencies and were thus widely disseminated [3]. However, academic literatures on evaluation mirrored the credibility of these surveys very differently [4]: the misplaced emphasis on incubators' rather than incubated firms' performance, the adoption of biased performance indicators, the underestimation of incubators' operating costs and the disregard of the heterogeneity across different types of business incubators were altogether indentified as serious weaknesses of the abovementioned surveys and therefore

were severely doubted to undermine those conclusions of the surveys. Moreover, as been pointed out by a few researchers, the methodologies that had been applied in these surveys were fundamentally problematic since they were simply measuring the impacts of incubation service (policy intervention) without any comparable counterfactual reference (equivalent businesses without incubation service). As a consequence, the results of these surveys may serve to provide a snapshot for the operation of incubator programs from some certain aspects, but were intrinsically unable to justify these programs superiority in assisting business development relative to the natural market environment [9].

Meanwhile, new survey designs that conform more to the principle of experimental method (EM) or at least allow the control of idiosyncrasies across incubators were widely proposed to address the preceding criticisms from different perspectives. Unfortunately, as we shall see in the subsequence of this paper, these propositions have been hardly used in practice to better inform policy making regardless of the variations in social and economic context. The lack of resources, training, quality control and, above all, political commitment at high levels has been reported everywhere to hinder the implementation of refined evaluation which is claimed to be based on more scientific and objective methods. In contrast, traditional yet highly defective evaluation methods are still popular and are routinely used to circumvent public scrutiny and justify decisions already taken.

How shall we then understand this gap between aspiration and practice? In this paper, we seek to answer this question from two approaches, i) from a methodological perspective, we focus on the technical complicacy of EM and other advance evaluation methods which may potentially reduce their feasibility and popularity among agencies in charge of evaluation; ii) from an institutional perspective, we select and compare three cases in business incubator performance evaluation so as to identify those common and intangible factors that resist the use of EM in different national contexts and at different institutional levels. Specifically, we examine the most recent nationwide evaluation attempts made by the U.S., the European Union (EU) and China. We have chosen these

jurisdictions because they are unanimously recognized as the most representative cases in business incubator research in the light of their incubation programs' overwhelmingly large scale and influence and particularly their relatively mature models to operate these programs [5, 10-12]. Furthermore, their well-documented and widely disseminated efforts to comprehensively evaluate their incubator programs through nationwide surveys are still rare among other countries, yet are necessary and essential for the effort to develop an in-depth institutional analysis.

The remainder of the paper unfolds as follows: in the next section we discuss the techniques of EM and its variants in seeking to demonstrate the observable, methodological challenges of using EM to evaluate the effectiveness of incubators. Following that, we present an analytical framework to guide the identification of latent, institutional barriers of applying EM in practice. The evaluation practices of the U.S., the EU and China are then structurally anatomized and summarized to draw out some of the similarities and differences among the three nations. Finally, we draw conclusions on the potential for using EM in business incubator evaluation.

II. THE METHODOLOGICAL CHALLENGES

Since business incubators are intended to overcome the market failure in nurturing startup firms, the fundamental issue in incubator evaluation should be verifying the effectiveness of incubator's services in assisting incubatees so that they could obtain better chance of survival and growth. Only after this issue has been correctly addressed would policies that endeavor to promote or curtail the incubator program be rested on a sound and solid ground. Such a verification process normally means to establish the causal relationship between incubation service and firm performance through comparing what happened to firms receiving the service with what would happen to them otherwise. This procedure is necessary whenever the effect of an imposed intervention, e.g. incubation service, is needed to be distinguished and disentangled from the changes occurring as the result of other forces and factors (the external environment) [13].

Three research strategies are generally regarded as suitable to verify the causal relationship among variables of

interest—the comparative method, the EM and the statistical method [14]. A principle common feature of the three methods is that they all seek to establish general empirical relationships among two or more variables while all other variables are controlled. In line with the discussion above, this feature is vital because one cannot be sure that the assumed relationship is true unless the influences of other variables are controlled. In the case of nationwide evaluation by surveys, the EM and statistical method are preferred to handle those aggregate data whereas the comparative method is often used to deal with data scarcity and the small-scale nature of initiatives.

The EM, in its simplest form, would randomly assign equivalent samples to two groups, one of which (the experimental group) is exposed to an intervention while the other (the control group) is not. After the two groups are compared in this situation, any difference can be attributed to the intervention. Thus one could ascertain the existence of the causal relationship between intervention and the difference—with the critical assurance that no other factors are involved, because in all aspects but one the two groups are alike. At this point, equivalence between the experimental group and the control group must be achieved and guaranteed through a deliberate randomization process.

Notwithstanding EM is the most nearly ideal method for testing the causal relationship, it can rarely be used in policy evaluation because of practical and ethical obstructions. Taking incubator evaluation as an example, first, people have to subjectively choose from an array of parameters, including the firm's location, industry code and scale etc., to define the criteria of equivalence in sampling; second, sampled equivalent firms must be randomly assigned to an experimental group to be incubated and to a control group for subsequent comparison. In reality, however, socioeconomic phenomena such as firms have multidimensional characteristics and hence a specified criteria of equivalence if often partial and controversial. Further, there are very few incubators that would accommodate firms randomly assigned to them without any screen and thus deny the possibility of randomization. As a result, fundamental requirements of using EM usually become unrealistic when they are put against the context of most policy evaluation initiatives.

A frequently used solution, in response to the infeasibility of EM in most social settings, is the Quasi-Experimental Method (QEM) [13, 15]. The most commonly used QEM is a "matching" technique that sources back to early stage social experimentation literature [16], which non-randomly construct a control group by statistically matching individuals with subjects in the experimental group to make the two groups as comparable as possible [17-19]. In principle, QEM relaxes EM's "equivalence" restriction by tolerating the researchers' discretion in setting up the control group, thus making comparisons possible in a setting where they were previously unavailable. Encouraged by the precedents in using QEM to evaluate the impact of training programs, employment subsidies and other economic development programs [20-22], efforts have also been made to explore the usage of QEM in business incubator evaluation. For instance, Sherman and Chappell [4] proposed to construct a control group of non-incubated firms in a quasi-experimental designed study in order to estimate the effects of business incubators, but they had to abandon the design because of the tremendous difficulty in identifying "untreated" firms and thus in compiling a statistically meaningful sample of non-incubated firms. Philips [23] took an alternative approach and constructed a control group constituted by firms that applied for membership to an incubator but were ultimately rejected. But this approach should be considered ad hoc in nature since not every incubator keeps records of rejected applicants, and hence a nationwide survey will run into the same problem as in the Sherman and Chappell case.

A more serious methodological challenge in the use of QEM in business incubator evaluation is the resolution of the selection bias. In QEM, selection bias emerges if the subjects in the experimental group, in addition to the ones in the control group, are not randomly assigned. In specific, business admitted in incubators may be subject to two types of selection bias, and therefore, performance differences between incubated and non-incubated firms cannot be exclusively attributed to the incubation effect. The first type of bias is "self selection," suggesting that business entrepreneurs who are seeking or are selected in incubation

programs may be more motivated and equipped for business competition than average new business owners in the control group. As a consequence, the incubatees are very likely to outperform their peers in the control group. The other bias is "administrative selection," indicating that competitive selection or screening processes of many business incubators would help them to identify and select the most promising businesses or at least avoid the least promising ones [5, 24]. As a result of the two selection biases, incubatees are meant to perform better than their matched non-incubated businesses regardless of whether they are incubated or not. Without properly controlling for these biases, the effects of incubation programs and the performance of incubators will likely be overestimated.

In the preceding circumstances, some statistical methods have been developed either to account for selection biases [25, 26], or to replace the QEM as an approximation tool [13, 14]. To correct the selection bias, an exhaustive, if possible, list of individual characteristics that may predict individual's participation in a given program can be identified and corresponding data be collected through surveys or interviews [27]. However, Heckman et al. warn that there will be a trade-off between the control of selection bias and the inclusion of individual predictive factors because the inclusion of such variables may, as an extreme example, make matching impossible. Further the mechanisms of these techniques are far too complicated for policymakers and practitioners to comprehend and operate. Therefore, as in the latter case, the statistical method has also been used as an alternative to the QEM which would normally require the control of the key variables that are known or suspected to exert influence on the dependent variable and the uses of partial correlations to distinguish the effects of intervention variables. As the price of its improved applicability in real policy evaluation, the statistical method has a higher risk of omitting some influential variables and thus based conclusions. Accordingly, the results of such statistical methods must be exposed to broader examinations and more cautious interpretations before any policy recommendation could be drawn upon them.

III.   THE INSTITUTIONAL BARRIERS

An Analytical Framework

Following the standard "New Institutionalism" definition, institutions contain organizational structures and interactions, routines and procedures, norms and conventions of behavior, habits and belief systems, as well as the formal apparatus of the state [33]. We shall then approach the institutional challenges by exploring the professional capacities and institutional arrangements that affect the willingness and ability of a political system to use an EM approach in evaluating business incubator success. Such analysis can easily become immensely complex, so we particularly center on three representative cases from the US, the EU and China while simplifying the generalization process with an analytical framework, which will examine the evaluation activity at different institutional levels. This analytical framework contains three levels of analysis:

The micro level is concerned with the availability of human resources (levels and types of expertise, training, background and skills of policy officials) as demanded by the EM in business incubator evaluation within the chief agencies.

The meso level is concerned with the organizational structure, namely organizational procedures and management structures, systems of knowledge transfer, norms and incentive structures. In particular, we shall examine i) the organizational attitude (norms and culture) toward the reliability and objectivity of evaluation and towards the value of science and knowledge in policy making; ii) the incentive structure that directs the selection of evaluation method in decision making; and iii) the commitment of appointed leaders to a scientific, evidence-based policy evaluation and the following decision making process.

Finally, since the 'macro'/ constitutional/ higher level order is sometimes seen as providing the overarching societal structure within which decisions at other levels are taken, our macro level analysis will concentrate on the wider context, including the linkages with broader values, norm and societal goals, and connections with the larger policy network of stakeholders. Specifically, we will analyze i) the array of interests, goals, strategies of different stakeholders and the role of evaluation in the strategies of

stakeholders which serve to influence the decision-making process; and ii) the original policy objective set by governments before evaluation.

We explore the institutional barriers in the use of EM with the three-level framework for every case, in each country, to identify and characterize the main factors affecting the application of EM in the evaluation of business incubator performance. The following section presents a synthetic interpretation of these results to yield general lessons about institutional capacities and constraints to incorporate EM.

Institutional Barriers in Practice

Micro-level Barriers

The background of policy officials and their designated experts were found to be a substantial micro-level constraint on the selection of a policy evaluation method and can have a conspicuous effect on the subjects chosen to be evaluated as well. Officials' education and working experiences together shaped the way a specific evaluation method was perceived, especially from the utility and feasibility perspective. According to our previous analysis in the methodological challenges of using EM, proving the causal relationship between incubation service and better firm performance requires a profound knowledge of the EM, its variants and their strengths and weaknesses in respective under different situations. Such knowledge, unfortunately, is rarely obtained or understood by people other than professional scholars. Therefore, evaluation methods more technical than those direct comparisons being used to constitute benchmarking, or those evaluation subjects that may use such methods, are frequently labeled as "long", "terribly complicated" and "infeasible" in the three cases [29, 30].

Resources, such as time and money, are also a barrier to a varying extent. Many officials complained about the lack of time and money to seek improved evaluation design, mostly due to the irregularity of conducting evaluation. Although knowledge about the EM is a clear limit to the discovery of more fundamental policy issues and the use of optimized evaluation methods, it does not mean that the absence of

such knowledge has not been recognized by policy makers. Respondents, particularly in the US report, increased time pressure to deliver policy proposals, causing there to be less time for analysis, reflection or strategic thinking on the way to improve evaluation design, understand the rationale and significance of better alternatives such as the EM, and to assist its implementation. A typical opinion expressed in China is that people in charge of the evaluation either have no access to, or have no time to acquire, advanced knowledge of evaluation [11].

Meso-level Barriers

Organizational norms constitute major barriers to the recognition of the significance of EM. First, evaluation in general has been viewed as a largely irrelevant formality—an imposition rather than a helpful aid to decision making. In EU and China, the idea of evaluating the performance of business incubators was introduced late in the overall policy process, and hence had limited potential to contribute to the formation of project visioning. Consequently, policy decision has been understood as being made politically and thus depends on rationalities that differ from technical rationality. Benchmarking, which implicitly admits the effectiveness of business incubation and always justifies further investment as an effort to "improve" the performance, is therefore much more preferred politically than the risky EM. Second, most of the guidance on the use of evaluation methods aims to encourage less detailed and less time-consuming forms of assessment. Thus the use of advanced tools such as EM and integrated assessment models is downplayed while simple tools like benchmarking is advertised in detail and then mandated [31]. In China, for instance, a strong skepticism prevails towards formal analysis methods in general and economic tools (EM, cost-benefit analysis and economic modeling). Policy officials often consider their expert-based evaluations (drawing on professional experience, rules of thumb, advice from colleagues and external specialists etc.) as superior to formal analysis using complex methods [32, 33]. These factors have contributed to a situation where formal evaluation tools like the EM are regarded as unfavorable to benchmarking when taking into account the

indifference of officials to evaluation activity already in place.

In addition, leaders of the administrative agency in each case often see formal assessment as a threat to their discretion as decision-makers. In the US case, executive officers in NBIA tended to see the results from EM as a possible impediment to their efforts to lobby for more funding through the legislative process [3]. For the agencies in charge of the policy, a lack of transparency means more freedom to internally assimilate the potential negative effects (or uncertainties about effectiveness) without the risk that this information is captured by EM and used for political purpose by actors distrusting business incubation. In this respect, as the EM would potentially take away flexibility and make it harder to avoid the pitfalls that emerge from the political process, it again becomes undesirable in difficult political contexts.

Macro-level Barriers

The methods and parameters of evaluating business incubation programs are also revealed to be strongly influenced by the purpose of the exercise and the values that are brought to bear. It is important to be aware of who is asking the question, why they are doing so, and what their preconceptions are about the answers. In the US, where business incubation was invented in the late 1950s and has experienced both prosperity and backset in the last half century, praises of and suspicions about its effectiveness persist. We see conflicting preconceptions toward such programs competing with one another among different institutional entities at the macro-level. As a result, despite the methodological challenges and the micro- and meso-level institutional barriers in the use of EM, initiatives attempting to verify the usefulness of business incubation programs are still being promoted and funded [3, 24, 34]. In contrast, China and the EU share the perception that their business environments are inferior to the U.S.'s in terms of promoting entrepreneurial startups [35]. Therefore, business incubators, as an imported instrument from the U.S, have been pre-conceptualized as a beneficial addition to their existing innovation ecosystems. Accordingly, these countries tend to pursue ways to improve and maximize the

output of business incubators instead of challenging the efficacy of the initiative, where immense sunk costs and the reputation of the government in supporting economic development exist. Thus the Chinese government and the European Commission prefer forward looking evaluation methods such as benchmarking and the Participatory Evaluation Approach [36, 37] to the EM..

Further, the pattern of stakeholder involvement presents another macro-level barrier in the use of EM or other advanced evaluation tools in the EU and China. Unlike the US case, where the main body of business incubation programs is a grass-roots phenomenon and involves substantial investment and participation of local stakeholders [38, 39], the European Commission or the Chinese central government independently promoted and sponsored the most of their incubation programs [10, 11]. Thereby, business incubators are often results of the agreements between ambitious local governments who normally commit to an administrative role, and the central government who assumes the investment responsibility. As a consequence, stakeholder involvement is restricted to providing peripheral networks for the operation of the incubator in the EU and China rather than evaluating its effectiveness or redirecting its strategy. From this perspective, the value of EM has more leeway to be advocated and acknowledged in the evaluation of US business incubation programs since their ownership structures are much more diversified and hence require the use of more objective and scientific evaluation method to convince stakeholders to continue their investment.

IV. CONCLUDING REMARKS

Despite the worldwide adoption of business incubators by policy makers as the Holy Grail for entrepreneurship and business development, solid evidence of the advantages of business incubators in enhancing the competitiveness of client firms remains elusive. In this paper, we ascribe the vagueness and imprecision in evaluating the effectiveness of business incubation to the failure of identifying and engaging the appropriate methodology, viz. the EM. Our study first reviews the methodological challenges to the use of EM and then identifies those institutional barriers at the micro, meso and macro-levels, which further exacerbated

the problem. There are also complex and overlapping relationships between these levels. For instance, the operation of incubation program evaluation at the meso-level is often influenced by macro-level preconceptions while the micro-level barriers such as availability of time and relevant knowledge apparently have their roots at meso and macro-levels.

Our analysis also inspires reflections on how to achieve the rationality and objectivity of policy evaluation in a messy world of policy making. While the routine use of policy evaluation has promised more public scrutiny of policy proposals and introduced some bounded forms of rationality into the decision making process, one may question that the calls for methodologically sound approaches or objectivity (evidence-based policy making) actually overestimate the value of evaluation in a real policy making process which is intrinsically ad hoc and can only be incrementally improved. The uncompromising request for evidence constructed by a certain method (i.e. the EM) is also disputable, given claims that evidence is itself a social construct [40] which can be used by powerful actors to pursue their interests. Our evidence indicates that simply aspiring to the application of objective and scientific method in evaluation are far beyond the institutional tolerance of associated agencies and thus are not making evaluation more welcomed there.

We suggest that to use EM in practice will inevitably require a surmounting of the institutional barriers, which demands an in-depth analysis of the institutional settings, purposes and strengths and weaknesses of the method, and above all, long-term engagement in the process by analysts and policy makers. With respect to the evaluation of business incubation programs, in particular, an effort to build a suitable database, to design more actable EM variant and to locate stakeholders for sponsoring the evaluation, is a necessary first step.

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