

expected impacts of the project. It can be qualitative or quantitative. Qualitative checklists show the expected impacts in relation to several environmental aspects. Quantitative checklists use coefficients and formulae to assess the impact made upon the environment.<sup>14</sup> Different types of checklists can be recognized, from purely descriptive to more quantitative in the identification of expected impacts.<sup>15</sup> The limitations of a checklist approach are due to its generality, and for this reason it is employed when a full and in-depth analysis of impacts is not required. The types of project which can be assessed using the checklist technique are, for instance, those involving water resources, for example housing projects which might alter natural water habitats. Leone and Marini recommend the use of indices to describe the ecosystem situation before and after project implementation.<sup>16</sup>

The *matrix technique*, allowing cross-analysis between the activities of the projects and the environmental characteristics of the area where the project is to be implemented, includes the consideration of the cause and effect relationships. The differences between matrices are due to the quantity and quality of variables included in the matrices. The environmental characteristics are usually classified in three categories: physical and chemical features, biological characteristics and social variables. Matrices have been used to assess the environmental impacts produced by large scale projects such as airports or major urban regeneration schemes.

The *overlay technique* is a cartographic method. Several thematic maps are overlaid in order to describe the environmental quality of the area and to verify whether the project is compatible with the characteristics of the area. The techniques developed by McHarg can be included in this category.<sup>17</sup> The basic procedure is based on the preparation of several maps, showing the environmental components which are expected to be affected by the development project. Each map is shaded according to the degree of impact caused by the project on

the environmental component considered. The shadow will range from the lightest tone to indicate no impact to the darkest tone for significant negative impacts. Then these maps will be superimposed showing the areas in the darkest tone as unsuitable for the proposed development. This technique has been further improved with the development of Geographical Information Systems (GIS), which allow the handling of a great deal of data. In addition, the use of GIS enables the construction of several hypothetical scenarios of development in a shorter time than doing it manually. The limits of this method are threefold. Firstly, it does not assess secondary impacts. Secondly, there is no distinction between reversible and irreversible impacts. Finally, it does not take account of whether the impact takes place or not. Despite these limitations, this technique is suitable in the case of new urban housing developments, for instance, to give information on the types of soils or the natural habitats affected by the development.

Methods of impact identification based upon the use of *networks* try to estimate project impacts using, as the starting point, the single actions which form the project. Each action generates direct, indirect and primary and secondary impacts, which this technique tries to depict. According to Glasson *et al.* this technique can only be used to nominally identify impacts, since it does not give insight into the magnitude or significance of impacts.<sup>18</sup>

*Quantitative techniques* are based on the production of indices to measure the changes caused by the project. The technique developed by the Batelle Columbus Laboratories identifies a score for each of the four components of the environmental impacts to be assessed, namely: ecology, environmental pollution, aesthetics and human interest. The aim is to assess through mathematical functions the changes induced by the project. If the new score is greater than the original one there is a negative impact.<sup>19</sup>

The important issue is which technique is relevant for urban design schemes. This question is