

*Short paper on*

## **Sustainable District Logistics: understanding a new paradigm**

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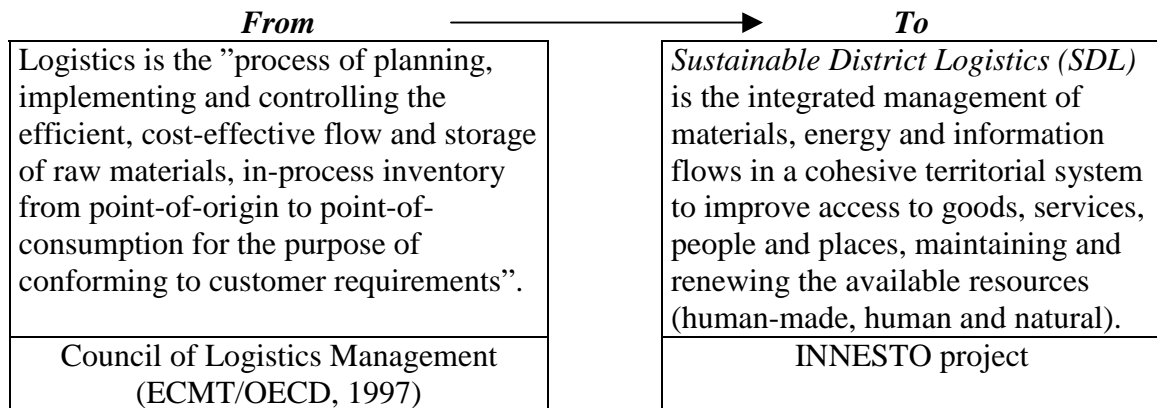
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The *Sustainable District Logistics (SDL)* approach is geared towards the paradigmatic change in the current approach to logistics. This change can be described in the following figure:



The SDL approach aims to contribute to the ongoing debate on sustainability and logistics, already supported by a series of European Union documents, in particular:

- *A sustainable Europe for a Better World: A European Union Strategy for Sustainable Development (CEC, 2001)*
- *European transport policy for 2010: time to decide (EC, 2001)*
- *European Governance (CEC, 2001a)*.

The following basic questions are considered by the SDL approach:

- How can logistics contribute to Sustainable Development?
- How to conceive the logistics governance?
- How to combine the interests of the different SDL stakeholders?
- How to plan and manage logistics towards Sustainable Development?
- How can logistics manage the complexity of a system?
- How can *Sustainable Quality Management* be useful for readdressing logistics towards sustainability?

## How can logistics contribute to Sustainable Development?

Logistics is the management of accessibility. Accessibility is the "capacity to access" the available resources and implies equity issues because it guarantees the basic rights to see, reach, produce, buy, use, consume, and so on.

The management of accessibility regards how the available resources (economic, environmental and socio-cultural) are used.

In other words, logistics connects territorial systems, ensuring the interrelationships between resources throughout their life cycles, from sourcing, to transformation, to distribution and final utilisation. It is the connection of a series of links between material and immaterial resources with different temporal and spatial scopes.

For these reasons, the SDL approach reformulates the central question that arose during the 1994 World Conference on transport (OECD, 1996), substituting "transport" with "logistics": "*what quality for what logistics for what kind of development?*".

The SDL approach recognises that logistics (and not only transport) is "not an end in itself but a means to an end", and that there may be other ways of achieving a particular end rather than physical logistics.

The Vancouver Conference (OECD, 1997)<sup>1</sup>, dedicated to transport policy, arrived at the following conclusion: “Sustainable mobility (transportation) is achieved when the needs for access to people, services, and goods are met without producing permanent harm to the global environment, damage to local environments, and social inequity”.

More recently, the European Union Strategy for Sustainable Development (CEC, 2001) set three main objectives to improve the transport system and land-use management, namely: the reduction of transport growth (decoupling it from the economic growth), a shift from road to rail, water, and public passenger transport and a more balanced regional and local development.

## How to conceive the logistics governance<sup>2</sup>?

The SDL approach aims at promoting territorially and socially determined "*deals*" to govern and manage logistics, which is embedded in the complex dynamics of a particular context, through the open-ended, co-evolving and self-organising utilisation of local resources.

Logistics districts should be defined in a flexible and adaptable way according to the dynamics of *multi-level-governance*<sup>3</sup>.

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<sup>1</sup> These guiding principles were drafted during the Vancouver Conference (OECD, 1997) to develop transportation systems that maintain or improve human and ecosystem well being:

1. *Access*, all people are entitled to reasonable access to other people, places, goods.
2. *Equity*, nation states and the transportation community must strive to ensure social, interregional and intergenerational equity, meeting the basic transportation-related needs of all people including women, the poor, the rural, and the disabled.
3. *Individual and community responsibility*, all individuals and communities have a responsibility to act as stewards of the natural environment, undertaking to make sustainable choices with regard to personal movement and consumption.
4. *Health and safety*, transportation systems should be designed and operated in a way that protects the health and safety of all people.
5. *Education and public participation*, people and communities need to be fully engaged in the decision-making process about sustainable transportation, and empowered to participate.
6. *Integrated planning*, transportation decision makers have the responsibility to pursue more integrated approaches to planning.
7. *Land and resource use*, transportation systems must make efficient use of land and other natural resources while ensuring the preservation of vital habitats and other requirements for maintaining diversity.
8. *Pollution prevention*, transportation needs must be met without generating emissions that threaten public health, global climate, biological diversity or the integrity of essential ecological processes.
9. *Economic well being*, taxation and economic policies should work for and not against, sustainable transportation, which should be seen as contributing to improvements in economic and community well being.

<sup>2</sup> According to “The Governance Working Group” of the International Institute of Administrative Science (1996), Governance is a broader concept than government: it refers to the way in which governments, citizens and their organisations relate with each other to manage their common affairs and to solve the problems of their territories. The United Nations (CSOPP, 2000) underlined the following basic elements of governance: Political Legitimacy, Democratic participation, Empowerment, Inclusiveness in shaping public affairs, Transparent public administration and policy management, Accountable public service, Effective implementation of public policies. The European Union has reiterated these elements in five principles for Good Governance (CEC, 2001a): openness; participation; accountability; effectiveness; coherence.

These dynamics are of a self organised nature and determined by the relationships between all the logistics stakeholders. Only the logistics stakeholders can represent the spectrum of resources gathering different points of view concerning the interests of the economy, the local communities, the natural environment and the future generations.

In SDL districts, an intensive flow of interrelationships exists between the civil society<sup>4</sup>, the public sector and all the others constitutive components of the system (social, economic and environmental).

Different motivations create a range of interrelationships between the SDL stakeholders. Very often the different interest groups act separately and don't communicate effectively with each other because of different expectations from a logistics point of view.

<i>Stakeholder typology</i>	<i>Expectations</i>
Producers and suppliers SMEs and larger companies (e.g. employees, managers, entrepreneurs)	Profit increase Logistics costs saving Logistics efficiency and simplification of procedures Stable and enduring relationships
Wholesalers and retailers	New markets, clients and relationships
Logistics operators (e.g. shippers; forwarders, warehousing agents)	Collaboration and support from the public sector Remuneration, employment security Health work conditions
Transport operators (e.g. road haulers, rail, shipping, air, companies and brokers)	Training and professional career
Local governments, public authorities and administrations	Planning criteria, procedures and efficacy in their fields of competence and responsibility Reduction of environmental and social pressures Public spending reduction Well-trained and experienced employees Citizens acknowledgment and legitimisation
General public (citizens, families and communities)	Equal opportunities of access to goods, services, places and people Efficient logistics, transport and information services Efficient and accountable institutions Better quality of life, also through the reduction of environmental and health problems due to logistics and transport
Environment	Reduction of natural resources consumption, pollution and so on Respect of biodiversity and ecosystems life
Future generations	Opportunities in terms of resources availability to allow them a sound development

<sup>4</sup> Civil society is placed at the centre of Governance and policy mainstreaming. Civil society is constituted by the multiplicity of units (families, groups of interests, trade unions, environmental associations, etc.) territorially created by the citizens, empowered to autonomously organize themselves and to evolve together (Seligman A., 1992; Fukuyama F., 1999; World Bank, 2002).

## How to combine the interests of the different SDL stakeholders?

There are structural difficulties for the different stakeholders to cooperate in a common, more integrated framework, due to:

- the difference in the time horizon the actors usually consider (the time horizon of companies is considerably smaller than that of public institutions)
- the tendency of companies to look exclusively at the economic dimension as opposed to the more comprehensive approach characteristic of public institutions
- the sometimes very sectorial approach of small companies, carriers and specialised public agencies
- the short-term highly competitive environment in which many small companies and the whole transportation sector are operating, as well as their limited capacities for strategic considerations (whereas large companies can afford to be more open to modern management approaches)

Opportunities can be also identified for a more integrated cooperative approach, namely:

- a growing public awareness for environmental and social and cultural issues in business
- a growing awareness that innovative solutions may pay a double or triple dividend, hence giving positive results in more than one dimension
- the particular local roots of many small businesses which lead them to consider other than strictly economic arguments
- the different role of the regional public bodies: they are not only cooperation partners but they also have some means to influence the rules of the game. They can set boundary conditions or require certain considerations where permits (e.g. for construction) are required
- the innovative role of logistics companies who introduce new planning and management concepts with their clients
- the example of some large companies who have produced some very successful good practices of integrated logistics approaches within their companies
- the new opportunities for cooperation and transparency given by advanced Information and Communication Technologies

Unfortunately, the stakeholders that find it more difficult to seize these opportunities are the small companies and their networks, which are the main target group of the SDL approach.

From this situation some basic challenges emerge for the development of an operational “Sustainable District Logistics” tool-box:

- **Network approach:** Implementation of a non-hierarchical structure for decision making.
- **Tools for dialogue:** Appropriate tools should enhance the efficiency of participations.
- **Sharing of information:** Modern ICT based on the Internet can provide new and flexible solutions.
- **Transparency of positions and priorities of the actors involved:** This can help find optimum solutions for all parties.

- **A common language:** Efficient communication requires a common language in which to describe individual problems. Different cultures often lead to misunderstandings and time consuming debates.
- **Multi-dimensional appraisal:** A global analysis can show the acceptability of solutions for various stakeholders with different priorities.
- **Scenarios:** Scenarios can show the impact of different approaches in different dimensions and can help to invent new solutions.
- **Integration of existing logistics tools:** To extend their capabilities towards multidimensional approaches or to use them for showing the economic potentials of scenarios developed with other means.
- **Time efficiency:** All methods should be very time-efficient. Visual presentation tools may be important for speeding up the mutual understanding process and facilitating the acceptance of new approaches.

## How to plan and manage logistics towards Sustainable Development?

Logistics is essential to an efficient and strategic management of the transfer and storage of materials, components and products starting from the suppliers, passing through the producers, arriving at the consumers.

Logistics activities regard the time-related positioning of resources and include procurement, manufacture, distribution, storage, transport, recycling and waste storage, information technology and, more generally, finance and personnel. It is an integrated cycle that implies the utilisation of several resources: physical, human, financial and cybernetic.

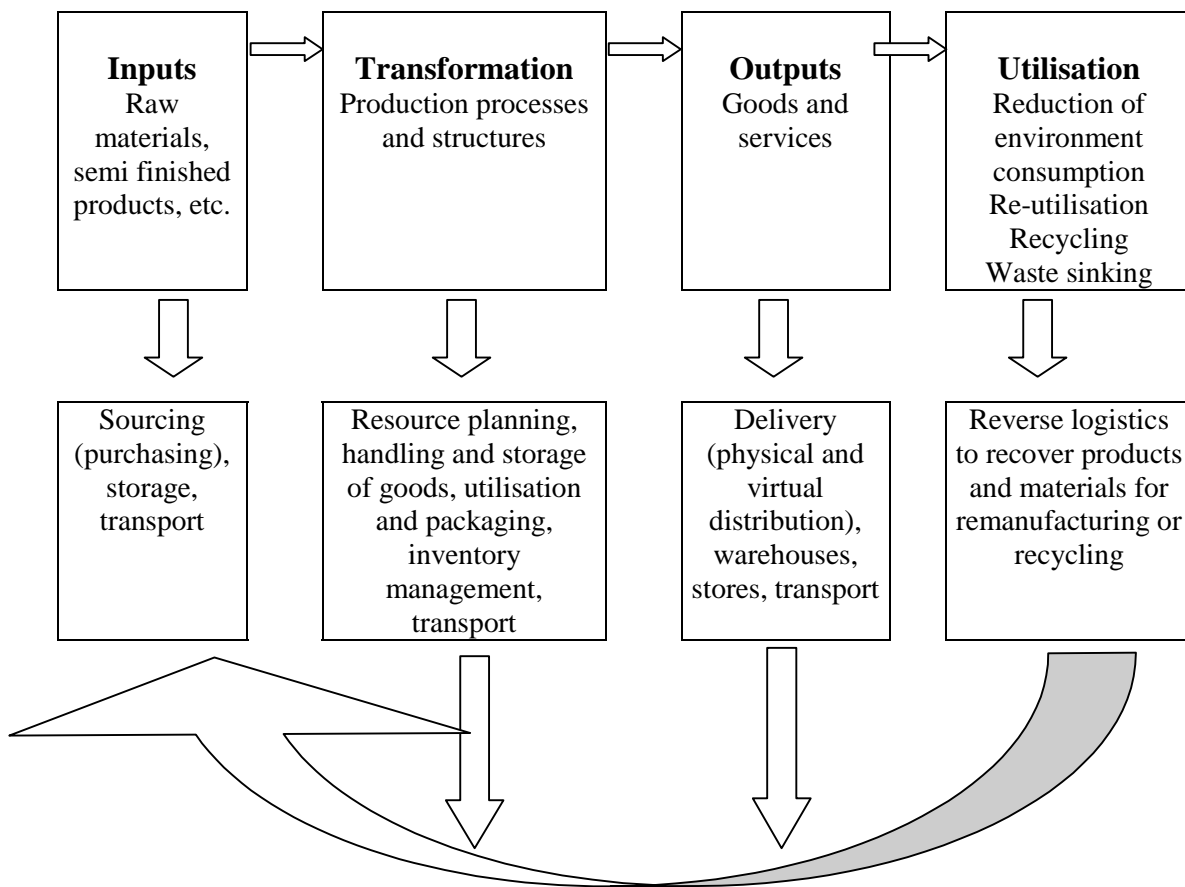
More specifically, logistics supports the production and the flow of goods and services throughout their life cycle.

By integrating the principles and definitions of the different approaches to logistics and management, a further step towards sustainable logistics can be made, as shown in the following table:

<i>The 9 levers of logistics mix</i>	<i>The 8 aims of logistics</i>	<i>The "7 Dimensions" of eco-efficiency</i>
<i>Planning and Marketing strategy</i> <i>Purchasing</i> <i>Production Planning</i> <i>Storage and Materials Handling</i> <i>Inventory Management</i> <i>Warehouses and Stores</i> <i>Transport</i> <i>Customer Service</i> <i>Technical Support</i>	Right material Right quantity Right quality Right place Right time Right method Right cost Right impression	Reduce the material intensity Reduce the energy intensity Reduce toxic dispersion Enhance recyclability Maximise use of renewable resources Extend product durability Increase the service intensity
Quayle M. & Jones B., 2001	Kobayashi S., 1998	DeSimone L. D. and Popoff F., 1997

The quality cycle of logistics can be presented in a recursive way, as summarised in the following chart.

*Logistics within the Quality cycle*



**How can logistics manage the complexity of a system?**

A system is understood as an organised unity of interrelationships between elements (human, non-human species and the natural environment) and actions (Morin E., 1977; Pascal B., 1670; Wilber K., 1995; Koestler A., 1967).

Logistics plays a key role in the evolution of systems.

Spatial interconnections require the capacity to simultaneously incorporate the local and global dimensions in the decision-making processes. This is the meaning of *glocacity*, which owes its birth to logistics (OECD, 1996a).

The roots of *glocacity* are in product planning and design: a global product can be a single standard product; but it can also be a generic product with specific local variations for several local markets.

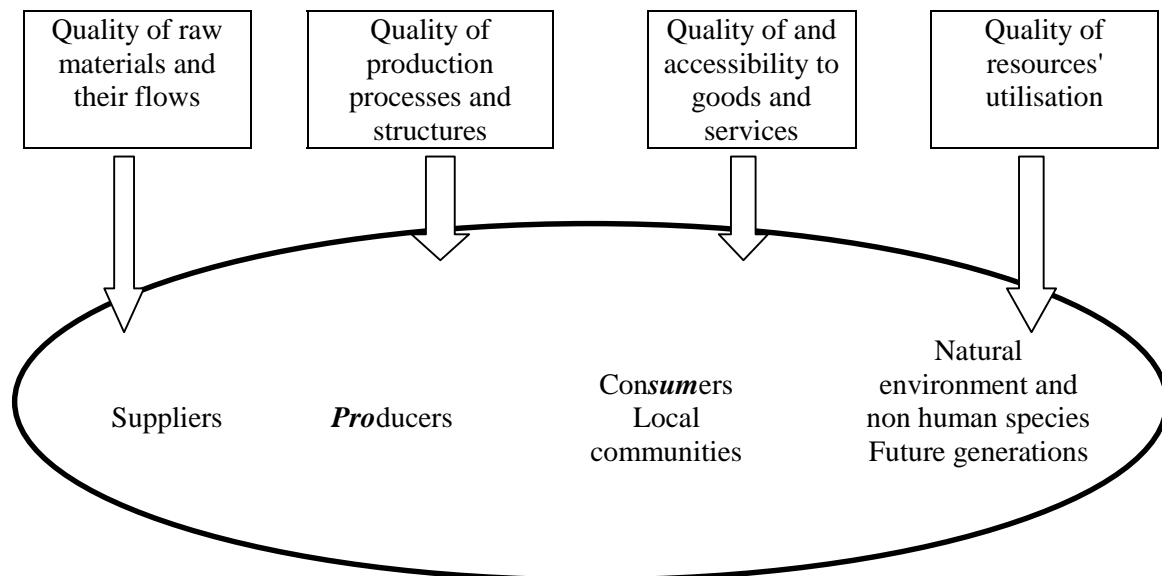
*Glocacity* considers diversity as a resource for innovation, with the conviction that each customer and each local situation asks for appropriate marketing and logistics strategies. The orientation of logistics towards *glocacity* implies the existence of territorially diffused networks and partnerships (such as business and trade associations, local consortia, jointly managed projects, etc.), as well as new organizational patterns, less hierarchical and more participative.

*Glocacity* also requires the implementation of the principle of subsidiarity, which implies devolution of responsibilities; the integration of top-down and bottom-up approaches in decision making; public, private and social joint management of local initiatives; the financial autonomy of local authorities, etc.

As a result, glocacity, like subsidiarity, is activated when larger dimensions and higher levels think locally and act globally while smaller dimensions and lower levels think globally and act locally. These decision making procedures connect people and organisations in different spatial and temporal dimensions.

The "prosumer theory" (Toffler A., 1980), which reunites producers and consumers (producer + consumer = prosumer) in the cycle of wealth creation, requires stakeholders' participation in order to increase their awareness and responsibility. Only participation makes it possible that, for instance, wastes are recycled as inputs for the next cycle of production, material products (from industry) and services are increasingly integrated, and so on.

*Eco-prosumerism in logistics*



Therefore:

- the quality of a territorially determined system depends on the quality of its logistics, which allows the components to relate to each other
- vice versa the quality of logistics depends on the human capacity to organise the territorial structures, from the economic, socio-cultural and environmental points of view.

**How can Sustainable Quality Management be useful for readdressing logistics towards sustainability?**

Quality Management means that permanent attention to quality is important at every stage of "production", while everybody at all levels shares the responsibility.

The emphasis of a quality management system lies on the procedures. Objectives and criteria evolve continuously and thereby need to be re-examined on a regular basis.

The transparency of objectives, continuous monitoring and regular evaluation are constitutive elements of quality management.



The path towards quality management can be traced as follows:

- *Total Quality Management (TQM)*<sup>5</sup> conceived a company as a living organism, open to society and managed through innovative methods aimed at the improvement of the human capital.
- *Total Quality Environmental Management (TQEM)*<sup>6</sup> incorporated the environmental dimension into the corporate strategies.
- *Sustainable Quality Management (SQM)*<sup>7</sup> goes further embedding corporate planning within a holistic vision of local and regional Sustainable Development.

SQM regards three interconnected SDL issues. These three issues are the basis for both a comprehensive analysis of the present situations and an integrated approach to the creation of innovative courses of action (strategies, policies, programmes, projects, plans).

<i>SDL issues</i>	<i>SQM - Sustainable Quality Management®</i>
What direction should be given to logistics systems?	<b>ORIENTATION</b> towards sustainable development: 10 components, defined through the selection of main principles and concepts
What driving energies should be stimulated to produce the above changes?	<b>DYNAMICS</b> : 6 levers of transformation, selected through the comparison of the main development facilitating forces in different local contexts
What societal capacity should be built into governing logistics in a sustainable way?	<b>SOCIAL POTENTIAL</b> : 16 key factors, identified through the selection of the main characteristics of human capital in different local contexts

The SQM / SDL orientation, dynamics and social potential can be shown by the following examples of actions.

<sup>5</sup> The first concepts of TQM, combining Eastern (e.g. Japan) and Western (e.g. the USA) cultures, appeared clearly in the 1950's, but it was during the 1970's and 1980's that TQM acquired a world wide influence. The ISO 9000 series was created for TQM

<sup>6</sup> TQEM was officially born in 1990, when the GEMI (Global Management Initiative) grouped more than twenty big companies of the USA to voluntarily adopt this new entrepreneurial paradigm. The TQEM system requires that all parts of the organisation are integrated and must be able to work together. TQEM pursues a holistic approach to understand the links between an organisation and its natural environment and to foster, especially by adopting life-cycle analysis, ecological performance and clean manufacturing processes which reduce pollution at the source rather than end-of-pipe. The ISO 14000 series was created for TQEM, as well as EMAS and Ecolabel.

<sup>7</sup> The term Sustainable Quality Management appeared for the first time in the 1990's in a programme of UNIDO (United Nations Industrial Development Organisation) aimed at analysing the entrepreneurial tendencies in several countries. The basic need of this initiative was to address TQM towards sustainable development. However, it was on the basis of a EU research project that the "*SQM – Sustainable Quality Management ®*" system was created in 1999. SQM is a versatile system for the assessment and management of sustainable development processes: [www.sqm-praxis.net](http://www.sqm-praxis.net)

**What do we want to sustain in logistics?**

The integration between three Development Dimensions: economic, environmental and socio-cultural

*1. The economic dimension of development* underlines the importance of the following elements:

- the economy of agglomeration, supported by local governance methods;
- lower transaction costs of internal and external exchanges through the process of identification and cooperation between social actors;
- activation of potential resources through the social mobilisation related to the sense of belonging;
- innovation supported by a cumulative knowledge acquisition, creation of activities that are directed at improving quality of life for the local population.

These elements constitute the basis of an approach to *endogenous development*, which gives a central role to the interaction between economic actors, the society and the institutions and to the identification, mobilization and combination of potential resources (e.g. *System areas*<sup>8</sup>; *Industrial districts*<sup>9</sup>; *Milieux innovateurs*<sup>10</sup>).

From a logistics point of view, the economic dimension should be addressed through, for example,

- the reduction of the material, energy and transport intensity (flows) in the economy (decoupling); incorporation and reduction of the environmental and social costs (the so-called externalities) in logistics accounting; reduction of transport growth and more balanced modal split in favour of rail and water; Information and Communication Technology to substitute transport; etc.

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<sup>8</sup> *System areas* have been defined (Garofoli G., 1981, 1983) as an area of specialised production where a closely tied interdependence between small businesses is formed around a dominant sector. Within this productive area, an interwoven relationship is formed that includes businesses, unions and local government. The face to face relationship between operators creates an informal information system that facilitates the diffusion of professional, technological and business knowledge.

<sup>9</sup> Marshallian *industrial districts* have been defined (Becattini G., 1987, 1991) as a social territorial entity characterised by the active co-presence, in a territorially circumscribed, naturally and historically determined area, of a people's community and industrial enterprises population that tend to mutually interpenetrate. These create an agglomeration that result in: a network of interpersonal relationships and a common culture of workers, businessmen and politicians; an industrial atmosphere that facilitates the transmission of knowledge and information as well as the diffusion of innovation. The district is a powerful generator of internal-external economies. The individual specialisation allows for non-competitive relationships and the access to higher technologies to smaller businesses. The "industrial atmosphere" favours a creative approach and the mutual trust between local operators.

<sup>10</sup> The term *milieux innovateurs* (Aydalot P., 1986) was derived from the phenomena of territorial development from innovative processes and from the synergy that occurs in specialised territorial areas, which are characterised by agglomeration of small businesses. The *milieu* concept was based on the importance of the socio-cultural environment which determines the capacity to generate innovation. This translates into a network of territorial relations that favour a dynamic process of collective learning, which can be reinforced by a polarization and attraction of external businesses.

**2. The environmental dimension of development** underlines that any definition of logistics boundaries is rather difficult to make, because all ecosystems involve life and biological processes that are in constant exchange with each other. Ecosystems<sup>11</sup> are nested systems, because they are located within larger systems and contain subsystems that are entirely or partially inside their boundaries. In a nested system each level influences the functioning of the adjacent levels and all processes are interrelated.

From a logistics point of view, the environmental dimension should be addressed through, for example,

- maintenance, reuse and recycle of the available resources; promotion of eco-efficiency in transport, product and processes; relaxing land use and landscape configuration from density of hard infrastructures; etc.

**3. The socio-cultural dimension of development** recognises that evolving knowledge is embedded in a territorial system and is based on the integration between a variety of interrelationships, such as those regarding: individuals, organisations and society; past, present and future times; local, interlocal and global spaces; technical and social skills; specialist and generalist disciplines. Knowledge is an open collective process determined by and determining spatial, temporal, social, economic and environmental dimensions of a system.

Knowledge and thinking are interlinked and converge into the decision making process. Even though knowledge has been separated into specialized areas, the challenge to combine sciences is still alive and growing in importance<sup>12</sup>.

Knowledge jumps across disciplines and operates simultaneously at several levels and dimensions, being strongly embedded in the economic, socio-cultural and natural systems. Yet at the same time it can be conceived also as a single system<sup>13</sup> that nourishes the human capital and, consequently, the governance capacity for sustainable development.

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<sup>11</sup> Ecosystems (Tansley A. G., 1935; Koestler A., 1967; Salt G. W., 1979; Prigogine I. and Stengers I., 1984; Norton B. G., 1994) are evolving systems whose form and functions change in relation to the temporal and spatial variations in the exchange of energy and matter with their environment. Ecosystems are complex systems, whose evolution and trends can neither be explained nor predicted by a study of their individual parts. Since ecosystems are sensitive to changes in their environment, human activities have had an important impact on their evolution, even to the level of the biosphere itself, as shown by global warming, ozone depletion, and so on. The rapid acceleration of technological growth within the industrial and post industrial society risks to damage the functioning and evolution of ecological systems at all levels, in varying degrees and with unpredictable results. Risk and vulnerability (Giddens A., 1990) are in fact no more limited to individual activities, but they potentially spread outside the individual sphere of control, threatening the survival of humanity.

<sup>12</sup> One of the scholars who reflected on this subject was Pascal B. (1670), whose considerations on the relationships between humanity and the nature of knowledge show the importance of a holistic approach. Recently, the term “consilience”, as a unity of knowledge binding different disciplines together, was adopted by Wilson E. O. (1999), while Morin E. (1999) introduced the concept of “cognitive democracy” as a process which opens the decision making, ensuring the continuous acquisition, combination and dissemination of knowledge at all the levels of the human societies.

<sup>13</sup> The term “noosphere”, introduced by Teilhard de Chardin and developed by Popper, Morin and other scientists, refers to this “knowledge system” endowed with a dependant autonomy, having its own life, the power to influence the human mind, but, at the same time, relying on all the other systems and being created and cultivated by the human mind.

From a logistics point of view, the social cultural dimension should be addressed through, for example,

- promotion of sustainable styles of production and consumption; investments in human capital; investments on Research & Development; etc.

**Why do we want to sustain it?**

To integrate three Equity Dimensions: social, interlocal, intertemporal

**4. The equity dimensions of sustainability** applied to logistics improve the accessibility to, within and outside the territorial system.

As far as Social equity is concerned, logistics requires, for example,

- reduction of unnecessary and undesirable travels, movement and material flows; improvement of accessibility through soft and clean technologies meeting the needs of all people, including women, the poor, the rural, the disabled; etc.

As far as Interlocal equity is concerned, logistics requires, for example,

- development of fair and solidarity relationships between different local / regional contexts; diffusion of connecting high technology systems; etc.

As far as Intertemporal equity is concerned, logistics requires, for example,

- strategic (long term) environmental, social, economic and cultural impact assessment of logistics processes; etc.

**How do we want to sustain it?**

Through the integration of four Systemic Principles: diversity, subsidiarity, networking & partnership, participation

**5. The systemic principles of sustainability** applied to logistics improve the glocacity of the strategic and holistic management of the resources (human, natural and human-made) within and between territorial systems.

As far as Diversity is concerned, logistics requires, for example,

- maintenance and development of local identities; diversification and innovation; etc.

As far as Subsidiarity is concerned, logistics requires, for example,

- reduction of the spatial range of material flows; integration of top-down and bottom-up approach in streamlined organisation of material flows; etc.

As far as Networking & Partnership is concerned, logistics requires, for example,

- development of regional / local networks of production and consumption; networked businesses, alliance between logistics companies, environmentally friendly transport modes and operators; etc.

As far as Participation is concerned, logistics requires, for example,

- public (people and communities) involvement and legitimate acknowledgement in the decision-making; information, animation and facilitation; etc.

The orientation towards sustainable development requires change processes, continuously stimulated by the following transformation levers.

**6. The transformation levers that move logistics towards sustainability are:**

Enhancing problem understanding	to nourish awareness and responsibility through close interrelationships between the organisations, the surrounding environments, the spatial and the temporal dimensions
Open collective learning	to create a working environment orientated towards the SDL approach, methods and tools
Negotiation and co-decision	to arrive at strategic decisions that have the wider possible consensus between the SDL stakeholders
Creation of a shared vision	to define transparent purposes and to follow them with coherent organisational behaviours (missions) through the involvement of the SDL stakeholders
Client orientation	to offer a logistics that meet the customer needs and requirements
Result orientation	to assess SDL performances, costs, revenue, stakeholders - satisfaction

The above levers are used for a continuous capacity building of the SDL stakeholders to improve territorial governance.

**7. The social potential key factors that foster the governance of Sustainable District Logistics are:**

<b>The SDL governance</b>	<i>Social Potential key factors</i>
<i>Openness</i>	Perception of a variety of development approaches
	Entrepreneurial creativity and innovation
	Enrichment of the local knowledge to create a cohesive multicultural environment
	Discovery and re-encoding of the local specificities and knowledge
	Integration of skills for innovative processes
<i>Intensity</i>	Capacity to cope with complexity
	Optimal levels of attainment and fulfilment of life
	Existence of a system of shared values
<i>Solidarity</i>	Primary reliance on the endogenous potential resources
	Social cohesion
	Existence of shared visions of local development
<i>Stability</i>	Fair distribution of responsibilities and competence
	Facilitating structure for autonomy and collaboration in decision-making
	Access to information and dialogue
	Opportunity and room for fair interactions
	Existence of facilitators and animators of multiple interactions

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