**A participatory approach to tracking system transformation in clusters and innovation ecosystems – evolving practice in Sweden’s Vinnväxt programme**

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**Abstract**

For decades, cluster initiatives and funding programmes have been used as instruments of industrial and innovation policy – addressing system failures by strengthening linkages among actors, fostering innovation and developing more effective innovation systems. More recently, a growing segment of these initiatives are also focused on driving system-level transformation and contributing to broader societal benefits. This segment is characterised by larger-scale and longer-term strategic efforts involving a variety of stakeholders across different parts of society, aimed at contributing to addressing societal challenges. These characteristics are shared with the emerging frame of transformative innovation policy, which highlights the importance of embedded practices of learning and reflexivity to enable continuous monitoring of progress and inform and adapt the direction of systemic change processes – requiring new approaches to governance and evaluation.

Despite deep experience with implementing cluster programmes and other systemic innovation policy instruments, practitioners still struggle with monitoring and evaluation. Current approaches focus on evidencing strengthened innovation (and economic effects) on the level of firms and research actors, and fail to capture contributions on the level of the broader system.

This paper presents an evolving approach for tracking system transformation in clusters and collaborative innovation initiatives. Through an interactive, co-development process with initiatives in the Swedish Vinnväxt programme, this research proposes a definition and set of system effect categories for cluster initiatives. It tests a participatory approach for tracking their contribution to system-level change over time, providing an initial case on which to build and apply in other transformative innovation programmes.

**Keywords**

Tracking system transformation, cluster evaluation, innovation ecosystems, collaborative innovation initiatives, system level effects, participatory evaluation approach

**Introduction**

The use of cluster initiatives and other collaborative innovation initiatives as instruments of industrial and innovation policy now stretches over several decades. The focus of the cluster policies supporting these initiatives is to address system failures by strengthening linkages among actors in established clusters. While the hypothesized benefits of strengthened collaboration are typically broader, fostering innovation is at their core, hence a strong link between cluster initiatives and a range of other measures designed to support effective innovation systems. Yet in recent years we also observe that cluster initiatives are asked to contribute more than solely providing for stronger economic productivity and competitiveness among firms. On the one hand, the adoption of a strategic regional approach to innovation through smart specialization strategies (S3) (European Commission 2014) has reenforced the dimension of directionality in the discourse around cluster policies. On the other hand, the launch of the United Nations Sustainable Development Goals (SDGs) has helped push industrial and innovation policies to adopt directionality that is focused on addressing complex societal challenges. In turn this requires the alignment of aims and investments in longer-term systemic efforts.

As a result, we witness a growing segment of cluster initiatives and related policy programmes that are expanding their focus from fostering innovation and firm-level competitiveness, to simultaneously contributing to system-level change processes that will bring broader societal benefits (Wise and Johansson 2012; OECD 2016a, 2016b; Wilson et al. 2017; European Commission 2019, 2020a, 2020b). This change is reflected in the use of different terminology when describing collaborative initiatives with scope for meeting broader, system-level aims; for example, “superclusters”, “industrial ecosystems” and “innovation ecosystems” (ISED Canada 2017; Vinnova 2019; Innovation Norway 2020; European Commission 2020a). Moreover, many policy programmes that support cluster initiatives and/or other types of collaborative action are being adjusted to leverage existing collaborative structures to develop more efficient and attractive system resources (or relations) and to innovate (or transform) the system.

This journey with respect to collaborative initiatives can also be framed in terms of the evolution of innovation policy more generally, which is experiencing a shift in terms of the primary targets of research and innovation investments: from a focus solely on economic growth; towards a focus on tackling societal challenges and generating combined environmental, societal and economic impacts. This ongoing shift has recently been articulated as the ‘third frame’ for innovation policy, aimed at the transformation of socio-technical systems (Weber and Rohracher 2012; Schot and Steinmueller 2018).

The broader strategic agendas associated with these changes have led to demands for new evaluation approaches to evidence the impacts and values at a system level, leading to the exploration of new practices for evaluating systemic instruments (Arnold 2004; Hummelbrunner 2011; Edler et al. 2012; Magro and Wilson 2013). So-called Transformative Innovation Policies (TIP) are focused on addressing complex societal challenges and come with a number of specific evaluation requirements: the integration of evaluation and learning activities as part of the design and implementation of policies, programmes and projects; the use of more participatory and inclusive approaches; and the use of a mix of methods and techniques for continually collecting and reflecting on information in order to evidence signs of change and to adapt strategies going forward (Chataway et al. 2017; Boni et al. 2019; Molas-Gallart et al. 2020; Molas-Gallart et al. 2021). As Weber and Rohracher (2012) point out: “the long-term character of transformative change, associated with the uncertainty surrounding innovation and change requires a continuous monitoring with respect to progress towards the transformation goals and the development of adaptation strategies. Reflexivity needs to be built into the process of transformative change (*ibid*.: 1044).”

Recent academic contributions have helped frame the challenges, establishing a framework, principles and approach for TIP evaluation (Boni et al. 2019; Molas-Gallart et al. 2020; Molas-Gallart et al. 2021). However there remains a shortage of research on practical experience with tracking system transformation in innovation programmes. More specifically, while research on the evaluation of cluster initiatives and other collaborative policy programmes has made important recent advances in terms of evidencing the impacts of collaborative and networking dynamics (Aragon et al. 2014; Calignano and Fitjar 2017; Graf and Broekel 2020; Lucena-Piquero and Vincente 2019), there are important gaps in terms of evidencing their contribution to system-level change processes and wider societal outcomes.

This paper contributes to addressing these gaps by proposing a definition, key characteristics and initial set of system effect categories for cluster initiatives and other collaborative innovation initiatives, as well as testing a participatory approach for tracking their contribution to system level change over time. It does this by presenting the results of a three-year interactive research project with Vinnova’s[[1]](#footnote-1) Vinnväxt programme in Sweden, a transformative innovation programme that is rooted in regional innovation systems and cluster dynamics (activity and place based, and collaborative in nature). By providing insights from practical experience with a participatory approach to tracking system-level effects in Vinnväxt, the research aims to contribute not only to the development of cluster policy evaluation, but also to the broader field of transformative innovation policy evaluation.

Following a review of the conceptual and practical background to the research, section 3 describes the Vinnväxt case and the research approach. The results are presented and discussed in section 4, and are followed by conclusions, policy implications and directions for future research.

**Conceptual and Practical Background**

*The Evolution of Innovation Policy and its Evaluation*

Recent academic literature has provided a comprehensive overview of the evolution of innovation policy over the last half-century. Among others, Weber and Rohracher (2012) and Schot and Steinmueller (2018) have discussed how the underlying rationale and assumed model of innovation have influenced policy aims and practices over time. This evolution can be simplified into three frames (TIPC 2019 – see Figure 1), in each of which there have been parallel changes to innovation policy evaluation in terms of the indicators and methodologies used to measure innovation.

Frame 1: Innovation for growth

In this frame innovation policy directly addresses a market failure leading to lack of investment in basic scientific research and technological advancement due to the challenges of appropriating the benefits. The underlying understanding of innovation was that it followed a linear path from discovery to commercialisation and broader dissemination, and that increased innovation was a motor of economic growth. Policy instruments aimed at stimulating knowledge generation (for example, through R&D subsidies and tax credits), developing effective regulatory and educational policy, and building awareness of the importance of technological advancement. Evaluation of Frame 1 innovation policies correspondingly focused on statistical measures of R&D inputs (in terms of funding sources, performers and personnel) and outputs (in terms of articles, patents and different kinds of innovation), typically using Frascati Manual approaches for collecting and reporting data (OECD 2015).

Frame 2: Systems of innovation

The underlying rationale for the second frame of innovation policy, prevalent from the 1980s until today, is the need to address system failures reflected in the lack of linkages, mutual learning and use of knowledge between different actors and actor groups. The underlying understanding of innovation is that it is fostered through regular interaction and feedback loops between actors (government, science and industry) in a geographically, sectoral or technologically defined ‘system of innovation’. Policy instruments thus aim at developing linkages, interactive learning and coordination/alignment between actors in order to stimulate knowledge utilization, innovation and entrepreneurship, which in turn fosters competitiveness and economic growth. In this frame, cluster initiatives can be a key policy instrument, and we begin observing the rise of systemic interventions with policy actions focusing on the level of the innovation system (Smits and Kuhlmann 2004; Wieczorek and Hekkert 2012). This expanded framing of innovation policy is also reflected in evaluation practices. The *Oslo Manual* (first published in 1992) addressed the need to reflect how innovation systems operate, using qualitative approaches (for example, the Community Innovation Survey) to complement existing statistical approaches. It also introduced new measures to capture innovation capabilities, the role of linkages with other firms and institutions in the innovation process, and external factors influencing innovation in firms, as well as measures for innovation activities and outcomes (OECD/Eurostat 2018).

Frame 3: Transformative change

The underlying rationale for this emerging third frame of innovation policy is the need to address failures in directionality, policy coordination, demand articulation and reflexivity that are necessary elements for solving complex societal challenges. Policy instruments seek to foster new connections between systems, providing “spaces for experimentation” and co-producing solutions that can be expanded to enable broader socio-technical system change (for example, through missions and challenge competitions or challenge-driven innovation programmes) (Schot et al. 2019). The evaluation of these (emerging) policy instruments is underdeveloped. We witness increasing attention to monitoring transformative outcomes in the form of changes in behaviour, relationships, activities or actions of people, groups and organisations. We also witness increasing use of continuous monitoring and evaluation to support learning and reflexivity and change the way people think about and act toward future changes (Earl et al. 2001; Arnold et al. 2018 and Schot et al. 2019). In the context of these emerging developments, recent research has highlighted the need for new evaluative strategies and approaches for transformative innovation policy (Boni et al. 2019; Molas-Gallart et al. 2020).

Figure 1: 3 Frames of Innovation: Characteristics and Evaluation

[FIGURE 1 HERE]

Source: TIPC (2019) and authors’ own elaboration

*Evaluating Transformative Innovation Programmes: The challenge of tracking system-level change*

The complexity of objectives and the long-term nature of transformative innovation programmes create new requirements for the role of and approach to evaluation (Arnold 2004; Hummelbrunner 2011; Magro and Wilson 2013, 2019; Caffrey and Munro 2017; Boni et al. 2019; Molas-Gallart et al. 2020; Molas-Gallart et al. 2021). In addition to monitoring efficiency, effectiveness and relevance, evaluation of transformative innovation programmes also needs to monitor progress and inform the direction of the systemic change process underway (Arnold et al. 2018; Patton 2016; Boni et al. 2019; Molas-Gallart et al. 2020; Molas-Gallart et al. 2021). In this regard, so-called developmental evaluations use mixed methods, try to understand the context of the initiative, and evidence outcomes and impacts over time. They may require working with stakeholders to co-develop sets of performance metrics that are specific to the initiative and that use new means of gathering, storing and making sense of data to ensure that the evaluation results support further development (Patton 2016; OECD 2017). These aspects overlap to a certain extent with TIP evaluation principles (Boni et al. 2019; Molas-Gallart et al. 2020; Molas-Gallart et al. 2021), which stress mixed methods, participatory approaches and the integration of evaluation as a formative and strategic dimension of a project, programme or policy process to support learning, evidence system-level changes and inform strategic choices over time (see Table 1).

Table 1: Comparison between Traditional, Developmental and TIP evaluation

[TABLE 1 HERE]

Source: Based on Patton (2006); Chataway (2017); Boni et al. (2019); and Molas-Gallart et al. (2020).

Yet there are key differences between developmental evaluation and the emergent “formative approach to TIP evaluation” developed in the Transformative Innovation Policy Consortia (TIPC). Developmental evaluation is designed to capture system dynamics to provide context-specific understanding that guides ongoing innovation and adaptation in dynamic environments (Patton 2006). TIP evaluation, with its strong roots in sustainability transitions literature and the multi-level perspective (MLP) on socio-technical transitions (Geels 2002, 2010; Geels and Schot 2007), is designed to monitor signs and progression of systemic change in 12 categories of transformative outcomes (Ghosh et al. 2021), in order to enhance reflexivity and learning and potentially trigger changes to experimental policy engagements (EPEs) (Molas-Gallart et al. 2021). Whereas developmental evaluation has an open position on the direction and progression of system development, TIP evaluation monitors the progression of system transformation through stages of niche building, niche expansion and embedding, and opening up and unlocking regimes.

However, both share the perspective that the primary purpose of evaluation is to track (or constructively monitor) the signs of system-level change in real time, and support learning and reflexivity among participants in order to assess the contribution of the initiative to its aims of longer-term systemic transformation (Janssen 2019; Molas-Gallart et al. 2021). Instead of measurable indicators, the signs of change are indicated by, for example, the development of the constellation of actors and interactions among them, the evolution of strategic aims (in relation to broader system-level transitions) and the outcomes that have been affected by the collective action. The approach to data gathering and analysis (or sense-making) involves participating actors, seeks to include a variety of perspectives, and is embedded in the process of continual strategy development. The results, in the form of contextualized insights and narratives, are used as “food for thought” to be interpreted by the collaborative group in order to guide the agile adjustment of the transformation trajectory (for example: same direction or changed path; more or less resources to different areas/experiments; need for different/more actors’ engagement; etc.).

*Cluster policies as instruments of system innovation*

For nearly three decades and corresponding with the development of the second frame of innovation policy, regions and countries around the world have employed cluster-based policy programmes as part of their industrial, innovation and regional development policies (OECD 2007, 2010, 2016a). Cluster-based policies are expected to deliver not only higher firm-level innovation and productivity through strengthened knowledge-sharing and collaboration, but also more efficient and competitive regional innovation systems. While cluster initiatives are often seen as focusing on firm-level innovation and growth, cluster policies have often assumed a broader remit in terms of strengthening the local system through collaborative action. They typically bring industry, science, the public sector and (more occasionally) civil society actors together in participatory processes geared to increasing competitiveness, encouraging diversification, and ensuring resilience.

In recent years, we have witnessed an evolution of cluster policies (Table 2). This has been centered on the increased use of cluster initiatives as intermediaries that can support actions to address a wider range of specific regional and national policy challenges: skills development, entrepreneurship, digitalisation, industrial modernisation, internationalisation and sustainable development (Wise and Johansson 2012; OECD 2016a, 2016b; Wilson et al. 2017). In cluster policy programmes around the world, we see the introduction of concepts such as shared value (Porter and Kramer 2011; Alberti and Belfanti 2019) and system leadership (Senge et al. 2015; Nelson and Jenkins 2016; Dreier et al. 2019), as well as the introduction of new selection criteria and capacity building activities related to addressing the SDGs. More recently, we see clusters taking on an active role in response to the COVID-19 crisis,[[2]](#footnote-2) both to address urgent supply chain issues as well as to support longer-term recovery strategies. Indeed, cluster-based policy programmes (and particular cluster initiatives) are increasingly recognised as a policy instrument that can be leveraged to mobilise actors together in a common strategic direction, aimed at achieving broader industrial transformation and system innovation (OECD 2016b; European Commission 2019, 2020a, 2020b).

Table 2: Evolution of Cluster Policy

[TABLE 2 HERE]

Source: Own elaboration

*Evaluating cluster policies as instruments of system-level change*

Despite deep experience with cluster policy implementation over several decades, practitioners still struggle with monitoring and evaluation of these systemic instruments (Smith et al.2020). Evaluation practice maintains a focus on indicators of innovation and firm-level economic performance and often fails to capture the development of collaborative strength and the contributions it can make to wider system-level impacts. Yet we witness increasing interest in exploring and tracking the contribution of collaborative initiatives to broader system-level effects. Examples include the analysis of economic ripple effects of clusters in the Norwegian Innovation Clusters programme (Røtnes et al. 2017), attempts to apply Porter and Kramer’s (2011) shared value concept to cluster dynamics (Alberti and Belfanti 2019), and the exploration of Strategic Innovation Programmes’ contribution to system transitions in Sweden (Åström and Arnold 2020; Åström et al. 2020).

Exploring these approaches becomes even more important as cluster policies evolve towards a tool being used to serve transformative innovation paradigms and a range of wider policy goals. In this sense there is a need to experiment with and develop approaches to evaluation that support both the tracking and contextualisation of signs of systemic change being stimulated by these collaborative instruments, as well as the use of this information for learning and reflexivity. Building on emerging developments in both cluster and innovation programme evaluations, this paper analyses a practical case that has developed and tested new participatory approaches to tracking transformation through embedding a developmental evaluation approach in a specific policy context. Vinnväxt is a long-term policy programme in Sweden with the aim of ensuring transformational change within innovation systems, and with collaboration and a cluster methodology at its core. As such this was a valuable opportunity to develop a frame for capturing the system level impacts of such investments that could inform further research and evaluation approaches in both the cluster and the TIP fields.

**Empirical Context and Methodology**

*The Vinnväxt Case: From developing innovation systems to guiding system transformation*

The Vinnväxt programme is run by Sweden’s Innovation Agency Vinnova and was initially launched in 2001. Since then, it has promoted sustainable growth in Swedish regions by bringing together triple helix actors in long-term, collaborative initiatives designed to contribute to the development of internationally competitive regional innovation environments in specific growth areas. The programme provides funding and other support services over a period of 10 years (or longer).[[3]](#footnote-3) This can be used for institutional development and needs-driven R&D to strengthen cutting-edge competences in the various innovation environments.

The programme implementation approach has included active strategic dialogue between Vinnova (the funding agency) and the funded Vinnväxt initiatives. It also develops activities to support “strategic learning” (i.e. to continuously follow and reflect on developments over time to inform the direction of collective action going forward). Indeed, at least five percent of Vinnova funding should be used for strategic and reflective learning, providing external “constructively critical” coaching and supporting analysis for the initiative’s management (and for the board/steering group), as well as documenting the story of the initiative and the effects it has had on the system. Strategic learning tasks are conducted by action researchers or consultants and serve as a complement to the programme’s monitoring and evaluation system.

In addition to the continuous evaluation provided by the action researchers and/or consultants hired by each Vinnväxt initiative, Vinnova implements monitoring and evaluation activities comprised of four main elements:

* Ex-ante evaluation (based on the proposal submitted to the open call), comprised of a “base report” (including the initiative’s theory of change and initial 3-year action plan and budget)
* Regular monitoring through annual reports submitted by initiative leaders, regular dialogues with programme management and experience exchange workshops
* Interim evaluations conducted by external international evaluators after the 3rd and 6th year of the contract period
* Ex-post evaluations (of system impacts) conducted two years after the end of the contract period

Based on an in-depth programme development effort in 2001 (Vinnova, 2001), Vinnväxt reflects an operationalisation of the systems of innovation policy frame, yet also includes elements of the transformative change frame (Schot and Steinmueller 2018, TIPC 2019):

* Alignment between objectives to foster innovation and to address social and environmental challenges (*Vinnväxt focus on sustainable growth*)
* Engagement of an open, dynamic system of actors to contribute to system-level changes (*Vinnväxt expectation for continuous mobilisation of all Triple Helix actors and for coordinated action, for example to create infrastructure and societal services*)
* Directionality and long-term perspective (*Vinnväxt funding for a ten-year period – guided by a clear strategic direction for the collaborative action from the start*)
* Interactive approach to programme implementation and governance (*Vinnväxt programme team taking the role as active funders/investors*)
* A focus on formative evaluation (*Vinnväxt processes of continuous and embedded “strategic learning” – for development of the individual initiatives and of the programme/policy*)

The inclusive approach to long-term processes aimed at addressing societal challenges and system level development, supported by a unique combination of activities to support strategic learning and reflection make Vinnväxt an ideal case to explore the contribution of collaborative initiatives to system transformation and to begin developing a common language and approach.

Over time, the Vinnväxt programme has developed an increasing focus on the innovation environments' contribution to restructuring and renewal, with the 2030 Agenda and the sustainable development goals as a guiding framework for transformation (Kontigo 2016; Vinnova 2018). This is reflected in the programme description and call texts (Vinnova 2001, 2002, 2005, 2013, 2018), as well as evolving monitoring and evaluation practices (see Table 3). These demonstrate a clear evolution over time in various dimensions, which together move the focus from one of developing innovation systems (frame 2) to one of realising transformative change (frame 3).

Specifically, the *programme objectives and characteristics*shift from “sustainable growth and more effective and attractive regional innovation systems”, to “renewal and contributing to social and environmental (in addition to economic) objectives”, to “having SDGs as the driver for collective action”. The *selection criteria* shift from strategic development and improved international attractiveness for “existing areas of strength” to long-term strategies for “renewal and transformation” and resilience through the capacity for continual system-level change. They also demonstrate progressively increasing expectations on the role of the initiative’s leadership, from “providing a strategic direction and facilitating linkages within the initiative”, to “mobilising resources and creating increased leverage through connections with other actors and initiatives in the system on regional, national and international levels”, to proactively taking on the role of “catalyst” and “system integrator”. This also demonstrates increasing expectations for policy coordination.

In terms of the programme’s *effect logic/expected results* there is a shift from “strengthened research and education, more effective interactive learning and increased collaborative action for company competitiveness” to “effective regional and thematic innovation systems with the ability to interact for change and innovation, and equipped for future challenges” and to “contributing to Agenda 2030 goals”. Finally, the evolution in objectives and expected results is mirrored in an evolution of *strategic learning practices* (including monitoring and evaluation). These have built from a strong base of interactive dialog and action research to integrate more elaborated reporting/monitoring processes and an increased focus on capturing the initiative’s contribution to system-level changes and impacts (including the research project reported here which was focused on developing a more harmonised understanding and systematic approach to tracking transformation over time).

Table 3: Evolution of the Vinnväxt programme 2001-2019[[4]](#footnote-4)

[TABLE 3 HERE]

Source: Own elaboration

As mentioned above, annual reports comprise one part of the overall monitoring and evaluation system for Vinnväxt. Starting in 2009, more detailed annual reporting (including a web survey) was introduced to capture information on actor-level engagement and outputs (including firm-level innovation activities), as well as system-level developments (including new companies, investments, etc.). Reporting practices continued to be developed over the following years to gather information on Vinnväxt initiatives’ contribution to system-level investments and dynamics. From 2012, the Vinnväxt programme management began developing the “layer model” (Figure 2), a conceptual model to illustrate the different layers of effects that are catalysed by Vinnväxt initiatives.

The layers build on each other, such that Layer 1 (which represents the core Vinnväxt funding from Vinnova and regional actors) is leveraged to initiate new collaborative activities and mobilise additional project funding, either directly to the Vinnväxt initiative (Layer 2), or to other actors supported by the initiative (Layer 3). Layer 4 is a listing of key events and system-level developments that can be linked to the financial and human resources mobilised in the first three layers. As such, this “layer model” provides a way of documenting the ripple effects to which the collaborative Vinnväxt initiatives contribute and capturing the development of the innovation ecosystem over time.

Figure 2: Vinnväxt ”layer model”: A model to capture system impact (investments and dynamics)

[FIGURE 2 HERE]

Source: Own elaboration based on Vinnväxt programme illustration

To document layer 4, Vinnväxt initiatives are asked to list key events (or developments) in the innovation system (e.g. new establishments or investments, research infrastructures), explaining what role the initiative has had in realising the event. This element of annual reporting has proven challenging, as Vinnväxt initiatives have different interpretations of what qualifies as a key system-level development and varied approaches to developing their annual lists. It is also difficult to follow and communicate progress over time, to compare and learn from other Vinnväxt initiatives, and to highlight the contributions that Vinnväxt initiatives make to broader system-level transformations.

In recognition of these challenges, Vinnväxt programme management initiated a meta-level action research project focused on developing a common and theoretically-grounded understanding of system-level effects, as well as a more structured and harmonised method for evidencing system-level changes over time. This would, in turn, inform and support Vinnväxt initiatives’ strategic efforts, enable better use of data collected through annual reports, and foster increased visibility of Vinnväxt initiatives’ contributions to broader system-level transformation.

*Research Approach: Leveraging the System of Actors to Track System-level Change*

The project has followed an interactive research approach, built on a continuous joint learning process between researcher and participant (Svensson et al. 2007; Svensson et al. 2015), and employing qualitative methods for data collection (document analysis, interviews, focus groups). The research has involved 60-70 stakeholders (Vinnväxt initiative leaders and their teams, the network of action researchers working with each Vinnväxt initiative, Vinnova programme management, and a broader international network of researchers, policymakers and cluster evaluation practitioners) in an interactive, co-development process structured in three phases.

The first phase of research focused on developing and testing a conceptual framework, combining academic literature review, comparative analysis of impact studies of cluster programmes in several countries, and two parallel series of interactive workshops among two discrete focus groups.[[5]](#footnote-5) The cluster programme framework of effects distinguishes between three levels of effects (actor, collaborative initiative, and territorial system). Whereas current cluster evaluation practice has focused on indicators of innovation and firm-level economic performance (the actor level of effects), less attention is paid to capturing the development of collaborative strength (the collaborative initiative level) and the contributions the collaborative initiative makes to wider system-level impacts (the territorial system level). While there are emerging evaluation approaches that place more weight on relationships at the centre of clusters (Aragón et al., 2014b; Choi et al., 2013; Etxabe, 2018; Felzensztein *et al.*, 2018; Giuliani and Pietrobelli, 2016; Graf and Broekel, 2020; Lucena-Piquero and Vincente, 2019), there lack examples of evaluation approaches that capture if and how cluster initiatives contribute to systemic change and transformative outcomes in their (regional) innovation system. Thus, the focus of this research project was on exploring the level of the territorial system – i.e. what contributions Vinnväxt initiatives make to transformation of their respective regional innovation systems.

The second phase was a pilot within the Vinnväxt programme, which sought to develop a common understanding of system effects and define a set of system effect categories for innovation ecosystems, as well as test participatory approaches for tracking system-level changes. Through documentary analysis of previous years’ annual reports and reflection on current activities and strategy documents (defining intended future actions), as well as three semi-structured group interviews with (5) Vinnväxt initiative leaders, a set of system effect categories was agreed and integrated into the annual reporting templates for listing of “key events” (“layer 4” in Figure 2). The results were discussed and elaborated through several rounds of semi-structured group interviews with Group 1 (the focus group of Vinnväxt stakeholders). Following this process of participatory dialogue, a revised set of system effect categories and suggested methodological approaches (summarised in a guide for Vinnväxt initiatives[[6]](#footnote-6)) was launched in advance of the third research phase: a scaled-up testing of the system effect categories in the annual reporting process of the full Vinnväxt portfolio of 12 initiatives.

**Results and Discussion**

*Research results*

The research has resulted in an initial definition and list of system effect categories for innovation ecosystems, as well as a structured approach for reporting and tracking system-level change over time. In the context of this research, a ***system level******effect*** is defined as a development step (milestone, event) or outcome that has been influenced by (a set of) actions of the collaborative initiative, and which has a lasting, longer-term impact on several actors in the system (both within and beyond the collaborative initiative). Four aspects of this definition can be highlighted as key characteristics of a system-level effect:

1. *Strategic intent of the collaborative initiative*   
   One of the key rationales underpinning transformative innovation policy is directionality (i.e. a process for exploring development paths and negotiating collective priorities). The strategic intent and actions of the collaborative initiative should have a contributing influence on the system-level effect.
2. *Evidence of progress over time*  
   Given the long-term nature of system-level transformation, the focus of monitoring and evaluation is on tracking and evidencing the signs of system-level change and steps along a transformation journey (i.e. qualitative evidence of key milestones that demonstrate progress towards an intended strategic direction, as compared to measurable outputs).
3. *Affecting multiple organisations and actor groups*  
   In contrast to other measures of innovation activity (e.g. new prototypes, patents, products and services) that occur at the level of an individual organisation, system-level effects affect multiple organisations (and actor groups). This includes both those directly engaged in the collaborative initiative and others that have not been engaged.
4. *Longer-term, sustainable change*A system-level effect should represent a longer-term, sustainable change in the resources, actors and institutions (including policies and behaviours) that are mobilised towards the collective aims.

During the final research phase’s scaled-up test with the full portfolio, Vinnväxt initiatives reported a total of 103 system-level events or strategic milestones where the initiative played a contributing role, and marked these within the *seven main categories of system effects* set out in Table 4. An eighth category of “other” was used to capture additional types of system-level effects that did not fit within the proposed categories. However, only 3 of 103 events were categorised as “other”, thus confirming that the categories capture the various types of system-level contributions that Vinnväxt initiatives are making.

Table 4: System effect categories for innovation ecosystems

[TABLE 4 HERE]

Source: Own elaboration

The system effect categories that were derived from the participatory involvement of the Vinnväxt initiatives mirror many of the functions of technological innovation systems (TIS) (Hekkert et al. 2007; Bergek et al. 2008; Wieczorek and Hekkert 2012), as well as other functions supporting structural change processes (e.g. articulation of expectations or directionality, formation of new or deepening networks, changes in policies or regulations) that are not covered by the TIS functions (Haddad and Bergek 2020). This reinforces the relevance of the set of activities that are performed to contribute to system-level change processes and complements other recent findings on the role and functions of intermediaries in system transformation (Kanda et al. 2019; Kivimaa et al. 2019; Åström and Arnold 2020; Åström et al. 2020). Rather than adopting the TIS functions or other existing categories of change agency functions, the analysis maintained the categories derived by the participating stakeholders, adopting the TIP principle of inclusive and participatory evaluation processes (Molas-Gallart et al. 2020).

As a result of applying the descriptive categories in annual reporting processes (each reported event is allocated to one category from Table 4), Vinnväxt initiatives are better able to document and track strategic milestones within their respective innovation ecosystems over time. An example from one Vinnväxt initiative (Figure 3) illustrates the categorization of reported key events in two years (2018 and 2019). The visualization of milestones shows that this initiative contributes to many types of system effects, with a relatively higher proportion of highlighted milestones in “strategic partnerships” and “infrastructure” categories in 2018, and a relatively higher proportion of highlighted milestones in facilitating new investments nationally in 2019.

Figure 3: Tracking System Effects – example Vinnväxt Initiative and sample of milestones

[FIGURE 3 HERE]

Source: Own elaboration

This information provides qualitative evidence of the collaborative initiative’s contributions to various system-level change processes and effects, as well as a way of visualising their particular “system effect profile” (i.e. their differentiated role and contribution in relation to other actors in the innovation ecosystem) and how this evolves over time. The information also serves as a basis for reflecting and adjusting the strategic direction and priorities for future investments and collaborative action. However, as each reported event is given the same level of importance, the information does not provide any indication of the relative importance of particular events, nor how they contribute to broader strategic aims or transformation trajectories. Additional narrative is needed to put these pieces of evidence into a context and explain the relative significance of the milestones that have been achieved in terms of progress towards system transformation aims.

Figure 4 provides an overview of the categorisation of events across all Vinnväxt initiatives, both in the 2018 pilot study and the 2020 full portfolio study.[[7]](#footnote-7) This confirms that Vinnväxt initiatives contribute to a variety of system level change processes and effects, with a notably strong role in bringing together actors in the system and developing longer-term collaborative platforms for strategic action (SP/ISS); informing and influencing policy and strategy (POL/ST); and developing/attracting new research and innovation infrastructure (INF).

Figure 4: Vinnväxt Portfolio Contribution to System-Level Change

[FIGURE 4 HERE]

Source: Own elaboration

In addition to establishing an initial definition, key characteristics and list of system effect categories, the research has also contributed to enhanced monitoring practices by proposing a structured approach for tracking system-level transformation over time (Figure 5). This approach has built on existing annual reporting practices within the Vinnväxt programme[[8]](#footnote-8) and the common understanding of important system-level events achieved through the categories. From that base it highlights how to use the information as an input to strategic governance (e.g. decisions on adjusting courses of action and investments) and communication (e.g. evidencing and describing the initiative’s contribution to system-level change), by leveraging the role of embedded action researchers. This shared, structured approach is in line with the guiding principles for TIP evaluation (Boni et al. 2019; Molas-Gallart et al. 2020). It enables enhanced capacity at the programme level, providing information on Vinnväxt initiatives’ contribution to system-level transformation that is more easily communicated and “traceable” over time. This, in turn, informs initiative and programme levels, supports dialogue (internally as well as with Vinnova and other funders) and the development of strategic direction over time, provides the opportunity to benchmark and learn across initiatives, and enables broader communication and visibility of Vinnväxt initiatives’ role as “system change agents”.

Figure 5: Approach to tracking system transformation in Vinnväxt

[FIGURE 5 HERE]

Source: Own elaboration

*Discussion of insights*

While this interactive research project has realised initial goals,[[9]](#footnote-9) the results are only first steps towards developing a stronger understanding of and approaches for tracking longer-term system transformation processes and for assessing how they contribute to advancing transformative aims. Nevertheless, the research has provided several insights and lessons that can guide future development of evaluation practice.

First, it has highlighted the limited understanding of and focus on capturing system-level effects. Even though many initiatives (Vinnväxt and other cluster/collaborative initiatives globally) are strongly engaged in driving broader system-level changes to benefit society, this is not what is captured and communicated in current monitoring and evaluation practices. Rather, the focus is on tallying actor-level research and innovation results and longer-term economic performance. Indeed, there is only limited understanding of what is meant by the system-level. Attention to this among practitioners is scarce and even though some initiatives regularly publish success stories (or other narratives), these are not often viewed as stories of progress (steps) along a longer-term transformation journey. On a programme (and policy) level, even though renewal or transformation of the system is an expressed aim, there is not a consistent understanding (across innovation programmes) of what this implies and how system-level effects can be captured in monitoring and evaluation (aka strategic learning) practices.

Moreover, although recent academic contributions have introduced principles and frameworks to guide the evaluation of system transformation, there remain different interpretations of both what “signs of change” or outcomes to look for (i.e. 7 system-level functions of TIS as used in e.g. Janssen 2019, or 12 types of transformative outcomes as proposed in e.g. Molas-Gallart et al. 2021), how to assess the contribution of these outcomes to the envisioned system transformation (assessing progress towards the strategic directionality), and how to embed practices for “constructive monitoring” in real time in ongoing (or future) policy initiatives. The Vinnväxt case provides a conceptualisation of system-level signs of change: new “measures” to evidence and continuously monitor what aspects of the system are changing, how the collaborative initiative made this possible, and how this contribution is a step towards longer-term system transformation aims. Yet with the open directionality of the programme and individual initiatives, there lacks an assessment of the degree of system-level change and progression towards the desired transformation over time as emphasized by Ghosh et al. (2021) and Molas-Gallart et al. (2021).

A second key insight from the research is that one cannot adopt a traditional approach of evaluating “bang for the buck” when assessing impact of transformative innovation initiatives (Janssen 2019). Rather, one can only “constructively monitor” and use the information for continued learning and strategic development. Practitioners, policymakers and academics alike are quite firmly rooted in existing conceptions of monitoring and evaluation as an activity that is done to (vs. with and for) an initiative, resulting in a report that includes certain measurable indicators and charts (vs. narratives of change), with the primary aim of judging progress and making decisions on continued investment (vs. learning for continued development). Tracking system transformation requires a different mind-set and expectations about the purpose, approach and results from (and use of) such exercises. It essentially requires adopting a developmental evaluation mindset (Patton 2016) that involves participating stakeholders in feedback and learning processes. In this regard, the approach used in the Vinnväxt case to derive “key system level milestones” for annual reporting, to interpret and gain insights from the signs of system change to guide decisions on future directions for action is a practical example of the inclusive and participatory consultation and reflective learning processes proposed by Molas-Gallart et al. (2021).

A final insight from the research is the importance of tracking transformation as an integrated part of policy programme design and implementation. A unique characteristic of Vinnväxt is that is has (from the beginning) had a “strategy for learning” embedded in the programme design. Elements of this have included an active programme management team at Vinnova, action researchers attached to each initiative,[[10]](#footnote-10) a comprehensive set of monitoring and evaluation activities, and a model for following system effects (Figure 2). The combination of elements has provided a strong base from which to build and has highlighted the benefits of incorporating such elements into programme design. In the Vinnväxt case, the research has also highlighted the possibility for leveraging the existing network of action researchers to deliver on some aspects of the approach.

In summary, the developmental evaluation approach used in the Vinnväxt case can be viewed as an operational example of many aspects recommended in the formative evaluation of transformative innovation policy (see Table 1). The strategy for learning (elaborated above) integrated into Vinnväxt’s programme design established several inclusive, participatory and reflective practices that are useful to track transformation in long-term “experimental policy engagements”. These include an active programme management and project-level governance, embedded action researchers that can facilitate regular participatory consultation and reflective learning processes, and reporting practices that encompass constructive monitoring of system-level signs of change. However, a couple of aspects needed for evaluating transformative innovation policies that are missing in this case are stronger directionality towards societal goals and an assessment of progress towards the envisioned direction of the system transformation as emphasized by Ghosh et al. (2021) and Molas-Gallart et al. (2021).

**Conclusions and Policy Implications**

This research is based on a novel attempt to work with stakeholders in co-developing a conceptual framework as well as a specific approach to developmental evaluation practice for tracking system-level change linked to a specific collaborative innovation policy programme (Vinnväxt). As such it has made a significant step in highlighting the contributions that collaborative innovation ecosystems make to system-level transformation processes and has provided insights from practical experience with tracking system transformation in innovation programmes.

Initial evidence from the Vinnväxt case indicates that such longer-term collaborative innovation initiatives make a variety of contributions to the broader system, evolving over time as the collaborative initiative matures and takes on different (more ambitious) system leadership roles, and as the context and strategy changes. There are also indications that new system effect categories (e.g. market formation) may emerge as these collaborative innovation ecosystems take on new roles. Although primarily derived from Vinnväxt initiatives’ experience (representing only a minor segment of innovation ecosystems globally), these system effect categories reflect many of the same roles that clusters and other such collaborative innovation initiatives play in industrial transformation processes (European Commission 2019) and also reflect many of the areas for cluster strategy used in the European Cluster Excellence Initiative (ECEI) quality label for cluster organisations (ECEI 2013). Future research should test the definition and system effect categories with other types of innovation ecosystems and clusters, confirming the relevance of the categories, as well as exploring the different system-level contributions that are made by different types of collaborative initiatives at different phases of strategic development.

The model to capture system impact (Figure 2), definition and categories of system-level effects (Table 4) and generalisable approach to tracking system transformation (Figure 5) provide a basic conceptual frame and approach for tracking system transformation on which to build. This first attempt at tracking system-level results in Vinnväxt has demonstrated the benefits of certain programme design elements (e.g. active programme management, embedded action researchers/“followers”, strategic dialogues and other activities to facilitate reciprocal learning between policy/programme and funded initiative), and generated a participatory approach to evidencing system-level change. Whereas the stronger directionality towards societal goals and an assessment of progress are still areas where additional evidence is required, the developmental evaluation approach (helping to inform ongoing processes of transformation) outlined in this case has shown how this approach can be used as a base for further development and testing in the context of other transformative innovation programmes.

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1. Sweden’s innovation agency [↑](#footnote-ref-1)
2. See <https://www.clustercollaboration.eu/forum/covid-19-response-forum> [↑](#footnote-ref-2)
3. Funding from Vinnova is in the range of 2-8 MSEK per year over the ten-year period. [↑](#footnote-ref-3)
4. The Vinnväxt programme has had a total of six calls (with different approaches) since 2002 – resulting in six “generations” of Vinnväxt initiatives (by year of initiatives’ start date: 2003, 2004, 2006/08, 2013, 2016 and 2019). The table provides an overview of programme objectives, key characteristics, selection criteria and expected results/effects from four of the six calls – illustrating the major shifts in the programme’s development over time. Data has been collected from call texts and interviews with (previous and current) members of the Vinnväxt programme team. [↑](#footnote-ref-4)
5. Both sets of workshops took place between 2018 and 2020. The first was a series of six workshops among 27-35 individuals representing Vinnväxt initiative leaders (or managers), programme officers and action researchers (Group 1). This provided a specific applied policy and practitioner context. The second was a series of four workshops among 25-35 researchers, practitioners and policymakers from 12 countries (Group 2). This provided a broad-based, international triple helix perspective. For more information on the development of the framework, see Wise et al. 2019 [↑](#footnote-ref-5)
6. The guide (in Swedish only: ”Hur kan vi följa systemresultat? – en guide för Vinnväxt initiativ”) explains the ”why, what and how” of tracking system-level results – providing a generalised process and tips for documenting, prioritising, categorising and communicating important system-level results over time (including how to leverage actions researchers). [↑](#footnote-ref-6)
7. Each initiative selects and categorises its own strategic milestones/system-level events. There are no requirements on how many events are reported. In 2019, each initiative reported between 4-17 events (of the total of 49 events in 2018 and 103 events in 2019). [↑](#footnote-ref-7)
8. Including comprehensive “baseline information” on renewal/transformation strategies and actor constellations, as well as documentation of new project financing and important system-level events of relevance to the collaborative initiative [↑](#footnote-ref-8)
9. Of a strengthened common understanding of system-level effects, a more structured and harmonised method for evidencing system-level changes over time, a better use of data collected, and increased visibility of Vinnväxt initiatives’ contributions to broader system-level transformation. [↑](#footnote-ref-9)
10. Following context, stakeholder perspectives and progress in real time; documenting and interpreting, as well as questioning and coaching [↑](#footnote-ref-10)