

Spread and Scale in the Digital Age: A Conceptual Framework

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Abstract: Funders, policymakers, and designers are increasingly interested in spreading new instructional approaches to larger numbers of learners in school and non-school contexts. This paper presents a conceptual framework for research on spread and scale in a digital age that accounts for the interactions among environments, organizations, individuals, and educational innovations. Most existing scholarship on scale-up comes from the pre-digital age. Digital technologies often reimagine how learning occurs, requiring new capacities for adults who use them with children and new pathways for scale-up. Drawing on interviews, case studies, and a comprehensive literature review on scale in education and other fields, the framework provides guidance for designers who seek to spread and scale digital learning innovations and for researchers who seek to study these processes.

Introduction

As interest in large-scale learning innovations continues to grow, learning scientists have drawn attention to the urgent need for frameworks and theories that can help designers and other stakeholders configure conditions to support and sustain educators' equitable implementation of innovations (e.g., Penuel, 2019; Philip, Bang, & Jackson, 2018). While it is generally understood that learning at scale is multidimensional (Coburn, 2003; Morel, Coburn, Catterson, & Higgs, 2019), the field lacks conceptual tools that can help investigate the dimensions that enable or hinder the ways in which new ideas and resources are taken up in school and non-school contexts (McKenney, 2018). Further, much of the existing work on scale-up comes from the pre-digital age. Advances in digital technologies have expanded learning possibilities, and digital innovations have also expanded pathways for spread and scale. This paper presents a framework for research on spread and scale in the digital age that identifies factors that influence the processes and outcomes of scale. It accounts for interactions among individuals, organizations, environments, and innovation, and, in doing so, aims to provide conceptual tools for designers seeking to implement digital learning innovations at scale and scholars studying innovations at scale.

The problem of scale—how to move successful ideas, programs and approaches to more people and places—has challenged educational leaders, program designers, practitioners, and researchers for over three decades. While researchers have paid a great deal of attention to scale, efforts to study it have surfaced a lack of clarity around the use of the term. Conceptual ambiguity around what it means to “scale,” “scale up,” “spread,” and implement “at scale” has created difficulties in identifying appropriate research designs, distilling lessons across studies to inform future research, and developing new knowledge about strategies for effectively fostering scale (Morel et al., 2019).

Early research on scale lacked conceptual grounding, often defining scale in terms of the amount or number of users of an innovation. Educational researchers critiqued this view of scale as incomplete and offered more multidimensional conceptions (Coburn, 2003) or focused on student outcomes (McDonald, Keesler, Kauffman, & Schneider, 2006). Yet, the widespread adoption of social and digital media has created new pathways for spread and scale, warranting a conceptual reassessment of scale in education.

Much of what we know today about scale-up and its challenges comes from research and experience in the pre-digital age. New technologies have created exciting new possibilities for learning and scaling learning opportunities, but they have also introduced new actors, new social relations, and new challenges (Clarke & Dede, 2009). On the one hand, the Internet and more recently the explosion of social media have created novel ways for educators to get access to innovative approaches and new means to bring people together across time and space to support their learning. It also brings new ways of conceptualizing what it even means to be at scale, as ideas and approaches from the open source and software design communities move into the educational arena, raising questions about traditional relationships between designers and users. Yet ongoing engagement with digital technology does not always fit easily into the everyday work of front-line educators, which limits its use in supporting substantive and sustainable change. Furthermore, unequal access to wireless technologies and a lack of material and human capital to engage with these new technologies has the potential to exclude the very children that may most benefit from educational innovation. New technology, therefore, requires that we rethink the strategies we use to foster spread and scale. And, it requires us to move beyond visions of achieving scale as a

top-down, unidirectional, and transactional process to consider the ways it can be lateral, bi-directional, and interactive.

Given the rapid pace of technological change, research and writing about spread and scale has not caught up with these new realities. Even when researchers have focused on contemporary examples, they have paid only limited attention to the role that digital media might play in efforts to spread and scale. As a result, designers, educators, and educational leaders seeking to reach youth with innovative learning approaches have little research-based guidance to inform their efforts. Frameworks that can inform innovation implementation for consequential, long-term change are uncommon but urgently needed in the learning sciences (McKenney, 2018). We seek to address this need with a framework that provides research-based guidance to today's practitioners, researchers, and funders who seek to spread and scale innovative educational experiences to learners in school and out-of-school settings.

The argument underlying our conceptual framework is that appropriate and effective strategies for promoting spread and innovation depend upon: 1) how one conceptualizes scale as an outcome; 2) what is being spread; and 3) the organizational, environmental and policy contexts of the people and places one seeks to reach, and 4) a reformer's capacities, institutional home, and position in the broader environment. By identifying the range of things one might spread—and the relationships between them—we seek to bring more clarity and specificity to discussions of spread and scale. By identifying and naming the key elements of context that are consequential for spread, we seek to direct attention to the role of the environment and public policy. And, by identifying a range of strategies that address the technical, learning, cultural, and social structural dimensions of the challenge, we seek to broaden the field's understanding of the set of strategies they can marshal as they seek to spread innovative approaches to diverse settings and learners.

Methods

The framework emerged from a study funded by the John D. and Catherine T. MacArthur Foundation. Since 2006, the MacArthur Foundation, as part of its Digital Media and Learning (DML) Initiative, has invested over \$150 million dollars on development of digital media innovations. After an initial exploratory phase devoted to understanding how learning is changing as a result of digital media, the Foundation supported several innovative programs that drew on new understandings of digitally mediated learning to design model learning systems for youth in school and non-school settings. The DML initiative faced the challenge of spreading these new programs to more schools, libraries, and other youth-serving institutions in order to meet its goal of "creating, at sufficient scale, the conditions to continually test, refine, and expand the ideas, practices, and policies that emerged from Phase 1 and now constitute Connected Learning" (John D. and Catherine T. MacArthur Foundation, 2012). The Foundation leadership asked the authors to develop a framework to guide their strategic thinking about spread and scale as they moved into the next phase of their grant making.

Framework development

We developed the framework over the course of a two-year grant from the MacArthur Foundation. During the first year of the grant, the authors undertook a range of activities to develop a conceptual framework for spread and scale in the digital age. We interviewed 65 strategically identified thought-leaders, researchers, and practitioners in education, high tech, and other fields to gain their insights on the impact of digital technology on pathways for spread and scale. Although the majority of interviewees (40) were associated with DML, including project leaders and staff involved in the work on the ground, additional interviewees with expertise in spread and scale in education and who were not associated with DML were also included.

Interviews were supplemented with 16 days of consecutive observations of DML projects, events, and meetings. The authors spent most of their time learning about Quest to Learn in New York City, Hive in New York City, Chicago, Pittsburgh, and Toronto, and YOUmedia in Chicago, New York City, and the Learning Lab sites. We supplemented interviews and observations at these sites by viewing/listening to multimedia artifacts (e.g., written materials, videos, webinars, podcasts) produced by members of the DML. We visited and observed these innovative programs at various stages of spread and scale to learn about educators' experiences, strategies, and challenges. Our efforts went well beyond the kinds of digital innovations that the MacArthur Foundation funded, to investigate the role of digital media in the spread and scale of a wide range of instructional approaches, programs, and tools: digital and non-digital, school-based and non-school based; instructional approaches and whole school reform models.

Additionally, we conducted a comprehensive literature review of research on spread and scale in schools, libraries, and youth-serving organizations. Finding that the existing research on spread and scale only rarely considered the affordances and constraints of digital media, the authors also reviewed research on spread and scale in digital media environments in other fields. We also conducted a targeted review of research on social

networks, social movements, and the role of technology in organizational change. In all, 75 articles, books, and book chapters were reviewed. We also drew on other works we were familiar with from our backgrounds in new media, digital literacies, organizational change, data use, social networks, and social movements.

We drew on the interviews and the literature review to develop our conceptual framework. Once the conceptual framework began to take shape, we tested its utility by using it to think through the specific case of spread and scale in DML. This dialogue with the issues faced by the DML project helped us to revise the conceptual framework and gain better clarity about individual dimensions of the conceptual framework and the relationship between them.

Finally, we presented the framework to a gathering of foundation staff and key DML leaders. The conversation over a day and a half generated numerous insights, which we subsequently incorporated into the version of the conceptual framework presented here.

Findings

As noted previously, the argument underlying our conceptual framework is that appropriate and effective strategies for promoting spread and innovation depend upon: 1) how one conceptualizes scale as an outcome; 2) what is being spread; and 3) the organizational, environmental and policy contexts of the people and places one seeks to reach, and 4) a reformer's capacities, institutional home, and position in the broader environment.

Conceptualizing scale

The literature review indicated that there are fundamentally different ways of conceptualizing the goals or outcomes of scale. We identified two constructs: spread and scale. Spread we define as the process by which the innovation one wishes to spread reaches more people. Scale we define as the desired outcome of spread. The way in which one conceptualizes scale is important because it influences how one crafts strategies for fostering it and how one knows when it is achieved. Digital media have impacted both traditional notions of scale and introduced new ways of thinking about scale. We identified four main conceptions of scale: adoption, replication, adaptation, and reinvention. While each conception of scale emphasizes reaching increasing numbers of people, organizations or places, they have fundamentally different ideas about what it means to do so: the role of individuals and organizations as they engage with new ideas, tools or practices; how the object of spread changes or remains the same; and the ultimate outcomes, whether it be adoption, implementation, and/or innovation. We describe each conception below.

Adoption: This conception equates scale with achieving widespread use of an innovation. The exact nature of that use, however, is not articulated (e.g., Jenkins, Ford, & Green, 2013). Those holding this conception may also consider an innovation "at scale" when it has achieved a user base of a certain size (e.g., Guadagno, Rempala, Murphy, & Okdie, 2013). In education, those who conceptualize scale in this way primarily focus on the degree to which an innovation is present in a large number of schools or classrooms (e.g., Stringfield & Datnow, 1998). Despite criticisms of this approach (Coburn, 2003; McDonald et al., 2006), some affordances of this approach have also been identified. For example, social movement scholars have noted that widespread adoption can build legitimacy for new ideas and lead to changed practices and beliefs (Strang & Soule, 1998)

Replication: For this conceptualization, an innovation is considered at scale if it is widespread, implemented with fidelity, and produces specific outcomes. Proponents of this approach view student achievement as a primary goal of education and consider widespread impact as a marker of scale (e.g., Slavin & Madden, 2007). The assumption is that well-designed innovations, if implemented with fidelity, will reproduce reliable results in different settings. Replication is conceptualized in two related ways: outcomes and uses. Some view replication in terms of the production of "similarly positive effects in different settings [among] ... a greater number of students" (McDonald et al., 2006, p. 16). Others conceptualize scale as the replicated use of an innovation to reproduce particular outcomes or as the replication of capabilities required to engage in certain types of work (e.g., Peurach & Glazer, 2012). Replication as an approach to scale has become common in educational research and often guides those who view learner outcomes as an outcome of scale.

Adaptation: This conceptualization understands scale as the widespread use of an innovation that is modified according to local context needs and within the bounds of predefined "core principles" of an innovation. Scale according to this approach is "transferring and adapting [a] new set of interrelated innovations to new contexts" (Dede & Nelson, 2005, p. 111). Modifications can be appropriate or inappropriate, with appropriate adaptations adhering to a set of core principles or practices that remain unchanged. As with reformers who view scale as replication, those who understand scale as adaptation are often concerned with the achievement of expected outcomes (Dede & Nelson, 2005). However, appropriate modifications that are attuned to local needs and knowledge, which are perceived as key to an innovation's effectiveness (e.g., Means & Penuel, 2005).

Reinvention: Digital media impact not only pathways to spread and scale, but how we can conceptualize scale as an outcome. Reinvention is a conceptualization that is prominent in the digital media world and is making in-roads into education as well. This approach emphasizes that innovations catalyze further innovations (e.g., Bogers, Afuah, & Bastian, 2010). Rather than reproducing or adapting an innovation, actors recreate the innovation in their local context (“remix” it, in the language of digital media scholars) to create something new (e.g., Jenkins et al., 2013). What the innovation looks like, what it means, how it is used, what problems it solves, and what outcomes it produces is entirely dependent on creative reinvention by local actors. Although the ethos of reinvention is marked in open-source communities and the digital remix culture (e.g., Santo, 2018), reinvention is not an exclusively digital phenomenon.

This typology of scale builds on existing conceptualizations of scale in three ways. First, it suggests that there is a range of legitimate conceptualizations of scale. Second, it expands the catalogue of possible outcomes of scale. Third, it builds upon the dimensions of conceptualization articulated by Coburn (2003). Depth of implementation, sustainability, and ownership likely have continued relevance for these different conceptualizations of scale. However, what these dimensions look like will vary for each conceptualization.

What is being spread

Choosing appropriate strategies to foster spread and scale not only depends on how one conceptualizes scale; it also depends upon what one is trying to spread. In general, the spread and scale literature does not examine how the nature of what is spread impacts spread processes. We found that the nature of what is spread matters crucially to how it is spread. There are different processes and mechanisms at work for the spread for different types of things. Through our review of the literature we identified a range of things that spread (see Figure 1), including *identity* (people’s understandings of who they are, of what kind of people they are, and how they relate to others [Hogg & Abrams, 1988]), *ideas* (a governing conception or principle; a plan or design according to which something is constructed), *tools* (externalized representations of ideas used as mediating devices to shape action [Sherer & Spillane, 2011]), *work practices* (coordinated activities of individuals and groups in socially negotiated and understood ways), *products* (branded items that are meant to increase brand visibility and foster identity and affiliation), *models* (integrated systems of tools and practices in which the relationship between ideas, tools, and practices is specified to some degree), and *organizations* (groups of people who are intentionally structured to achieve a particular purpose). For example, many reformers seek to spread ideas (e.g., principles of constructivist learning). Ideas spread best when they are linked to existing values, ideas, or social trends that have salience at a given historical moment (e.g., Rao et al., 2003). Practices, on the other hand, are difficult to spread and often involve tacit forms of knowledge that can require face-to-face interaction and strong connections between people in order to spread. This suggests that it is imperative to attend to the features of what is being spread.

Contexts where spread occurs

Spread—and strategies to promote it—depends crucially on features of the contexts into which innovators are reaching. Local contexts—including individual and collective capacities, organizational conditions, and environmental and policy contexts—shape how open individuals and organizations are to new ideas, tools, and work practices. These contexts also have conditions that are more or less conducive to learning, change, and innovation. Different contexts also present varied strategic points of leverage for fostering and encouraging spread.

There is a two-way relationship between contexts and what spreads. On the one hand, local contexts influence the dynamics of spread. Simply put, organizational conditions matter for the degree to which individuals are able to engage with new tools, ideas, or practices. On the other hand, ideas, tools, practices, models, and organizations can also influence local contexts, possibly creating greater capacity or a more receptive environment. For example, new tools can foster the development of greater knowledge in a local site and new identities can create greater receptivity to new ideas and practices. In any case, however, what is spread must take account of the existing local context. We represent this relationship with a two-way arrow between contexts and what spreads (see Figure 1).

We define individual and collective capacities as the knowledge, skills, and identities of the people who mediate spread. Individual and collective *knowledge* in a local setting plays an important role in who takes up new ideas, tools, and work practices and how people engage with them in ways that facilitate or inhibit spread and innovation. *Skill* is also a key component of local capacity. In educational settings, for example, teachers and mentors need more than domain-specific knowledge, they also likely need the skill to use tools and practices to design activities for youth, maintain a safe learning environment, and differentiate students’ learning experiences. Furthermore, many tools, practices, and models implicate multiple people in a setting. For this reason, they require the collective ability to coordinate new forms of practice across multiple kids, adults, and

program leaders. Finally, *individual and collective identity* influences people's willingness to engage with new ideas, tools, and practices in the first place (Kellogg, 2011). Individual identity reflects values and practices that a single person takes on independently of others, while collective identity is an identity that is shared within a group or collectivity. For example, "I am a constructivist educator" indicates the development of an individual identity, while a faculty uniting against an overly prescriptive curriculum might assert professional autonomy as a collective identity. Like knowledge and skills, individual and collective identities both influence and are influenced by what spreads.

Organizational contexts play a key role in what and how things spread. By organizational contexts, we mean features of the home institution that influence individual and collective capacities, and the way individuals and groups engage with ideas, tools, practices, and models. Organizational context includes (but is not limited to): time, staffing, materials and technology; presence of expertise and mechanisms for accessing it; organizational norms, routines, and culture; leadership; and organization-level policy and priorities.

Individuals and organizations exist in broader environments that shape their resources, norms, leadership, learning opportunities, and priorities in profound ways. These contexts also influence what strategies are possible for reaching organizations and the people within them. There are several facets of the environment that appear to be consequential for spread, such as the availability of resources and knowledge in the environment, along with regional and national networks that provide access to it.

Finally, individuals and organizations sit within multiple and layered policy contexts that impact their work. For public schools and public libraries, the policy context typically includes the school district or central library system, the city, the state, and the federal government. Policy contexts matter because they provide (and take away) funding and other resources, apply normative pressure, create mandates, legislate work rules, shape market conditions, and set priorities that directly and indirectly affect an organization's work.

Strategies to foster spread and scale

The challenges of scale are not solely technical. The task is not simply creating the right infrastructure to get new ideas, tools, and work practices into the hands of more people, organizations, and communities. Rather, scale implicates issues of learning, culture, and social structure. We identified seven families of strategies that reformers use to address the technical, cultural, and learning dimensions of spread and scale: *communication* (using traditional and new media and rhetorical language to link ideas, tools, and practices with interests and values in a given environment), *capacity building* (developing structures to facilitate ongoing learning), *participation* (providing opportunities for people to actively engage with ideas, tools, and practices), *infrastructure development* (introducing digital and nondigital infrastructures to support spread and scale), *market development* (creating commercial networks and pathways to expand the potential market to reach more users), *policy* (using the power of policy to generate attention to an issue or approach), and *funding* (financially backing the spread of ideas, tools, models, and organizations). While this list is not all-inclusive, it illustrates a range of strategies that reformers might consider. Innovators can use some combination of these strategies to foster the spread of identities, ideas, tools, work practices, models, and organizations (as indicated by the center arrow from strategies to what spreads in Figure 1). However, they can also use these strategies to influence the multi-layered contexts that shape the work, creating more or less fertile conditions for spread and scale (indicated by the bottom left arrow). Finally, these strategies can be spread as well, as indicated by the arrow at the top of the diagram in Figure 1. This happens, for example, when reformers create professional development modules or even whole systems of professional guidance that they then seek to spread.

Who spreads

Strategies to foster spread are orchestrated by individuals and groups. These individuals and groups typically work in organizations that undertake this work either alone or in collaboration with other organizations. As King (2013) argues, "If you want to scale an idea or concept, you can't do it without an organization that is behind the work. Ideas don't enter the mainstream without an organization in place working relentlessly to implement them" (p. 5). As suggested in Figure 1, features of these organizations—the nature of the institution (whether it is a university, foundation, commercial enterprise, professional association, etc.), its capacity, the nature of external partnerships, among others—matter for the kinds of strategies available to reformers, and their ability to carry them out well.

First, the *nature of the institution* is consequential in several respects. Some types of institutions are not legally able to undertake certain strategies. For example, 501(c)(3) not-for-profit organizations are prohibited from lobbying. The institutional home also matters because the social organization of work, organizational mission, and existing work practices influence what is possible. Second, *organizational capacity* plays an important role, including the skills and knowledge of existing staff, available staffing and resources, and the

technical and human infrastructure to carry out a given strategy. Finally, *external partnerships and networks* also enable and constrain strategic choices. Organizations are rarely able to achieve spread and scale in the absence of partnerships. Furthermore, many initiatives are undertaken by a network or coalition of organizations, rather than by a single organization. The nature of these external partnerships and networks, their level of coherence, coordination, the resources, skills, and knowledge they bring to the table, and their position in relation to the targets of spread (i.e., do they create greater reach) influence the nature of strategies an individual or group of organizations can undertake as they seek to spread ideas, identities, tools, and practices.

Dynamic nature of spread and scale

It is important to note that the framework positions scale and spread as dynamic processes. Considering scale as polysemous in nature also opens the possibility that scale is dynamic. Accordingly, the relationships among and between the different dimensions of our conceptual framework likely shift considerably over time. For example, conceptions of scale may shift depending upon where an initiative is in its development. As conceptions of scale shift over time, the strategies that reformers undertake to support objectives must also shift. Existing studies do not make explicit how and why conceptualizations of scale may change, nor how research designs might capture shifts in how an innovation's path to scale is conceptualized.

Conclusions and implications

This framework aims to bring more clarity and specificity to discussions of spread and scale in our advanced digital age. Practitioners, designers, and researchers have been grappling with the challenges involved in spread and scale for quite some time. However, these discussions have been hampered by incomplete conceptualizations about what one seeks to spread toward what end. While the issue of diversity of contexts has been addressed, too often attention has been focused on individual and workplace contexts with less attention to the environment and public policy. Furthermore, discussions of strategies to foster spread and scale have been constrained. They tend to focus primarily on the technical aspects of spread while paying less attention to the diversity of human learning and development, culture, social structure, and issues of power that are pervasive across contexts (Thomas et al., 2018).

The conceptual framework we present here is meant as a starting point to begin addressing some of these issues. By creating a typology of scale conceptions, we endeavor to highlight and name the different goals that might be present in different initiatives. By identifying the key elements of context that are consequential for spread, we seek to direct attention to a larger range of contexts than are typically considered. And, by identifying key strategies that can be used to address learning, cultural, and social structural dimensions of the challenge, we seek to highlight a broad range of strategic actions that innovators can take to foster spread, build capacity, and address the organizational, environmental, and political contexts for the work.

We offer the conceptual framework as a tool to guide strategic thinking for designers and researchers. For example, an initiative could use the framework to analyze the relationship between the individual capacities and organizational conditions necessary for spread, on the one hand, and the current knowledge and conditions in locales one seeks to reach, on the other. This could then inform efforts to develop strategies to adequately address those conditions. Researchers might use the framework to identify key dimensions of the problem of scale to target for inquiry. For example, there is limited research on the conditions that support innovation in schools and informal learning settings, particularly conditions that foreground human diversity. There is also little research that investigates when and under what conditions different conceptualizations of scale are appropriate and effective.

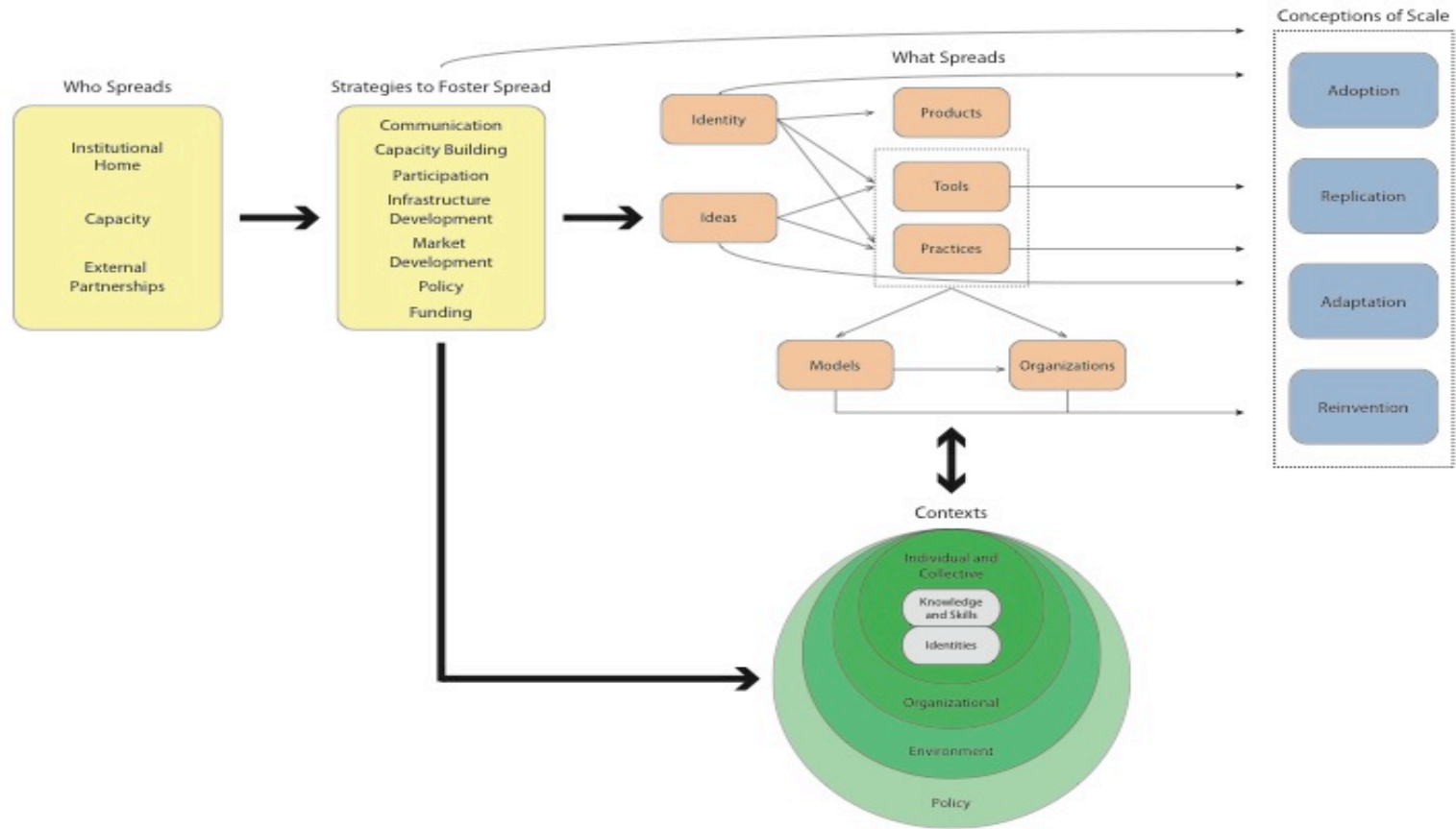


Figure 1: A framework of the dynamic processes of spread and scale.

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