



Title: *T-shaped people for addressing the global challenge of sustainability*

Track: *Service science projects in research and/or education*

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T-SHAPED PEOPLE FOR ADDRESSING THE GLOBAL CHALLENGE OF SUSTAINABILITY

<Service science projects in research and/or education>

ABSTRACT

Purpose – Poverty, hunger, inequalities, diseases, unsustainable use of resources, etc., in spite of advances of the last decades, still result unsolved worldwide issues. All relate to the challenges of sustainability and sustainable development that now call for urgent answers.

Education is one of the key drivers of a really transformative change. To address this change, however, a profound re-thinking of education programs is required, as has emerged at the end of the UNESCO's Decade of Education for Sustainable Development.

The purpose of this paper is to explore how the scientific community of the Naples Forum on Service responds to this call.

Design/Methodology/approach – By adopting a “3Pillars-Based” integrated perspective, key assumptions and findings from the three scientific communities of the Forum are identified to find foundational elements of a lifelong education process, targeted to address the multiple challenges of sustainability and sustainable development.

Findings – Through the interpretative lens of the Viable Systems Approach, convergence between the three scientific proposals of Network and Systems Theory, Service-Dominant logic and Service Science, relevant to the building of a common framework for re-thinking education, are discussed.

Findings indicate the skills with which decision makers must be endowed to face the challenges of transformative change toward sustainability and sustainable development. Boundary crossing and systems thinking capabilities are specifically identified as key skills to be developed. These findings suggest the opportunity to consider the “T-Shape” model as a general reference for re-thinking education methodologies and programs, as it implies an effective integration of soft and hard skills.

A trans-disciplinary systems thinking based body of theoretical and practical knowledge is required as fostered by Sustainability Science. Education of T-shaped People may be a solution.

Research implications - An integrated effort of scientific communities engaged in research that can contribute to the global call for a more sustainable and inclusive world, is essential.

Practical implications – Trans-disciplinarity implies the involvement of people from the business and social real world in the education process, to test and put in practice advances by adopting real problem solving approach.

Originality/value – This paper represents a call for engaging the Naples Forum on Service scientific and professional communities in worldwide collaboration to contribute to address the global challenge of a more sustainable and inclusive world by leveraging on education.

Keywords – T-shaped Professionals, Sustainability Science, Education for Sustainable Development, Systems thinking, Viable Systems Approach

Paper type – Conceptual paper

1. Introduction: the need for a cultural change

Many humanity issues, such as poverty, hunger, disease, inequality, etc. affect populations and society all over the world and call for urgent answers. Governments, at international and national level, are debating intensively with the scientific, social and business communities, to find solutions that could lead to the creation of conditions of wellbeing for all populations.

All these issues, in different ways, show the incapability of current models to effectively address sustainable development, social progress and economic growth for all. Thus, many of the changes required imply a deep rethinking of dominant schemes that must involve governments, businesses and the civil society. What is required is essentially a cultural change; a cultural change toward more sustainable development models. Cultural changes, however, do not follow linear and deterministic logics and do not produce effects in the short term as they generally emerge gradually as outcomes of multiple and overlapping trends (Castells, 2011).

One of the best leverages for achieving a really transformative change capable of acting at cultural level is education. The most active international and national governmental institutions are engaged in promoting sustainable development in its various forms and dimensions, by significantly acting upon culture, science and education. The leading international institution for culture, science and education – UNESCO – ten years ago, launched the Decade of Education for Sustainable Development, a long term initiative calling for a global action of education for sustainable development through formal, non formal and informal methods (UNESCO, 2014c). At the end of the Decade, many successes have been achieved but there still remains much work to do and a need for a change in the approaches to promote SD emerges indicating the new requirements for education for sustainable development.

In this context, the purpose of this paper is to explore how the scientific community of the Naples Forum on Service can join the global call for promoting sustainable development. The Naples Forum on Service is a meeting of scholars, researchers, professionals and practitioners from all over the world who share the goal of co-creating knowledge in our new service based society. Beyond the scope of the specific interests of the respective research fields, the three scientific communities involved in the Forum – represented by the 3 Pillars of *Network and Systems Theory*, *Service-Dominant logic* and *Service Science* – are sharing an innovative view of service and systems, which, in our perspective, can contribute to foster a paradigmatic change in the current business and development models as it focuses on key processes for SD, such as resource integration and value co-creation. These processes emphasize the relevance of knowledge and subsequently of education, in emerging social and business models.

By adopting a “3Pillars-Based” integrated perspective, through the interpretative lens of the *Viable Systems Approach* (Golinelli, 2010; Barile, 2013; Barile *et al.*, 2012a), we investigate the potential cultural, scientific and educational contribution of the three communities of the Forum to addressing the challenge of sustainability.

Outside the scientific context of the Forum an emerging research community is striving to develop a science of sustainability – *Sustainability Science* (Christen & Schmidt, 2012; Wiek *et al.*, 2012a, 2012b; Miller *et al.*, 2014) –, as an inter- and trans-disciplinary body of theoretical and practical knowledge required for progressing toward sustainable development (Becker, Jahn, Stiens, 1999). Within the scientific context of the Forum, a well established research community is progressing toward the development of a science of service systems – *Service Science* (Spohrer *et al.*, 2007; Maglio & Spohrer, 2008; Spohrer & Murphy, 2013) –, as a growing multi-disciplinary research and academic effort that integrates aspects of established fields of knowledge on service and service systems (Lobler, 2011). Within the research field of Service Science, debate is gaining attention both at academic and professional level, relative to a re-thinking the education programs of future managers to enable them to face the challenges of the new socio-economic scenario (Senge & Serman, 1992; Hekkert *et al.*, 2001). This debate has led to the definition of the profile of future decision makers as “T-Shaped” professionals, developed within the scientific communities of

Service Science (Schneider & Bowen, 2009; Spohrer, Gregory, Ren, 2010; Spohrer & Freund, 2014) on the basis of the seminal works of Leonard-Barton (1995). T-Shaped professionals combine a deep vertical expertise in one or more disciplines or systems and horizontal capabilities of crossing boundaries between disciplines and systems effectively facing various and emerging problematic contexts.

Sustainability Science, on the one hand, and Service Science, on the other hand, appear to have several elements of convergence both methodologically and theoretically, as inter and trans-disciplinary sciences, and practically oriented to promoting widespread wellbeing through innovation. Thus, we explore the further potential of this convergence by investigating, through the notion of “T-Shaped” professionals, the education requirements of decision makers needed to face the challenges of sustainable development.

The paper is organized as follows: we first analyse current trends and global orientations toward sustainability and sustainable development; then, we explore the contribution from the scientific communities of the Naples Forum on Service developing a 3Pillars-based interpretative framework to integrate knowledge for progressing toward sustainability; subsequently, we deepen the role of education as a lever to address the challenge of sustainability. Finally, we develop a T-Shaped skills profile of people capable of addressing sustainability and discuss some managerial and research implications.

2. The global challenge of sustainability and sustainable development

Since the conclusion of the meeting of the Brundtland Commission (World Commission on Environment and Development, 1985) the concept of sustainability has gained growing attention becoming the focus of a multi- and trans-disciplinary international debate (Komiya & Takeuchi, 2006). The interest in sustainability has progressively involved various scientific domains, going beyond the initially prevailing environmental perspective and including in particular social and economic perspectives.

There are currently different views of sustainability and vagueness about the definition of the term (WCED, 1987: 43; Pearce, Markandya, Barbier, 1989: 1; Burger, 2006; Dobson, 1996: 402). A basic distinction is that between strong and weak sustainability: “Loosely speaking, strong sustainability argues that we must live within the environmental and ecological limits that the planet clearly has. Weak sustainability argues that humanity will replace the natural capital we have, use and depend on, with human-made capital. Theorists virtually agree unanimously, that the latter has formed the conceptual basis for sustainable development. The all-pervasive nature of neo-classical economics has also come to permeate throughout thinking on sustainable development, with broad acceptance that intra-generational and inter-generational equity can only be achieved within the confines of economic growth” (Scottish Executive Social Research, 2006: 2).

A first attempt to develop an integrated sustainability framework – and perhaps also the most popular – is the *Triple Bottom Line*, a model formalized by Elkington in 1998. This model highlights the relevance of combining three dimensions – economy, environment, and society – to define development strategies able to meet the challenges of sustainability. Such strategies require a great effort of interdisciplinary collaboration. In effect, “to achieve outstanding triple bottom line performance, new types of economic, social, and environmental partnerships are needed. Long-standing enemies must shift from mutual subversion to new forms of symbiosis. The resulting partnerships will help each partner perform traditional tasks more efficiently, while providing a platform from which to reach towards goals that none of the partners could hope to achieve on their own. Effective, long-term partnerships will be crucial during the sustainability transition. Some will be between the public and private sectors, some between companies, and some between companies and groups campaigning for a broad range of triple bottom line objectives” (Elkington, 1998: 37).

The necessity of a global engagement in facing the main issues related to sustainable development has led policy makers to promote initiatives at international level to involve local governments,

scientific communities, the business world and the civil society in a collaborative effort to define a common governance approach and to develop models and tools progressing together along the pathway toward a more sustainable world (Sempels & Felix, 2009) (Table 1).

Table 1: Some milestones in the definition of the approach to sustainability

1972	Stockholm (Sweden) <i>United Nations Conference on the Human Environment</i>	<p>“The United Nations Conference on the Human Environment, having met at Stockholm from 5 to 16 June 1972, having considered the need for a common outlook and for common principles to inspire and guide the peoples of the world in the preservation and enhancement of the human environment”.</p> <p>http://www.unep.org/Documents.Multilingual/Default.asp?documentid=97&articleid=1503</p>
1980	<i>World Conservation Strategy</i>	<p>“The aim of the World Conservation Strategy is to help advance the achievement of sustainable development through the conservation of living resources. The Strategy:</p> <ol style="list-style-type: none"> 1. explains the contribution of living resource conservation to human survival and to sustainable development; 2. identifies the priority conservation issues and the main requirements for dealing with them; 3. proposes effective ways for achieving the Strategy’s aim. <p>The Strategy is intended to stimulate a more focussed approach to living resource conservation and to provide policy guidance on how this can be carried out. It concentrates on the main problems directly affecting the achievement of conservation’s objectives; and on how to deal with them through conservation. In particular, the Strategy identifies the action needed both to improve conservation efficiency and to integrate conservation and development”.</p> <p>https://portals.iucn.org/library/efiles/documents/WCS-004.pdf</p>
1983	The World Commission on Environment and Development is established.	
1992	Rio De Janeiro (Brazil) <i>United Nations Conference on Environment and Development (Earth Summit)</i>	<p>“The Earth Summit produced 27 principles—the ‘Rio Declaration’—on new and equitable partnerships and development through cooperation among States, social sectors and individuals. They reflect human beings’ responsibility for sustainable development; the right of States to use their own resources for their environmental and development policies; and the need for State cooperation in poverty eradication and environmental protection. The idea is that States must act in a spirit of global partnership to conserve, protect and restore the integrity of the Earth’s ecosystem”.</p> <p>http://www.un.org/en/events/pastevents/UNCED_1992.shtml</p>
1996	Istanbul (Turkey) <i>United Nations Conference on Human Settlements (Habitat II)</i>	<p>“The purpose of the second United Nations Conference on Human Settlements (Habitat II) is to address two themes of equal global importance: "Adequate shelter for all" and "Sustainable human settlements development in an urbanizing world". Human beings are at the centre of concerns for sustainable development, including adequate shelter for all and sustainable human settlements, and they are ennamed to a healthy and productive life in harmony with nature”.</p> <p>http://www.un.org/en/development/devagenda/habitat.shtml</p>
1997	<i>Treaty of Amsterdam</i>	<p>“The Treaty of Amsterdam (1997) was the third major amendment to the arrangements made under the Treaty of Rome (1957). It was largely an exercise in tying up the loose ends left over from the Maastricht Treaty (1992). However, in the ways in which it changed the operation of the Council of the European Union, absorbed the Schengen Convention and increased the role of the EU in home affairs, it pushed forward the model of a supranational European Union at the expense of intergovernmental co-operation”.</p> <p>http://www.civitas.org.uk/eufacts/FSTREAT/TR4.php</p>
2001	<i>VI Environmental Action Plan 2002/2010 EU “Environment 2010:</i>	<p>“The European Union (EU) defines the priorities and objectives of European environment policy up to 2010 and beyond and describes the measures to be taken to help implement its sustainable development strategy”.</p>

<i>Our Future, Our Choice</i>	http://europa.eu/legislation_summaries/agriculture/environment/128027_en.htm
<i>European Union Strategy for Sustainable Development</i>	<p>“The European Union has formulated a long-term strategy to dovetail the policies for economically, socially and environmentally sustainable development, its goal being sustainable improvement of the well-being and standard of living of current and future generations.”</p> <p>http://europa.eu/legislation_summaries/environment/sustainable_development/128117_en.htm</p>
<p>2002 Johannesburg <i>World Summit on Sustainable Development</i></p>	<p>“The overriding theme of the Summit was to promote action and major progress was made in Johannesburg to address some of the most pressing concerns of poverty and the environment. Commitments were made to increase access to clean water and proper sanitation, to increase access to energy services, to improve health conditions and agriculture, particularly in drylands, and to better protect the world’s biodiversity and ecosystems.</p> <p>The major outcome document, the Plan of Implementation, contains targets and timetables to spur action on a wide range of issues, including halving the proportion of people who lack access to clean water or proper sanitation by 2015, to restoring depleted fisheries to the preserving biodiversity by 2015, and phasing out of toxic chemicals by 2005. In addition, for the first time countries adopted commitments toward increasing the use of renewable energy “with a sense of urgency””.</p> <p>http://www.un.org/events/wssd/pressreleases/finalrelease.pdf</p>
<p>2006 Brussels <i>EU Sustainable Development Strategy (SDS)</i></p>	<p>“The European Council of June 2006 adopted an ambitious and comprehensive renewed SDS for an enlarged EU. It builds on the Gothenburg strategy of 2001 and is the result of an extensive review process that started in 2004.</p> <p>The renewed EU SDS sets out a single, coherent strategy on how the EU will more effectively live up to its long-standing commitment to meet the challenges of sustainable development. It recognises the need to gradually change our current unsustainable consumption and production patterns and move towards a better integrated approach to policy-making. It reaffirms the need for global solidarity and recognises the importance of strengthening our work with partners outside the EU, including those rapidly developing countries which will have a significant impact on global sustainable development”.</p> <p>http://ec.europa.eu/environment/eussd/</p>
<p>2012 Rio de Janeiro <i>Conference on Sustainable Development</i></p>	<p>“In Rio, Member States decided to launch a process to develop a set of Sustainable Development Goals (SDGs), which will build upon the Millennium Development Goals and converge with the post 2015 development agenda.</p> <p>The Conference also adopted ground-breaking guidelines on green economy policies”.</p> <p>https://sustainabledevelopment.un.org/rio20</p>
<p>2015</p>	<p>The <i>Sustainable Development Goals (SDGs)</i> proposal from the UN Open Working Group are under discussion for the definition of a post-2015 SD agenda.</p>

This intricate pathway had led to recognizing the need for integrating multiple and often overlapping efforts at a global level. The current discussion of the new set of Sustainable Development Goals (SDGs) for the next global agenda, defined by the Open Working Group of the United Nations through a participatory process and presented during the UN General Assembly on Sustainable Development on the 19th of July in 2014, moves from the premise of integrating the Millennium Development Goals (MDGs) framework. This proposal puts sustainability and sustainable development at the centre of the future global agenda.

Promoted since the Conference on Sustainable Development known as Rio+20, this participatory process has involved policy makers, universities and research centres, the business world and the

civil society, in a shared reflection about the achievements of the MDGs global program and the requirements of the new agenda. Necessarily, negotiations will have to converge toward a common framework in which the MDGs will be finally replaced by the new SDGs (Sachs, 2012). During the course of this huge effort, many targets have been satisfactorily met, while several others have been less successful (Botti et al., 2014). Thus, many big challenges are still unfulfilled and education appears as a possible leverage to act upon (Sala, Farioli, Zamagni, 2013).

3. A 3Pillars-Based interpretative framework for progressing toward SD

What has emerged so far from the scenario outlined above highlights the key issues that require addressing in order to put in place the changes necessary to advance the SD agenda (UNESCO, 2005, 2014a, 2014b). As more research, innovation, monitoring and evaluation are required, the key resource is knowledge and the key processes knowledge creation and education. Hence, our focus is on these two fundamental processes for promoting and achieving the cultural change necessary for SD.

SD is a common target for many disciplines. The mission of the emerging Sustainability Science is precisely to develop a unitary body of knowledge that can be shared and disseminated among the actors involved in achieving sustainability (governments, business decision makers, civil society organizations, individuals, etc.). The development of such knowledge, however, requires engaging scientists and professionals from different disciplinary and professional fields in a participatory process.

With respect to the principles, logics and approaches characterizing this participatory process, the three scientific frameworks present both elements of convergence and differences. On the one hand, the three Pillars of the Forum are all engaged in advancing knowledge for managing, realizing and innovating service systems processes that significantly impact on socio-economic processes of development, hence on sustainability. They are widely recognized to converge toward common visions and purposes (Barile, Spohrer, Polese, 2010; Gummesson, Mele, Polese, 2012). Substantially, they are all, in different ways, committed to realizing a “triple-loop learning framework” (Spohrer *et al.*, 2007: 15):

- *Efficiency*: “Things are done in the right way”
- *Effectiveness*: “The right things get done”
- *Sustainability*: “The right relationships exist with other service systems”

On the other hand, the three communities focus on different aspects of service systems that range from the structural configuration and dynamics of their functioning. The key for co-creation of new knowledge is precisely in this diversity, however, as it is a source of variety and opportunities to explore and exploit (Harrison & Klein, 2007; Barile, 2009b; Calabrese, Iandolo, Bilotta, 2011; Polese, Pels, Brodie, 2011; Barile *et al.*, 2012c).

Thus, each of the three communities can offer a contribution adding value to the building of a common framework for ESD. In particular:

- The *Service-Dominant logic* community provides the basic logic for integrating and co-creating knowledge resources in the multi-disciplinary and multi-professional context of ESD (Vargo & Lusch, 2006; Lusch, Vargo, Wessels, 2008; Vargo, Maglio, Akaka, 2008; Vargo & Akaka, 2012).
- The *Network & Systems Theory* community, and particularly the *Relationship* and the *Viable Systems Approaches*, can contribute to the structuring, organization and management of knowledge co-creation systems, developing models for effectively combining and managing variety in the context of ESD (Gummesson 2002; 2008, 2009; Barile, 2009; Barile & Polese, 2009, 2010; Hofacker & Pagani, 2009; Golinelli, 2010).
- The *Service Science* community can contribute to the scientific, professional and business context through which the challenge of sustainability can more easily reach the world of

organizations engaged in the production processes of solutions for satisfying socio-economic needs (Spohrer *et al.*, 2007; Spohrer, Gregory, Ren, 2010; Demirkan, Spohrer, Krishna, 2011; Edvardsson, Skalen, Tronvoll, 2011; Spohrer & Murphy, 2013).

To effectively lead the process of resource integration for co-creating SD-based knowledge, the intriguing notion of service as the application of one entity's knowledge for the benefit of other entities, which is shared by the three Forum's communities, becomes a powerful tool. In fact, under S-D logic: "An interesting development arising out of service science, management, and engineering is a broadened and more sophisticated view of service—one that moves beyond merely viewing services as a residual to the extractive and manufacturing industries. More broadly and abstractly, service is being viewed as the process of doing something for another person (or entity) that is beneficial. Think of it as the act of helping another. Services (plural) often refer to intangible units of output that a firm produces" (Lusch & Wu, 2012: 2). All service processes are characterized "by dialogue, continuous interactions, and updating" and "relationships among active participants in service systems are fundamental to sustainable development; hence, all interacting systems should rely on their own environments to provide services." (Pels *et al.*, 2013: 13).

This service concept, from a vSA perspective, can even be generalized and expanded from the business context to a wider context of collaborative knowledge exchange and becomes a useful reference for managing boundary-crossing processes in multi-actor, multi-disciplinary and also multi-stakeholder contexts (Sempels & Hoffmann, 2011; Spohrer, Piciocchi, Bassano, 2011; Sebhatu, Enquist, Johnson, 2013).

Such collaborative interaction, however, does not emerge easily, as it implies dealing with the boundaries that generally divide knowledge domains developed with a vertical specialization approach. In fact, "efficiency concerns tend to push service systems towards over specialization, while sustainability concerns tend to push service systems towards diversification and general competences" (Spohrer *et al.*, 2007: 15). This divide can determine a structural closure to interaction and so, generates cognitive distances. As shown by network research, "the degree of structural closure in a network, defined as the extent to which an actor's network contacts are connected to one another, has important implications for generating novel ideas and exercising social influence. A high degree of structural closure creates a cohesive network of tightly linked social actors, and a low degree of structural closure creates a network with "structural holes" and brokerage potential" (Battilana & Casciaro, 2012: 382). Rooted dominant schemes dramatically influence cross-boundary interaction as they significantly affect the process of interpretation of reality. "In an interdependent, specialized economy, every person uses and provides service. Therefore an individual needs to be able to develop talents that encapsulate knowledge and skills that they can then exchange in a market economy for the things they need for their survival and well-being" (Lusch & Wu, 2012: 5). With respect to the knowledge co-creation process, it is interesting to note that different minded actors "create a representation of something (object, idea, concept, etc.) or someone (individual, group, etc.) to construct a cognitive framework for their interpretation of reality. [...] However, an individual's thoughts do not form in isolation, but rather are based on collectively shared images of objects. Thus, the social representation is built on the common understanding of an object, idea, or concept" (Marchington, Rubery, Grimshaw, 2011: 106-107).

This shift of focus on the collective dimension of the cognitive process, leads to addressing attention to the dynamics of *interaction* between networked actors through which the cognitive process occurs. Specifically, a three level set of requirements emerges when different minded and skilled people are expected to collaborate in a participatory process:

1. *Efficiency of information flows through communication*: a preliminary problem is to create the conditions for multiple actors from different disciplinary and professional domains to effectively exchange information and communicate in the knowledge co-creation network.
2. *Adequateness of reciprocal understanding*: then, it is necessary to understand what relational

conditions will allow people to be able to effectively co-create new knowledge in a multi- and trans-disciplinary setting.

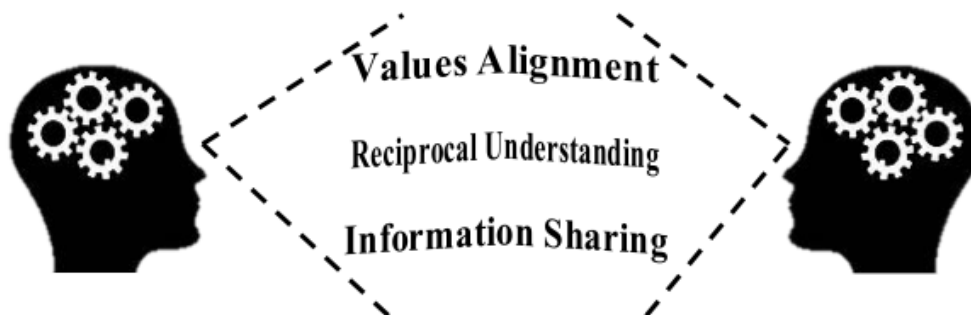
3. *Effectiveness of the expected outcome*: finally, the contents of the expected outcome must be defined, that is the knowledge and skills decision makers and professionals must be endowed with to be capable of leading and realizing the paradigmatic change toward SD.

According to the *vSA*, these requirements generate problems that can affect the effectiveness of the expected participatory process depending on the existence of conditions of *consonance* between the interacting actors (Barile, Spohrer, Polese, 2010; Barile & Saviano, 2011; Mele & Polese, 2011; Nordin, Ravald, Servadio, 2013). To assess the degree of consonance, the *vSA* uses the *Information variety Model*, which represents a system (an individual as well as an organization) from a knowledge and cognition perspective, as made of *information units*, *interpretation schemes* and *categorical values*. These three dimensions dynamically evolve during the cognitive process (Barile, 2009a, 2011; Barile *et al.*, 2013).

Thanks to this model, it is possible to investigate how the interaction among different actors involved in a relational network can ‘evolve’ in an alignment of perspectives, aims, and approaches as it is expected to *embed* sustainability in socio-economic as well as in education processes. Specifically, the *vSA* propose a three-level analysis (Fig. 1):

- *Information sharing*, which implies sharing information in an open collaborative environment overcoming the typical asymmetry that characterizes multi-actor cognitive processes.
- *Reciprocal understanding*, which implies complementary or at least non-conflicting interpretation schemes as they derive from the rooted knowledge endowment of each interacting actor.
- *Values alignment*, which implies that the interacting actors share the same values and visions of life.

Figure 1: A three-level model for analysing consonance among interacting actors



Source: www.asvsa.org

This alignment is fundamental to allow effective interaction and knowledge co-creation in a collaborative network. The three dimensions, however, impact differently on interaction effectiveness: information sharing depends on communication ; the interpretation schemes impact on reciprocal understanding; categorical values impact on values alignment and are the most relevant factor in determining the conditions and the outcome of interaction.

In this view, SD can become a common target if actors share a common vision about future desired scenarios (Fahey & Randall, 1998).

Our interpretative approach indicates the logics and criteria for creating the conditions of effective interaction. Such conditions are necessary for the building of a shared framework for re-thinking

and promoting ESD among the different scientific domains currently or potentially involved in the progress toward sustainability.

Thus, Sustainable Development can become a shared goal for the three Pillars of the Forum and *Education for Sustainable Development* a shared strategy, as symbolically represented in Fig 2.

Figure 2: SD in the scientific context of Naples Forum on Service



Source: Elaboration on the logo of the Naples Forum on Service, <http://www.naplesforumonservice.it/public/index.php>

Believing that this goal is within our reach and most likely will stimulate responses from the three communities, in the final step of our interpretative pathway, we will focus on the role of education as a lever for sustainable development by analyzing what emerges from the UNESCO program of education for sustainable development, in terms of knowledge and skills training requirements for people to face the challenges of sustainable development over the next decades.

4. Education as an enabler for sustainable development

The role of education in the pathway along the transition toward a more sustainable world has been widely recognized as capable of promoting a really transformative change (Fullan, 1993; Leithwood, Jantzi, Steinbach, 1999; King, 2002; Kemp, Loorbach, Rotmans, 2007; McNamara, 2010). For a broader picture of the current approaches to Education for Sustainable Development (ESD), reference is fundamental to the work of UNESCO as one of the leading actors in the global process of cultural change in favour of widespread shared orientation toward sustainability. One of the most relevant initiatives in the field of education for sustainable development promoted by UNESCO is the *United Nations Decade of Education for Sustainable Development* (2005-2014) (DESD), through which UNESCO “aims at integrating the principles and practices of sustainable development into all aspects of education and learning, to encourage changes in knowledge, values and attitudes with the vision of enabling a more sustainable and just society for all. The mandate of

the DESD has energized a vast number of stakeholders – across Member States, UN agencies, the education sector, the private sector and civil society – to work in partnership to reorient education systems towards sustainable development” (Buckler & Creech, 2014: 9).

ESD has been presented not as a particular programme or project, but as an “umbrella for many forms of education that already exist, and new ones that remain to be created. ESD promotes efforts to rethink educational programmes and systems (both methods and contents) that currently support unsustainable societies. ESD affects all components of education: legislation, policy, finance, curriculum development, instruction, learning, assessment, etc.” (www.unesco.org).

At the end of the Decade, ten key findings and trends have emerged that provide directions for future efforts, as summarized in Table 2.

Table 2: Key findings and trends of Education for Sustainable Development	
ESD, an enabler for sustainable development	ESD is galvanizing pedagogical innovation
1. Education systems are addressing sustainability issues	6. Whole-institution approaches help practise ESD
2. Sustainable development agendas and education agendas are converging	7. ESD facilitates interactive, learner-driven pedagogies
Importance of stakeholder engagement for ESD	ESD has spread across all levels and areas of education
3. Political leadership has proven instrumental	8. ESD is being integrated into formal education
4. Multi-stakeholder partnerships are particularly effective	9. Non-formal and informal ESD is increasing
5. Local commitments are growing	10. Technical and vocational education and training advances sustainable development

Source: Adapted from Buckler & Creech, 2014: 9.

Several successes have been achieved during the decade; however, Member States and other stakeholders involved in the process have indicated relevant challenges that remain open (Buckler & Creech, 2014: 10)

- *the need for further alignment of education and sustainable development sectors;*
- *the need for more work towards institutionalizing ESD to ensure strong political support for implementing ESD on a systemic level;*
- *and finally, the need for more research, innovation, monitoring and evaluation to develop and prove the effectiveness of ESD good practices.*

Thus, to realize the full potential of ESD, commitment should remain high and ESD should be put at the core of a shared challenge for a transition in education, teaching, learning and professional development towards more holistic, integrative and critical ways of tackling sustainability issues (Wiek *et al.*, 2012b).

This continuing global engagement should consider carefully the final report of the Decade that indicates that: “*Sustainable development cannot be achieved by political agreements, financial incentives or technological solutions alone. Sustainable development requires changes in the way we think and act.*” (UNESCO, 2013: 4). This means that technological advances, legislation and policy frameworks are not enough as they merely create the conditions for change. These conditions facilitate and encourage fundamental changes involving mind-sets, values and lifestyles. In this respect, education should strengthen people’s capabilities to bring about change.

This is actually the main challenge of ESD, but such changes are very difficult to address. Expectations embedded in ESD are recognized by UNESCO itself as particularly complex and require a huge effort from educational institutions to respond to them by rethinking consolidated approaches to education, to assure understanding and acceptance of sustainable practises and models at all levels (Rust, O’Donovan, Price, 2005; Lambrechts *et al.*, 2013).

A key aspect in the approach to education is to implement a *multiple-perspective approach*, which “promotes interdisciplinary and intercultural competencies as it addresses challenges to local or planetary sustainability. Interdisciplinary thinking, in which concepts and knowledge from different academic traditions are used to analyse situations or solve problems and allows students to use knowledge in new and creative ways.” (UNESCO Education Sector, 2012: 5)

Thus, the key of an effective approach to SD, and subsequently also to ESD, is in *interdisciplinary thinking* which implies the integration and exchange of knowledge resources from the various disciplinary domains that are involved in a scientific study of sustainability and sustainable development (McKeown *et al.*, 2002; Barth *et al.*, 2007; Cosimato, Troisi, 2014).

While, agreeing on the necessity of interdisciplinary thinking, it has also been highlighted that education for sustainability cannot be approached without a *systems thinking* mindset because it requires a “systemic change in thinking and practice, [...] essentially a new paradigm emerging around the poles of holism, systemic thinking, sustainability, and complexity” (Sterling, 2001: 2). A bottom-up approach is then also required “to develop systems education that will be of value to different types of students across conceptual boundaries (cultural, political and professional) and spatial boundaries, organisational, community, regional, international)” (Bosch *et al.*, 2010: 2).

Clearly, the core elements of an ESD agenda are essentially related to methodological issues that deal with *interdisciplinarity*, the subsequent *multi-perspective* approach and ulterior *multi-stakeholder* involvement, which also leads to *transdisciplinarity* as engagement must be extended to professionals and organizations from the business world and civil society for really global and multi-level participation in the process. All these methodological requirements should be adequately considered and included in an effective ESD framework.

At a more practical level, instead, there are several priority areas for improvement in an effective approach to EDS, These areas indicate fundamental tasks to accomplish at international and national level, as shown in Table 3.

Table 3: Some priority areas to improve the approach to Education for Sustainable Development

PRIORITY AREAS OF ACTION	TASKS
A. Clarify and communicable the concept and the key messages of education for sustainable development	A1. Implement chapter 36 and the CSD work programme as part if integrated follow-up to major UN conferences and conventions
	A2. Continue to clarify and communicate concept and key message, with emphasis on regional and national levels
B. Review national education policies and reorient frontal education systems	B1. Develop policies and strategies for reorienting forma education towards sustainable development
	B2. Include sustainable development objective in curricula
	B3. Develop guidelines for the reorientation of teacher training
	B4. Reorient teacher training
	B5. Introduce an interdisciplinary approach in teaching and research
	B6. Give due consideration to how the reform of higher education may support sustainable development
C. Incorporate education into national strategies and action plans for sustainable development	C1. Make education and public awareness significant competence in regional, national and local strategies and action plans for sustainable development
	C2. Complete the survey of existing regional and national strategies and action plans
	C3. Integrate at levels into national and local strategies
	C4. Integrate the aspect of gender balance and empowerment of woman into national education strategies
D. Educate to promote sustainable consumption and	D1. Raise awareness of relation to sustainability of current patterns of current patients of consumption and production: use educational tools and consumer

production patterns in all countries	feedback for policy-making; develop and promote social instruments; continue to work on indicators
	D2. Collect best practices in media and advertising
	D3. Report to the Commission at its seventh session on progress made
E. Promote investments in education	E1. Consider current levels of financing in education from the perspective of sustainable development
F. Identify and share innovative practices	F1. Continue work in international electronic registry
	F2. Develop and strengthen international and regional alliance, associations, networks among educational and training institutions and professional bodies
	F3. Strengthen networks and partnerships
	F4. Recognize and use traditional knowledge
G. Raise public awareness	G1. Develop capacities for raising public awareness and access to information
	G2. Undertake information campaigns
	G3. Take into account relevant international conventions

Source: Tilbury, 2002: 16

On the basis of these methodological and practical indications that emerge from the long pathway of experiences and studies addressed to defining the most appropriate approaches to ESD, in next section we explore the potential contribution to the global agenda for SD from “Pillars” of scientific and professional communities representing the three Pillars of the Naples Forum on Service. with the aim of finding unexplored convergences and opportunities for integrating the research effort in order to co-create knowledge for advancing the SD global agenda. To this aim, we deepen the role of education for sustainable development by building upon the notion of “T-shaped” professionals (Spohrer & Freund, 2014; Spohrer & Gardner, 2014), which is focused on education issues and already benefits from the integration of the three Pillars perspectives (Barile *et al.*, 2012b; Barile & Saviano, 2013; Barile Saviano, Polese, 2014).

5. Toward a model of “T-Shaped” people educated for addressing Sustainable Development

The illustrated evidence from the UNESCO DESD as well as from other studies on education (Krajnc & Glavič, 2005; Gough & Scott, 2008) provide useful indications of the skills with which decision makers must be endowed to be capable to face the challenges of a transformative change toward sustainability and sustainable development (Sternberg, 1994; Frey & Iraldo, 2008; Ostrom, 2009; Wiek *et al.*, 2012b).

In section 3 and 4, we highlighted the targets, the methodological and practical requirements, and the conditions for implementing an effective program of ESD.

Key elements have emerged that put at the core the inter- and trans-disciplinarity and the subsequent need for crossing disciplines, sectors, and systems, for first dynamically developing (knowledge creation) and then transferring (education) knowledge useful to implement and promote SD.

Given that a huge amount of specialized knowledge is currently available from the various disciplinary fields interested in SD, such as ecology, economics, social sciences, but also engineering, computer sciences, legal sciences, the problem is to link these disciplines within a coherent whole making them useful for realizing and promoting SD. In actual fact, specialization and technological progress have produced a class of highly skilled managers who appear increasingly incapable of facing certain decision making especially when dealing with complex issues (Aguari & Di Nauta, 2011). Hence, although other reasons may explain this situation

(Barile, 2009b), there may be, however, a lack of skills necessary to face such complex decision making conditions.

What are then the skills necessary to address SD? How can they be developed?

Based on long-term experience in ESD, the ESD Decade, in its Final Report, clearly indicates these skills as “critical thinking, understanding complex systems, imagining future scenarios, and making decisions in a participatory and collaborative way” (UNESCO, 2013: 5). In fact, sustainability and sustainable development must typically deal with complex problems that continuously challenge decision making at all levels of society, economy and environment processes. Achieving SD through a global engagement around a set of SDGs ranging from “End poverty”, to “End hunger”, “Ensure healthy lives”, “Achieve gender equality”, (<https://sustainabledevelopment.un.org/sdgsproposal>) has been is one of the priorities faced by decision makers in recent decades.

Actually, to be capable of addressing a wide range of goals and targets of SD, an appropriate knowledge endowment is required which spans various disciplines and sectors. Thus, one of the main criticality to face, as highlighted in section 2, is to integrate views, sciences, sectors, interests that generally appear difficult to combine, if not irreconcilable. SD, in fact, implies dealing with *Social Ecological Systems* (SESs) (Ostrom, 2009) that behave like *Complex Adaptive Systems* (Holland, 1992; Walker *et al.*, 2004; Liu *et al.*, 2007). The most critical aspect of dealing with such systems is centred by Ostrom when she affirms that “Scientific knowledge is needed to enhance efforts to sustain SESs, but the ecological and social sciences have developed independently and do not combine easily [...]. Furthermore, scholars have tended to develop simple theoretical models to analyse aspects of resource problems and to prescribe universal solutions. For example, theoretical predictions of the destruction of natural resources due to the lack of recognized property systems have led to one-size-fits-all recommendations to impose particular policy solutions that frequently fail” (Ostrom, 2009: 419).

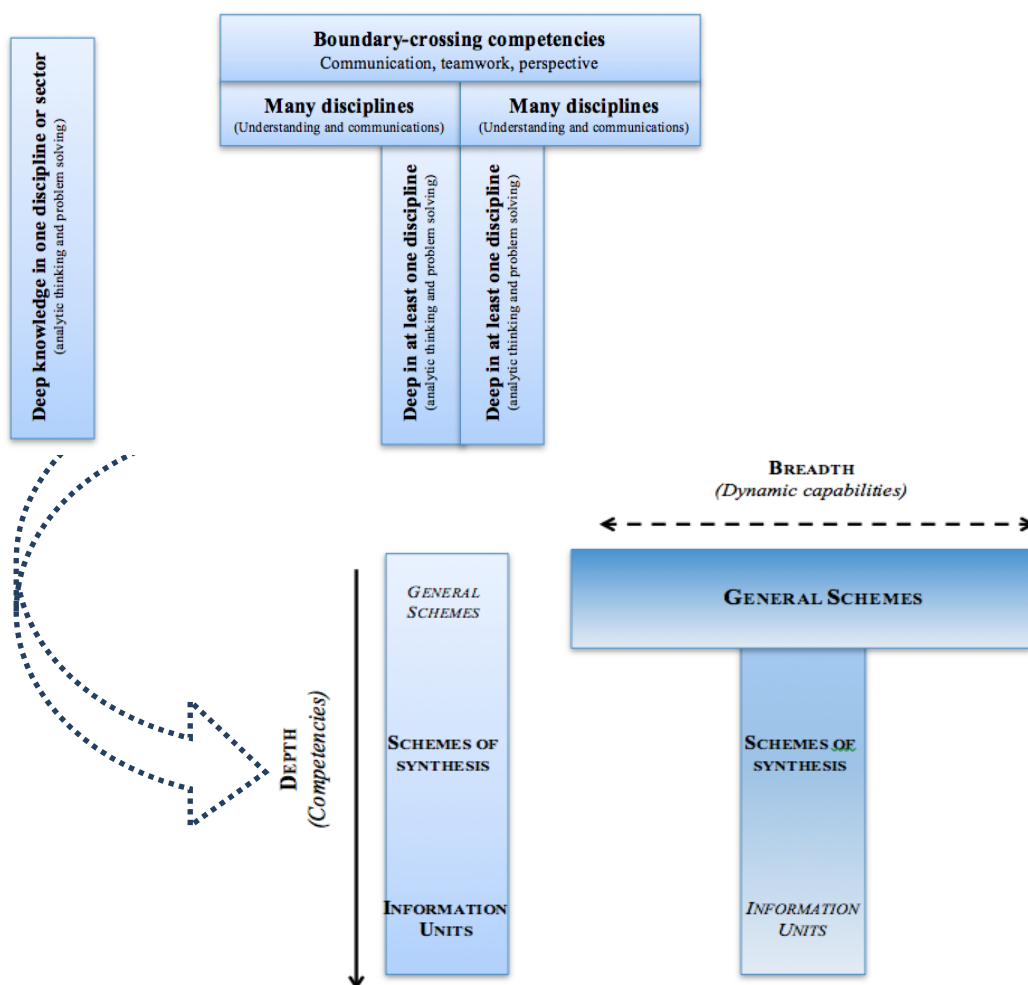
This point of view summarizes the main challenge of building a science of sustainability and advancing EDS. As discussed, both Sustainability Science and the development of an effective education program for SD suffer from the issue of implementing interdisciplinarity which appears theoretically easy to conceive but extremely difficult to put in practice also considering the institutional barriers which impede the affirmation of interdisciplinary sciences (Frost & Jean, 2003). In this respect, the experience of the Service Science community, which is more established at both academic and professional level, can be very supportive to the development and promotion of Sustainability Science. This challenge, shared with the scientific communities of the Forum, would contribute to the advancement toward a more sustainable world. To this aim, by building upon the UNESCO’s ESD reports and the proposed 3Pillars-based interpretation, we outline a possible model of reference based on the notion of “T-shaped professionals” reinterpreted through the lens of the vSA (Barile & Saviano, 2013; Barile, Saviano, Simone, 2014).

The need for T-shaped professionals, compared to the more common I-shaped professionals, has progressively emerged in the last decade as the current knowledge and service economy increasingly requires managers and professionals who combine a deep knowledge in at least one discipline or system (vertical bar) with capabilities of moving across disciplines, sectors and systems (horizontal bar).

In the first part of Fig. 4 a representation of what would be an I- and a T-Shaped professional is proposed indicating the skills configuration as characterized by a deep expertise in solving specific problems, which tend to maximize the efficiency in management processes (Spohrer *et al.*, 2007, 2010a). A T-shaped professional, instead, is “a new kind of executive, one who breaks out of the traditional corporate hierarchy to share knowledge freely across the organization (the horizontal part of the ‘T’) while remaining fiercely committed to individual business unit performance (the vertical part).” (Von Oetinger, 2001: 108). In other words: “Those who are deep problem solvers with expert thinking skills in their home discipline but also have complex communication skills to

interact with specialists from a wide range of disciplines and functional areas” (IfM & IBM 2008: 19). In the *vSA*, as represented in the second part of Fig. 4, the T-shape model is used to represent the knowledge endowment of a viable system in terms of *Information Variety* dimensions. ‘I’ shape knowledge is characterized by a basic endowment of general schemes, schemes of synthesis and information units that are contextualized to a specific problematic context and targeted to solve specific problems. A ‘T’ shape, instead, is characterized by a wider endowment of general schemes (Barile, Saviano, Simone, 2014: 9). People endowed with I knowledge are vertically specialized in one (or more) fields. People endowed with T knowledge in addition to a competencies expertise, are also capable of facing different categories of problems from different fields thanks to their flexibility in reconfiguring knowledge by crossing different contexts and applying their powerful endowment of general schemes. General schemes enable people to move horizontally and develop new knowledge through contextualization.

Figure 4: A VSA interpretation of T-Shaped knowledge



Source: Elaboration from Spohrer, Gregory, Ren, 2010: 678 and Barile & Saviano 2013: 51.

In this representation, information units represent the data possessed by the system and exchanged during interaction. The schemes of synthesis represent structured and contextualized knowledge, which qualifies the system’s set of competences. The general schemes represent the system’s cognitive schemes [...]. The categorical values represent the set of values, strong beliefs, convictions, etc.” (Barile, Saviano, Simone, 2014: 7). The generic configuration of skills is traced to the distinction between dynamic capability and competence: competence is contextualized knowledge, “a unique mix of knowledge, skills and technologies leading the generation of a series of profitable innovations” (Chiesa & Barbeschi, 1994: 295); capability is a complex bundle of

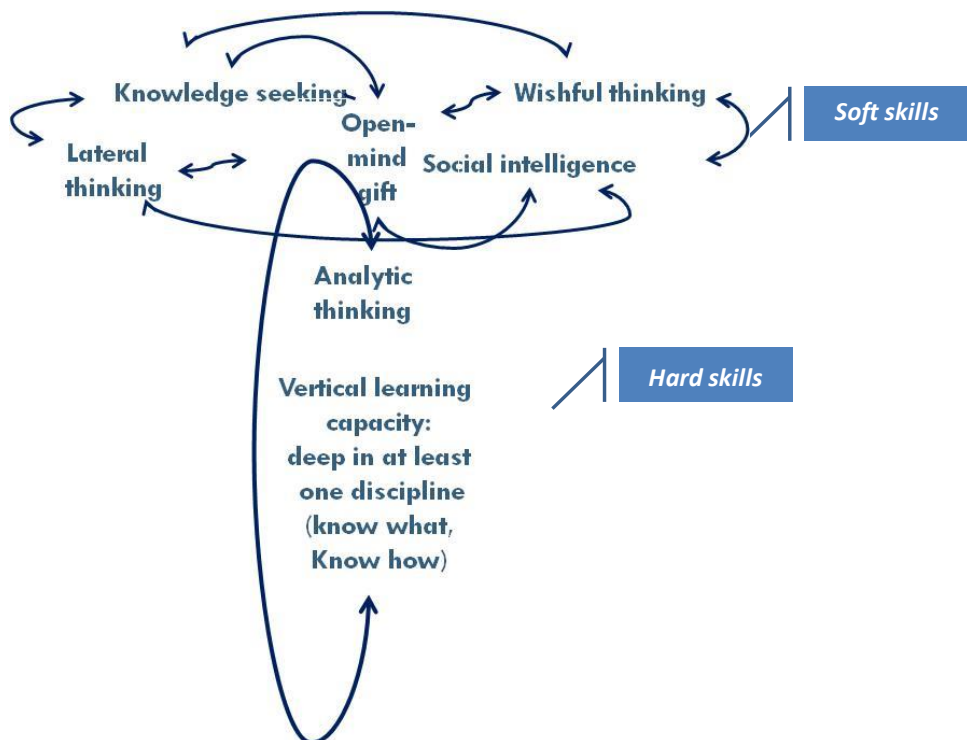
“skills and collective learning, exercised through organizational processes that ensure superior coordination of functional activities” (Day, 1994: 40); dynamic capability is an “ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece, Pisano, Shuen, 1997: 516)

There appears to be a strong convergence between the fundamental requirements identified by ESD and the T-Shaped model. At this point, we can develop our interpretative proposal of a T-shaped model applied to ESD.

As highlighted, the key endowment required for people engaged in SD is characterized by boundary-crossing and systems thinking capabilities, which represent typical examples of *soft skills*, i.e. “set of non technical, professional abilities such as communication, interpersonal and customer service skills as well as personal traits such as integrity, and responsibility” (Wushe, Shenje, Ndlovu, 2014: 187). The boundary-crossing skills are capabilities that allow or strongly support connections/links of various kinds: links between heterogeneous specialized knowledge; links between problems requiring solutions and solutions in need of problems; and links between people who have different cognitive frames because they live or work separated by geographical, organizational, hierarchical, or cultural boundaries. The key of such knowledge endowment are the ‘bridge capabilities’, which play a crucial *synapse role* in continuous learning and innovation and are the key process for a viable survival (Saviano & Caputo, 2013; Barile, Saviano, Polese, 2014).

A general representation of a T-Shaped endowment that combines soft and hard skills from a vSA perspective, is proposed in Fig. 5.

Figure 5: The set of skills of T-shaped people from a vSA perspective



Source: Adapted from Barile, Saviano, Simone, 2014: 11, www.asvsa.org

To apply this model to EDS, we can consider that the horizontal capabilities endowment is the common part of any T-shaped representation. To contextualize our model, it is necessary to specify the vertical endowment necessary to complete the T.

Although the debate about a science of sustainability is still in progress, especially related to the problems of creating inter- and transdisciplinarity knowledge, there should be a convergence on what disciplines are to integrate as it suggested by the *Triple Bottom Line* model (Elkington, 1997) whatever representation we use (examples are proposed in Fig. 6).

However represented, what a vertical knowledge necessary to analyze and solve sustainable

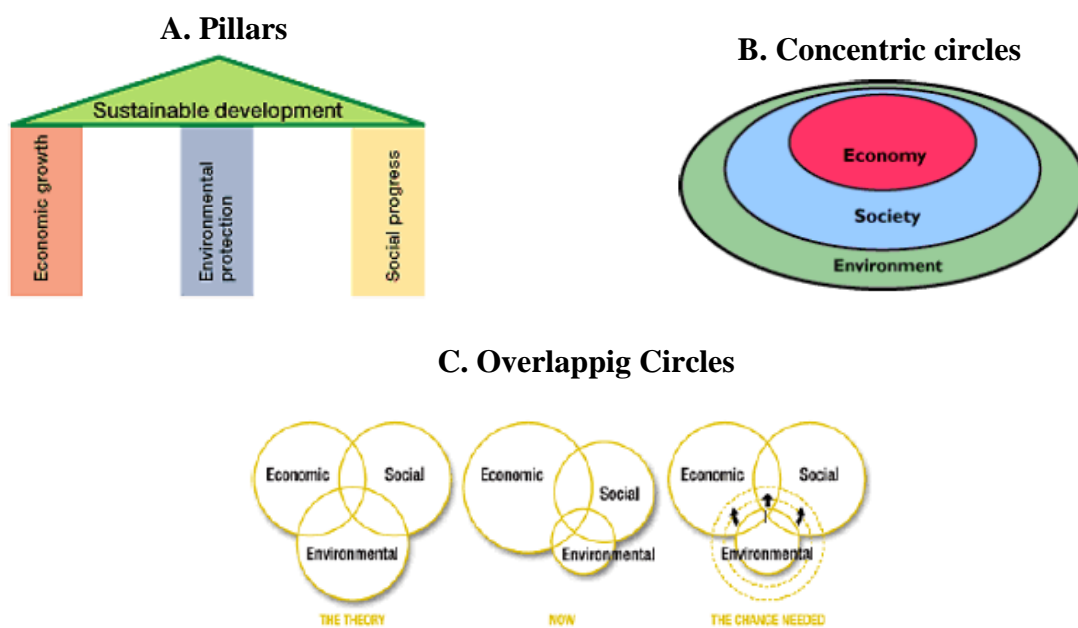
development problems must include are competencies in environmental sciences, social sciences and economic sciences, which are the three disciplinary areas generally involved.

A science of sustainability, in fact, should emerge from integration of basic principles and knowledge from environmental, social and economic sciences. Of course, the depth of such knowledge can vary depending on the degree of specialization, but the fundamental interpretation schemes and information characterising the three disciplinary fields are necessary. The key of the vSA view, in this respect, is that they will be the general schemes of ‘knowledge seeking’, for example, that will effectively direct the search for more specialized knowledge necessary to solve very specific emerging problems. Then, it would be not necessary nor probably useful to deepen expertise in each of the three scientific fields, because the general schemes will support the basic understanding of any kind of problem related to the three sciences, while the schemes of synthesis (specialized and contextualized knowledge) will be easily searched or developed in case of need.

This configuration of knowledge will ensure the flexibility necessary to continuously adapt the knowledge endowment to a fast changing and evolving scenario. Moreover, The kind of problems a T-Shaped professional will be in front of when dealing with SD, are rarely issues that can be faced with a problem solving approach and following a linear causality thinking, because these problems are generally emergent from complex dynamics typical of the behaviour of complex adaptive systems.

Accordingly, a basic vertical content of T-shaped knowledge for ESD should integrate the fundamentals of *environmental, social and economic sciences* as the three key disciplinary domains involved in SD.

Figure 6: Alternative representations of the environmental, social and economic dimensions of sustainability



Source: IUCN, 2006, p. 2

Therefore, in our view, considering that ESD acts as ‘*an umbrella*’ in the UNESCO’s framework, we believe that:

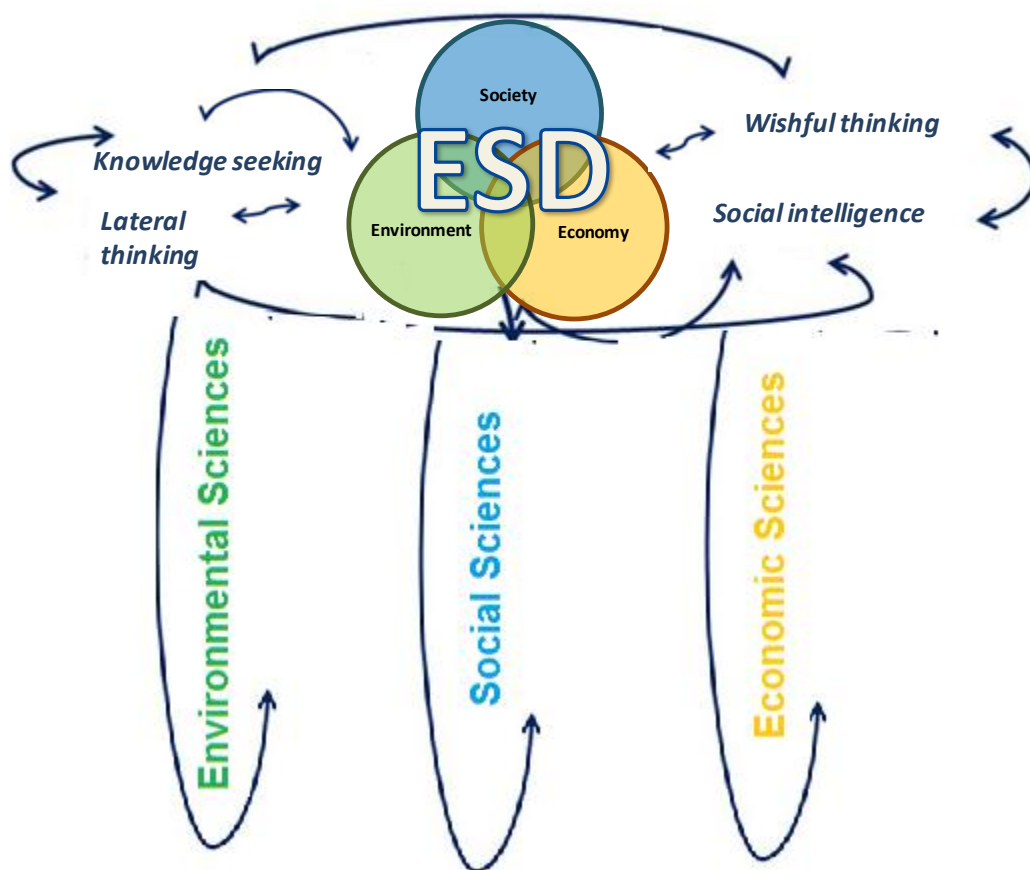
A T-shaped knowledge for ESD should be approached not so much by combining or integrating, the different disciplinary domains involved in SD, but by identifying and stimulating the development of common general schemes which can be applied in any specific field or problematic context related to SD so creating the conditions for interdisciplinarity.

These general schemes, in fact, forming the required boundary crossing competencies, are those that, in the vSA representation, we identify as *critical and lateral thinking, knowledge seeking, wishful thinking, open mind gift and social intelligence*.

Thus, to complete the framework of T-Shaped people educated to be capable of addressing SD, and resulting from integration of horizontal dynamic capabilities and vertical competencies, ESD can play a very relevant role as it allows the linking of disciplines and expertises, bridging the gaps between them and so developing the capabilities useful to easily seek and creating the knowledge necessary for addressing SD.

ESD should be addressed to developing the set of general schemata required to understand the various dimensions (environmental, social, economic) that compose sustainability, hence supporting the definition of models and perspectives capable of overcoming the boundaries between disciplines and the limits of the reductionist approach. This enables the information sharing, reciprocal understanding and knowledge co-creation needed to address the challenge of sustainability.

Figure 7: Crossing boundaries through Education for Sustainable Development



Source: Adapted from Saviano, 2015, www.asvsa.org

6. Research and practical implications

This paper represents a response to the call for an integrated effort on the part of the scientific and professional communities of the Naples Forum on Service who are engaged in research and who contribute significantly to the global challenge of a more sustainable world.

In this sense, research and practical implications overlap as the call is for an inter- and trans-disciplinary effort directed at involving and engaging both the scientific, the professional and the business world, as well as people involved in education processes in order to work together for

educating future decision makers and practitioners involved at various levels in the shift toward sustainability.

Hence, this call is also a response to Service Science's call to integrate resources and co-create knowledge by means of "an inclusive multidisciplinary approach to service innovation, with science, management, engineering and design as supporting academic disciplines, and with T-Shaped professionals as adaptive innovators to link and unite these disciplines. This will create measurable growth in service innovation for business and society"(IfM and IBM 2008: 21).

Such growth claims in turn, to be measurable for businesses and society not only economically and socially, but also and, principally environmentally as growth not simply green but capable of generating wellbeing for all through a new awareness of the role each of us can play in achieving a more sustainable world.

Let's start by working together towards educating ourselves as T-shaped people ready to face the challenge of sustainability and to promote sustainable development worldwide.

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