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Applied Science and Education: Vice versa benefit

E.J. Cilliers[a], W. Timmermans[b]
[a]Wageningen University of Applied Sciences, Van Hall Larenstein (The Netherlands)
Email: juanee.cilliers@nwu.ac.za, juaneep@gmail.com

[b]North West University, Potchefstroom Campus (South Africa)
Email: wim.timmermans@wur.nl

Abstract
Recently the concept of "applied science" gained importance, as the focussed shifted from basic research to practice-relevant research, especially when considering the complexities of urban environments and urban education. This article aims to illustrate the unique opportunities provided to the applied science approach, as a result of the European Interreg projects, introduced and funded by the European Union. From self experiences and best-practice evaluations, it was found that these integrated projects provided opportunities to strengthen the applied science approach (driven by policy formulation, trans-disciplinary research and unique opportunities to bridge theory and practice), and linkages with urban education. This article focuses on two specific Interreg projects and the contribution of these projects to create a platform for applied science (although different in approach, similar in end-result with regards to applied science), which cannot be taught in a class room, and thus furthermore enhancing qualitative teaching-learning strategies. It states the vice versa benefit when integrating urban education and practical projects by means of applied science.

Keywords: Applied Science, European Interreg projects, Integration, Research, Theory

1. Understanding applied science

"Every researcher soon learns that genuine research creates more problems than it resolves. Such is the nature of the discovery of truth" (Leedy 1989:9).

The process of research is complex, multi-dimensional and diverse. Recently the concept of "applied science" gained importance, as the focussed shifted from basic research to practice-relevant research, implementable research. Ulrich (2008) stated that adopting a scientific attitude will benefit professional competence, even where a profession is considered to be as much an art as an applied science, for example in the case of architecture and urban planning. The scientific approach, however, needs to be applied to the specific practical situation, focussing on the ad hoc systematic inquiry needed.

The scientific methods between applied science and basic science is not that different, but the practical implementation requires more than scientific training, as a thorough understanding of the concrete situation to which such methods are applied is needed. Ulrich (1987:276) refers to this as "the context of application". It is linked to the decision-making and legitimation processes by which results gain recognition as a basis for taking action (Ulrich, 2008). The basic science research processes comprises of the relationships between five main elements as captured in Figure I, namely the situation, the research topic, the research methods, the data and the conclusions.

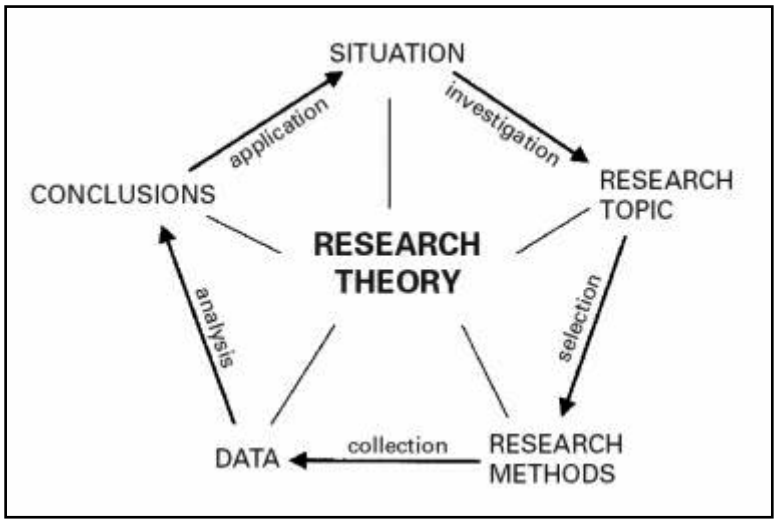

Figure I: The basic science research process
Source: Walliman (2001:194).

This compact diagram stresses the circularity of the process and the central role of research theory. In reality the research process is far more complex and multifunction that illustrated in the figure, involving guesses, intuition and intellectual cul-de-sacs (Walliman, 2001:194). Karl Popper states that "all life is problem solving" (1999:99) and research thus begins not with theories or observations but with problems. Science is the quintessence of a qualified problem-solving approach (Ulrich, 2008). Figure 1 illustrates this statement where a specific situation is investigated in terms of research topic. Research methods are selected and the specific data is collected in order to make an analysis of the situation. The conclusions should then be applied to the actual situation to address the initial problem, hence focussing on the applied science approach.

Ulrich (2008) refers to applied science as "the art of testing and contesting practical claims, problem definitions and solutions, with a view to securing truly reflective practice". Applied science is also being used as an evaluation practice, enhancing the ability to make sound choices by gathering evidence from case studies to answer the key applied research questions (Donaldson et al, 2009:241). Evaluation in this sense implies the process of determining merit, in a systematic and objective way with a degree of expertise (Scriven, 2007:1).
Donaldson and Lipsey (2006) have captured the detail of the different roles that different types of theories can play to improve contemporary applied research and evaluation practice (Alkin, 2004). The "application" value is demonstrated in terms of the "*fitness of theories",* not the ethics of practice (Popper, 1959/2002a:91).
The applied science and evaluation theory attempts to test, corroborate or falsify, theoretically anticipated consequences of actions. It should be noted, however, that applied science cannot justify claims to rational actions and consequences. Theoretical reasoning and empirical testing either "falsifies" the theories or else "corroborates" them for the time being, although it can never verify them definitively (Popper, 1959/2002a:248). "Demonstrating correct anticipation of the consequences of action is not the same as justifying the consequences themselves" (Ulrich, 2008).
Ulrich (2008) states that 'applied science' and 'expertise' should therefore be seen as one concept, rather than just 'applied science', as true expertise reaches beyond the mainstream notion of applied science. "This alternative term, then, invites us to associate with expertise a scientific attitude or research orientation that is less impoverished than the prevailing model of applied science" (Ulrich, 2008). As the world we live become more pluralist, it raises questions about special expertise, rationality, and objectivity of professionals, about the part that values

play in professional practice, along with corresponding critical skills and about both professional and civic education can be reformed as to teach and learn such skills systematically. “Reflective practice” might be the answer; although the mainstream literature on reflective practice is so preoccupied with "soft," psychological issues that it has hardly begun to address these questions systematically” (Ulrich, 2008).

A good model of applied science should not only offer a familiar framework for practicing what have been learned, it should also provide critical impetus and guidance for moving beyond and improving expertise (Ulrich, 2008). “This is the timeless way of building: learning the discipline, and shedding it.” (Alexander, 1979:16)

There are four desirable characteristics of scientific knowledge which can be used as a guide and as a basis for discussion, including abstractness (independence from a specific time and place, findings applicable to other situations, lead to development of general theories), intersubjectivity (clarifying the meaning of concepts), intersubjectivity (logical rigour used in the process such as mathematics, statistics and symbolic logic) and empirical relevance (a measure of the correspondence between a particular theory and what is taken to be objective empirical data) (Walliman 2001:192-193).

More than one approach to an investigation, referred to as triangulation, and is often used to strengthen the applied sciences process and evaluation theories, as it reinforces confidence in the research outcomes (Denzin, 1970). “Triangulation offers the prospect of enhanced confidence” (Bryman, 2000) and is one of the several rationales for multi-method research. The term derives from surveying, where it refers to the use of a series of triangles to map out an area (Bryman, 2000).

Denzin (1970) discerned four areas of triangulation, including (1) data triangulation (focussing on various data collection strategies for example sampling at different times and situations), (2) investigator triangulation (where two or more researcher collect, analyse and interpret data), (3) theoretical triangulation (acknowledging more than one theoretical approach to a problem) and (4) methodological triangulation (focussing on the use of multiple research methods).

The idea of triangulation has been criticized on several grounds, mainly because it becomes a device for enhancing the credibility and persuasiveness of a research account and because it compares sets of data deriving from different research methods and regards it as equivalent in terms of capacity to address a research question (Bryman, 2000).

However, indicators suggest that the demand for credible evidence is at an all-time high across the globe, and that applied research and evaluation practice is booming. Evaluation and applied science research are being conducted on a much wider range of problems, programs, policies, practices, products, personnel, organizations, proposals, and the like across a diverse range of community, organizational, government, and global settings (Donaldson et al, 2009:239).

As this article aims to illustrate the linkages between applied science as addressed above and the European Interreg projects, as well as the linkage back to urban planning education. In this sense, acknowledging the crucial inter-active multi-disciplinary approaches and trans-disciplinary approaches associated with the applied science approach, and implemented through the Interreg projects, as captured in Figure II.

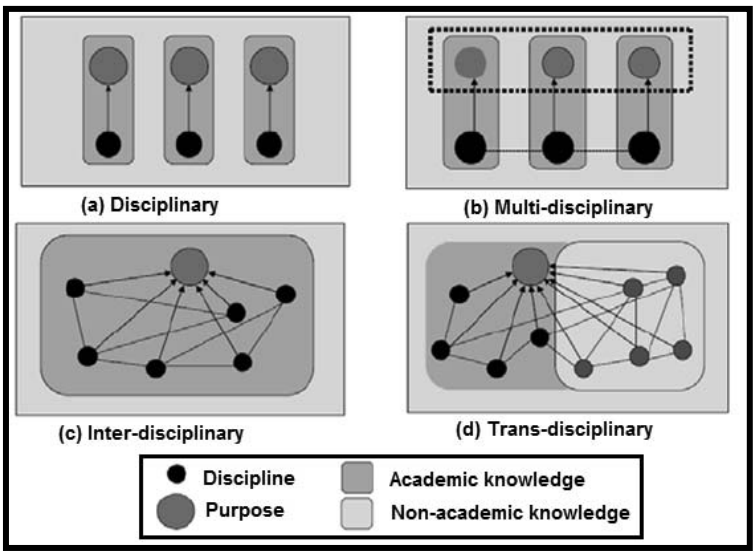

Figure II: Scope of disciplinary approaches in promoting the interface between disciplines Source: Fry et al (2007) and as applied by Cilliers (2008).

The ultimate goal (of applied science) is to guide the approach, thinking and insight capabilities of students and professionals based on complexity of functional involvement and strategic level. Within the education environment it involves the process of insight and thinking development of students. The traditional disciplinary approached evolved in a multi-disciplinary and intern-disciplinary approach where more disciplines interacted in order to reach a purpose, as Figure III illustrates. The recent trans-disciplinary approach incorporated academic knowledge and non-academic knowledge to this equation to promote the interface between the disciplines even more, linking to the applied science approach. The level of strategic involvement needed to address the modern level of complexity within the urban environment can only be addressed by this trans-disciplinary approach, driven by innovation and creativity, as seen from the case studies of the Interreg projects.

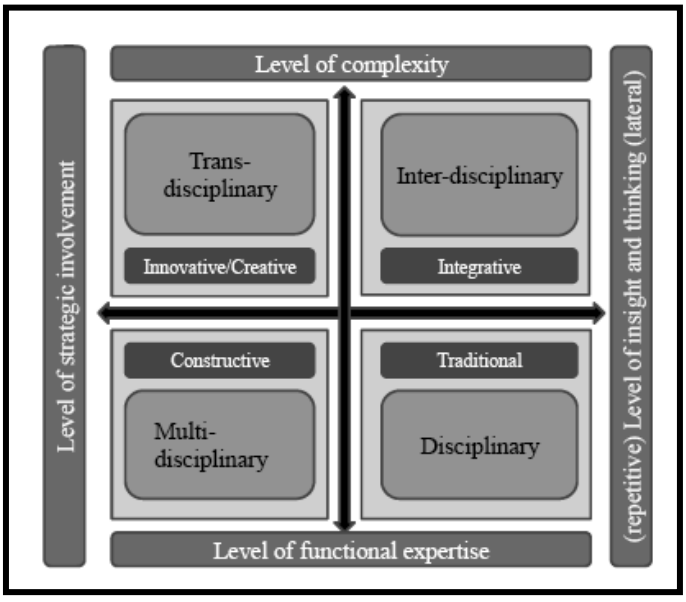

Figure III: Process of development of insight and thinking.Source: Schoeman (2010).

The background and details of the specific Interreg projects will be discussed accordingly, providing insights of the benefit it (can) provide in terms of urban planning education and

applied science approaches.

2. Understanding Interreg projects in terms of educational benefit

INTERREG IVB NWE is a financial instrument of the European Union's Cohesion Policy which funds projects that support transnational cooperation with the aim to find innovative ways to make the most of territorial assets and address shared problems of member regions 2012).

North West Europe (NWE) is a cooperation zone of eight countries: France, Belgium, Netherlands, Luxembourg, Germany, United Kingdom, Ireland, and Switzerland. It is a dynamic area within Europe, offering strong territorial assets as opportunities for further development on the one hand, but suffers from common environmental, social and economic pressures on the other hand. Both the opportunities and the pressures are neither confined by national governments nor by administrative boundaries and necessitate joint interventions. The European Union funds projects with an aim to facilitate such interventions, adding value through transnational cooperation in strong partnerships.

Four priorities of intervention were identified for the 2007-2013 period, namely innovation, environmental challenges, connectivity and promoting strong and prosperous communities.

The focus lies on innovative approaches and developing strategic projects to enhance innovation. The project results should be clear, definite, and measurable. In other words tangible results through actions, pilot investments, business cases or scenario developments, which should guarantee concrete, on-site, and long-term interventions. In this sense, linking to the objective of applied science.

All the projects abide to the basic project life cycle, involving matters such as background context, planning, resources, schedules, administration and implementations. The projects address complex issues (due to the transnational or interregional cooperation characteristics of the projects), including cultural differences between regions, different languages, different levels of administrative competences and resources between regions, physical distance between players and difficulties in defining the mutual objectives of the cooperation and common working methods. The typical cooperation project process is illustrated in the following figure:

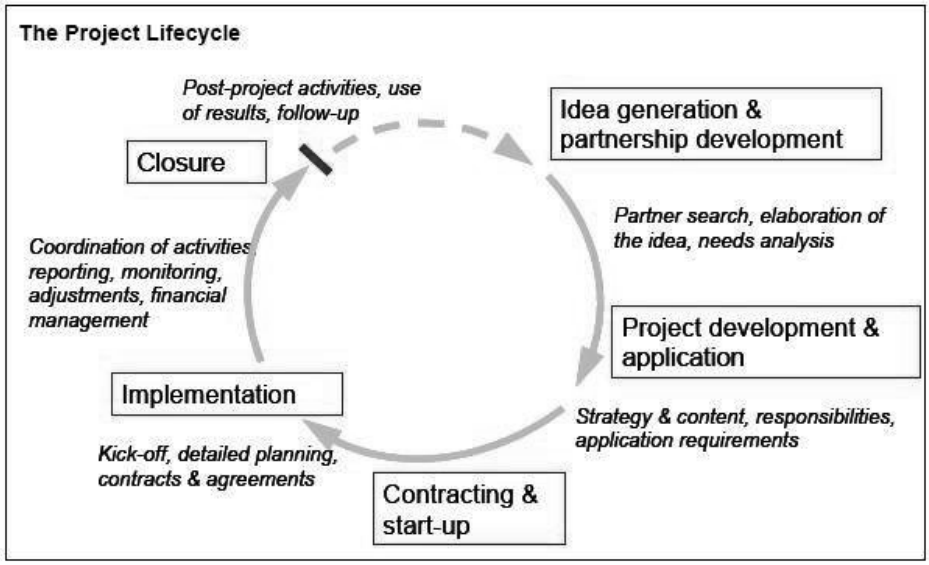

Figure IV: The project lifecycle
Source: Interreg IV (2007), Kacprzak (2010:16).

The projects create possibilities for an interface between practice and theory, mainly because project teams are made up of practice-orientated stakeholders (developers, local authorities, planners etc) and theory orientated-stakeholders such as universities. In this sense the projects are objective and ethical, not driven by financial gain or a political agenda. Furthermore, the

inclusion of Universities within the project scope, create opportunities for lecturers to incorporate project objectives, case studies and new material in current modules. The student input, ideas and "out of the box thinking" is diverted back to the Interreg Project and in various cases seemed to contribute to the creativity and innovation which was captured and originated by the project itself. A vice versa benefit was experienced in most cases and projects.
The two projects which were specifically included as part of the research for this article is the LICI (Lively cities) project and the VALUE (Valuing attractive landscapes in the urban economy) project, which will be explained in the following section with the aim to identify the specific challenges and approaches applicable to these project individually, and link it to the context of applied sciences and urban education benefit experienced.

3. Specific Interreg projects linked to urban education

VALUE (Valuing attractive landscapes in the urban economic) is a European Interreg partnership project aiming to demonstrate the economic value of green infrastructure in cities and regions. The project brings together nine project partner organisations in Belgium, Germany, the Netherlands and the United Kingdom. The objective of the project is to plan for, and protect green infrastructure investments in cities and regions, in order to deliver the greatest economic benefits.
The focus of the project is to provide quality green infrastructure, vital to support strong and prosperous communities. This is especially important as recent development trend suggest green-spaces are being replaced by urban developments, mainly because of the market value connected to the urban developments, but also because green spaces are seen as having less value than other land uses. By promoting awareness of the value of green infrastructure and attractive landscapes VALUE aims to help raise the importance of creating quality green spaces (Value, 2012), not only from a social (community cohesion) and environmental (ecological) perspective, but also from an economic (spinoffs due to added value of green spaces) perspective (Cilliers et al, 2010).
This project is link to the theory of evaluation in terms of the basic logic of evaluation, which refers to different types of value claims. In the VALUE project, market value was used as a type of value claim with a specific legal status and definition (Scriven, 2007:5). Market value was found to be subjective, relying on peoples preferences, willingness-to-buy and personal valuation. Therefore the real estate value was also used as a different type of value claim. The real estate value was found to be objective, revealing the 'real' value, defined as the most probable price (in financial terms) which a property should bring in a competitive and open market, assuming the price is not affected by undue stimulus (Scriven, 2007:5). The third value claim that was used in the VALUE project, was public value. Public values try to establish in a way if a project will be inter-subjectively acceptable, as for example when it is to be paid for with public money, or is intended to receive public acknowledgment (Scriven, 2007:8).
By means of these value claims the project evaluated three methods used to plan for green spaces, namely the Workbench method, the Green Credit method and the Value Added Planning method (Cilliers et al, 2010; Cilliers et al, 2011a, Cilliers et al, 2011b). The methods were tested in practice in selected case studies, to determine the effectiveness and anticipated success of the methods. Evaluations were done objectively by the university research team, not binding them to any political or ethic agendas. International literature and theories provided the platform upon which the evaluation process took place.
Recommendation were made (based on theoretical findings) to enhance to functionality and effectiveness of the various methods used in the project. The recommendations were not tested in practices, but remained a theoretical guidance to the methods, for future use.
The project approach was practice-orientated, linking backwards to applicable theories and literature (as opposed to basic research approaches being driven by theory). The practice

guided the science at first, identifying situations (case studies) and interventions (developments), but applied science addressed the shortcomings of the practice by recommending changes (based on literature).
Students at Van Hall Larenstein, Wageningen University in the Netherlands formed part of this project and practice-orientated approach to research. The objectives of the Interreg project was linked to urban education in the sense of student projects based on the theme of research. Students were educated in the new developments in terms of green-planning and given academic freedom to conduct their own studies in order to determine the value of green spaces in the urban environment. A new approach to valuation arose from the student input, guiding the end-result of the Interreg project findings. Students were able to test theory in practice, whilst at the same time applying new knowledge to situations, thus practicing applied science. Applied science cannot be taught in a class room, but the Interreg project made it possible to link urban education and applied science, benefitting both parties.
LICI (Lively cities) is a European Interreg partnership project aiming to reclaim public space for public use by using place-making and place-management approaches. The project enhances a bottom-up design approach instead of a traditional approach, where the design of public spaces is focussed on the needs of actual and potential users. The projects brings together eight partners from four different countries, Belgium, the Netherlands, France and the United Kingdom, all working together, sharing expertise, experience and knowledge to set up pilot tests, actions of place-making and long-term structures of place-management (LICI, 2012).
The research team includes a wide variety of stakeholders, each with different expertises, covering the spheres of public consultation, ecology, culture, performing arts, sustainable development and environment, heritage, green landscape, urban renewal, communication technologies, design, town centre management, place making, and tourism.
The project approach was theory-orientated, starting with a theoretical investigation to all guiding theories and literature on place-making and place-management (following the basic research approach). Partners were briefed about best practices, design methods, and concepts applicable to the project, as derived from the theoretical investigation. Case studies were then identified by the partners (in their own city), focussing on a misused, underused or non-used public space. The aim was to link the theory to practice, by testing (implementing) the various methods derived from literature, within the specific spaces. The methods were evaluated by the partners, based on the possibility of the method to transform empty, damaged public spaces into long-term lively places for communities (LICI, 2012). The case study evaluation, as well as the changes observed in the spaces, guided the amendment and recommendations made to the theories applicable to place-making and place-management processes. Students at Van Hall Larenstein, Wageningen University in the Netherlands were part of the project and had the opportunity to test the theory of lively cities in their own environments. The science was initially applied in practice, evaluated and either confirmed as true, or amended according to the findings in practice (Cilliers et al, 2012). Final year student reports were conducted on the theme of research, and it created a sense of interest among students to further them within this theme of research. The Interreg project in this sense contributed to the education of students as it broaden their horizons, their scope of thinking, their career opportunities and mostly their ability to link theory in practice (applying science). Applied science cannot be taught in a class room, but the Interreg project made it possible to link urban education and applied science.
The following section explains how the Interreg projects furthermore contributed to the education and understanding of research approaches linked to applied science.

4. Interreg projects contributing to understanding research approaches

Apart from the practical benefits that both the LICI and VALUE Interreg project had in terms of education and linking theory and practice, it also contributed to the education of students by given them an opportunity to experience different research approaches applicable to the different projects.
The LICI project followed the traditional research approach, applying theory to practice. Guiding theories and literature on place-making and place-management guided the practical

approach and intervention in the different spaces by means of identified planning methods, design tools and approaches. The changes in the spaces were evaluated, linking it back to the success of the methods, tool or approach used whilst planning for the space. The findings were used to compile a best practice analysis, guiding future theories on place-making and place-management.
The VALUE project followed a reversed research approach, linking practice to theory. Methods and tools (which were already used by the Amersfoort Local Municipality) were tested in practice. The methods and tools were then compared and evaluated in terms of guiding literature. Objective findings were made based on the anticipated outcomes and success of tools and methods used in the practice. The project findings were not linked back to literature, but used to guide the refinement of the tools to be used in the future.
FigureV illustrates the research process followed in the LICI and VALUE projects, focussing on the linkages between theory and practice, as was taught to urban planning students, as a result of their part within the Interreg projects.

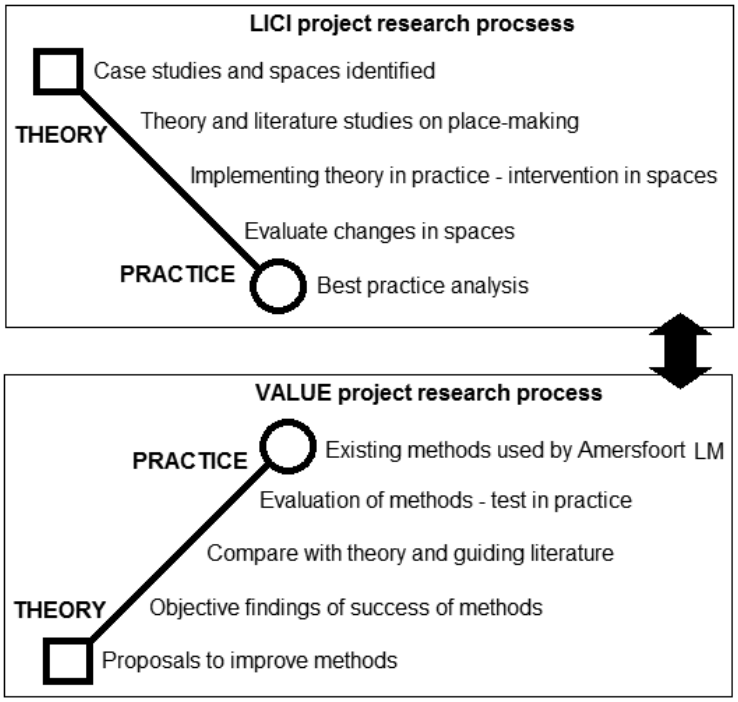

Figure V: Comparison between LICI and Value research processes
Source: Own creation (2012).

Applied science formed an integral part of both projects, even though the approaches of the two projects were different. This difference in approach actually contributed to the education and understanding of the complexity of the research process. Students were able to experience "applied science" in terms of the coordination of the projects, stakeholder involvement, participatory roles and the bridge between theory and practice. These factors will be explained accordingly to clarify the statement.

4.1 Understanding vertical and horizontal coordination

Applied science implies science, theories, being implemented in a variety of practical environments and accepted among a range of role players within these environments. The implementation and acceptance of the science is subject to vertical and horizontal communication structures, and vertical and horizontal planning and design approaches. As cooperation is a two-way process of communication between all stakeholders contributing towards joint project development, the appropriate allocation of responsibilities of each of the stakeholders should be clear (Kacprzak, 2010:24). This integrated approach, refer to as vertical

and horizontal coordination, creates a platform for the successful implementation of the theory in practice, and acceptance of the theory created by the participatory processes.
Vertical coordination relates to the consultancy and involvement of different levels of stakeholders (administrators, planners, government), with the aim to avoid conflicts and ensures a high level of harmonisation of activities carried out at different levels. Horizontal coordination relates to the involvement of wide range of stakeholders at all the levels (Kacprzak, 2010:22).
Both Interreg projects (LICI and VALUE) enhanced vertical and horizontal coordination, by ensuring a good partnership mix, representing all relevant levels of stakeholders. Vertical coordination ranged from communities encountered in the local case studies, to local and national authorities guiding planning and development, to European authorities providing the Interreg project platform, to international coordination with other project partners collaborating in each of the projects.
Horizontal coordination ranged from local municipalities involved in the broader planning of the specific space, to businesses and NGO's involved in the financial side of the planning of the space, to collaborating universities conducting research on the topic of interest, to students conducting participatory planning processes, to individual community members participating in the participatory processes. Figure VI illustrates the vertical and horizontal coordination brought along by the Interreg projects to address applied science within the projects, taught to, and experienced by the students involved in the projects.

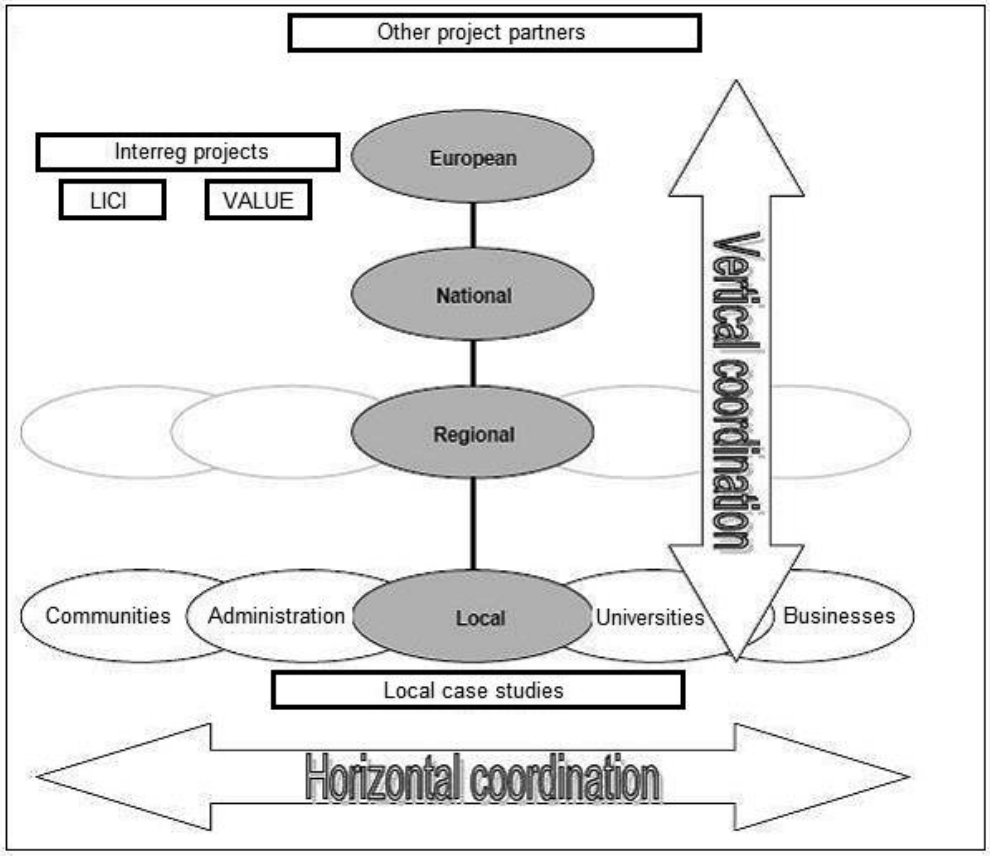

Figure VI: Vertical and horizontal coordination
Source: Adapted from Kacprzak (2010:23).

Both the LICI and VALUE projects included clear stakeholder identification processes, based on the participation ladder. The participation ladder distinguishes between the different levels of community involvement within a project, ranging from informative (participation only to

receive information from authorities) to co-operative (where authorities, communities and stakeholders are jointly in decision-making process) to an equal-rights-level (where final results are subject to equal preferences of authorities and the local communities). In this sense, the Interreg projects created a platform to apply science, based on the project and research process followed in the two Interreg projects, LICI and VALUE. It addressed the fact that science can only be applied in practice, once all stakeholders are identified, and clearly understands their role and function within the participation process.
The vertical and horizontal coordination brought along by the objective of the Interreg project contributed to the applied science approach and gave students the opportunity to understand these coordination complexities and importance.

4.2 Acknowledging stakeholders

Stakeholders can have an essential influence on shaping the ideas, gaining support for a development project and successful implementation and use of results. In this sense, stakeholders are directly linked to the applied science approach. If stakeholders did not buy into the idea, the theory will not be successful in practice, as the science would not be applied by them (the stakeholders), the actual users of the space. Effective stakeholder involvement is critical for project communication, publicity and mainstreaming of results, but also for ensuring applied science.
Both the LICI and VALUE projects were strongly focussed on identifying relevant stakeholders and involving them in participatory processes. Innovative methods and techniques for conducting participation processes were captured in both these projects. The projects illustrated the need to include both experts (organisations, authorities, developers, planners, specialists etc.) and non-experts (community members, users of the spaces) in the participation process as both these parties contribute to the planning process in a unique way. Along with describing the complexities of the participation process, both the projects (LICI and VALUE) identified practical steps to implement innovative, participation processes as part of the planning process to plan for economic green spaces (VALUE), or lively spaces (LICI). The outcomes of both the LICI and VALUE projects therefore addressed applied science in this regard. Students had the opportunity to be part of the actual stakeholder involvement processes, creating possibilities to test the theoretical class room knowledge in practical situations.

4.3 Opportunity to bridge theory and practice

The final and probably greatest contribution of the LICI and VALUE projects in terms of applied science, was observed by the linkage and bridge it created between theory and practice (backwards in the case of the VALUE project and forwards in the case of the LICI project). The projects created an opportunity to test certain theories in practice, evaluate the results and the science behind the process of thought. The Interreg projects have a strong practical component as project outcomes should include evidence and proof of the local benefit as a result of the project. The actual space (development area) is evaluated by a range of stakeholders, to determine the effectiveness of the project after implementation. If the project fails to implement, the project is not successful. There is also a strong theoretical link, as universities form part of the core research teams. Research and literature is used to guide the practical implementation and address best-practice situations. The constant interaction, created by the vertical and horizontal coordination, creates opportunities and possibilities to bridge the theory practice gap. The Interreg projects create the ideal environment to link theory and practice in an innovative and creative way. This experience cannot be taught in a class room and the Interreg project contributed to the quality of education, along with practicality and insight gained by the students.

5. Education can benefit from practice, as practice can benefit from theory

"All knowledge, in the context of its application, has not only an empirical or theoretical, but also a normative content" (Ulrich, 1983:20). Knowledge and expertise must do justice to the theoretical but also to the normative dimension (Ulrich, 2008). The Interreg projects (in this