Prerequisites and Examples of Applying the Logic of 'Problem Tree' and 'Goal Tree' in the Process of Planning Long-Term Development of Seaports

Michał Pluciński
University of Szczecin, Poland

Planning and long-term programming are important instruments for adapting the largest seaports to the changes occurring in their external environment (particularly to the changes which result from the ongoing transformation processes in conjunction with the Polish economy, Poland's EU membership and influence of globalization processes).
The analyses of seaports known to the author of this work have used components of the logic of 'problem tree' and 'goal tree' only to a limited extent.
Performing a problem analysis (problem tree) and goal analysis (goal tree) with regard to the plans and development programmes for the largest Polish seaports would facilitate combining components of three key planes within the framework the ports can be examined, i.e.:

- plane of economic and non-economic attributes of the seaports,
- plane of economic functions they serve,
- plane of seaport structures including their microstructures, mesostructures and macroeconomic structures.

Keywords: seaports, development, planning.

1. PLANNING IN THE OPERATIONS OF SEAPORTS

The current academic record as well as practice in this respect lead us to a statement that plans for the development of seaports are prepared at three main stages:

- national (national port system)[1],
- particular port (master plans, strategies developed by seaport managing entities),
- particular enterprises operating on the seaport land (transshipment-storage and industrial areas).

A process of long-term planning can be started with formulation of general port development goals (its visions and missions). Lower level goals can also be formulated, but one should bear in mind that once the analysis stage has been passed through, verification and follow-ups to the formulated goals are necessary. The current practice regarding formulation of the most general goals relating to the development of seaports shows that their content refers to three key planes (attributional, functional and structural - sometimes combined as two or three planes) within the framework of which the operations and

[1]On 24 November 2009 the Council of Ministers adopted a document developed by the Ministry of Regional Development entitled "Plan of ordering the development strategy" and confirmed that it is necessary to reduce the number of strategic documents. It suggests that the number of strategies (the so called target development strategies for the short-term and long-term strategies with regard to the national development) should be optimized and reduced down to nine. The nine strategies include the Transport Development Strategy which also pertains to the issues relating to the development of sea transport and seaports. The executory document in relation to the TDS concerning issues pertaining to the seaports is the "Strategy for the development of seaports by 2020 (with perspective by 2030)".

development of the largest Polish seaports can be examined[2].

One of the first stages in fulfilling a long-term plan for the development of seaports is identification of trends in changes to the environment[3]. This identification is a basis for formulating port development goals in terms of changes to its main function attributes and economic structures. The complexity of the very port operations and their relations to the entities located in their immediate or general environment make an analysis of seaport stakeholders**,** which is one of the so called 'methods of general research into enterprises' (a complex of enterprises in our case), a useful instrument applied before other analyses are performed. It allows to identify stakeholders of key importance for the analyzed seaports (secondary stakeholders)[4]. Identifying external stakeholders of key importance enables to perform in-depth analyses in relation to the group of external stakeholders in the largest Polish seaports. [5]

Because of the role the seaports play in economy and their position in the transport system an analysis of changes in commodity markets and transport markets is of crucial importance to the prediction of their development. An analysis of commodity markets which are important for maritime trade should include changes to the primary and secondary seaport markets, with regard to the subject aspect (trends in changes within the main cargo groups or particular loads)[6] and directional aspect (including the issue of balancing directional cargo handling)[7].

In the analysis of trends in changes to the transport markets, the research should examine both trends in the market of sailing services and transport markets which provide services for the seaport supply base. In the case of sailing services market one should take into account changes made to the most important parameters of vessels, arrangement of sea transport processes, technical and technological changes, progressing liberalization of the sailing markets, changes resulting from reducing the negative impact of sailing on the environment and human health and life, new sailing routes[8]changes in the subject aspect of the sailing services market (including integration of ship owners) or increase in danger to the safety of sailing. However, the analysis of trends in changes to the transport markets providing services for the seaports' supply bases includes changes related to the participation of particular transport branches which result from changes made to the subject structure of cargo used in maritime trade or resulting from competition between land-sea transport and direct land transport, atomization (fragmentation) of load suppliers and recipients, the role of 'time' factor in general cargo transport, which particularly applies to general unit load. Apart from the autonomous changes to the cargo and transport markets the analysis should also examine changes of integrated

[2] The attributional plane (competitiveness/competitive position) and structural plane (national transport system/national economy) are the most common.
The research was based on the documentation developed within the last ten years regarding the rank of development strategy relating to the ports of Gdańsk, Gdynia and Szczecin-Świnoujście seaports as well as the entire Poland's port system.

[3]S. Szwankowski and A. Tubielewicz have placed this stage of seaport planning on the third position after formulation of goals (visions, missions) and identification of current tasks as well as strategy of operations. Cf. S. Szwankowski, A Tubielewicz, Planowanie strategiczne w portach morskich [Strategic planning in the seaports], Wydawnictwo Instytutu Morskiego, Gdańsk – Szczecin 1992, pp. 16 – 17.

[4]As cited in: edited by M. Porada-Rochoń, Restrukturyzacja przedsiębiorstw w procesie adaptacji do współczesnego otoczenia [Restructuring companies in the process of adaptation to the modern environment], Difin, Warsaw 2009, p.41.

[5]Apart from such methods as PEST, PRESTCOM and DEEPLIST analyses, surrounding scenarios, key success factors, benchmarking. Cf. I. Penc – Pietrzak, Planowanie strategiczne w nowoczesnej firmie [Strategic planning in a modern company], Wydawnictwo Oficyna, Warsaw 2010, pp. 77 – 141.

[6] Regarding part of the cargo groups or particular loads there are trends which both diminish and strengthen their participation in maritime trade (e.g. - trends in changes taking place in the raw materials market).

[7]This kind of analysis is prepared by UNCTAD and other bodies. One of the examples include the UNCTAD Transport Newsletter 38, UNCTAD, Geneva 2007. The reports with regard to the changes in sea transport directions are also produced by consulting companies - see, for example, Price Waterhouse Coopers, Economic Views: Future of the Word Trade: Top 25 Sea and Air Freight Routes in 2030, 2011.

[8]The Northern Sea Route is a good example. As soon as sailing via this route became operational the route linking Europe and Asia got shortened considerably. For example, creating such an alternative for sailing through the Suez Canal had its impact on reactivating some Swedish iron ore mines which were closed down in the 90's of 20th century.

nature (components relating both to the cargo and transport markets), which can be illustrated with an example of the development of global delivery chains, intermodality and logistic concept.

The analysis of competitive environment is an analysis which relates to the main attribute of seaports which is their competitive position.

The complexity of port operations presented in elementary port literature persuades us to analyse both the most important external stakeholders of seaports and their resources as well as their internal stakeholders. Bearing in mind the fact that a modern seaport is a complex multifunctional object involved in a broad spectrum of business activities it would be extremely difficult to perform an analysis of all its components. An answer to these complexity issues can be the above mentioned analysis of internal seaport stakeholders including selection of key stakeholders.

Identifying and analysing the largest Polish seaports' own resources includes primarily the following:

- land resources which the ports own both within their administration (unused until now or acquired through revitalization) or in the vicinity of seaports (to be included in the administration in the near term),
- property resources - the existing port infrastructure and suprastructure; because of the primary nature of the infrastructure component and its much higher capital absorption as well as time consumption with regard to its production the analysis should primarily include all infrastructure components[9], not only in quantitative terms (length), but also in qualitative terms (extent of wear and tear, depth, direct connection with the land where cargo can be stored),
- human resources - both private sector labour force (full time employees of the operational entities and temporary workers employed in these periods of time when port operations are intensified) and public sector labour force (of the managing entity, maritime administration and national inspection personnel).
- financial resources - financial situation of the port operational entities, capacity of the port managing entity to finance infrastructural investments with their own resources.
- knowledge - technological and organizational as well as economic knowledge which is required by the ports to operate, enterprise, i.e. the so called knowledge extended with a set of specific character qualities which provides an opportunity to organize port resources and thus establish profitable undertakings, make unconventional decisions indicating which direction these undertakings should follow, increase creativity, modern forms of work organization, management, take a risk related to conducting business activities.

The SWOT (strengths and weaknesses, opportunities and threats) analysis is a synthetic and a the same time comprehensive analytical approach to both internal environment of the ports (ex post) and external environment of the ports (ex ante). It also seems to include combinations of components relating to the attributes of seaports, economic functions they serve as well as structures (micro, meso and macro) within the framework of which one can examine how the ports operate. With regard to the subjective aspect the analysis includes a broad spectrum of issues relating to the operations performed by the seaports, but it does not take up a challenge of demonstrating what consequences result from the existence of weak sides of a seaport in cause and effect terms.

2. USING THE TECHNIQUES OF 'PROBLEM TREE' AND 'GOAL TREE' IN PLANNING AND PROGRAMMING A LONG-TERM DEVELOPMENT OF SEAPORTS

As I said in the introduction the current practice of planning/programming the development of Polish seaports has used the analytical logic of 'problem tree' and 'goal tree' only to a small extent. A premise for changing these circumstances and using the 'problem tree' analysis more widely in plans/programmes relating to the future of the port system could be lack of reactions from the ports and local action decision-makers to the economic and social attributes of Polish seaports undergoing changes resulting from transformation, international economic integration and globalization. This incompatibility can result in negative consequences for the functional area, low level of attributional fulfilment and decrease in importance of the ports to the economic structure. Figure 1 and 2 are examples of 'problem trees'.

[9] If infrastructure of appropriate parameters is available and there is demand for port services suprastructure is this component which can be relatively quickly complemented with less expenditure in comparison to infrastructure.

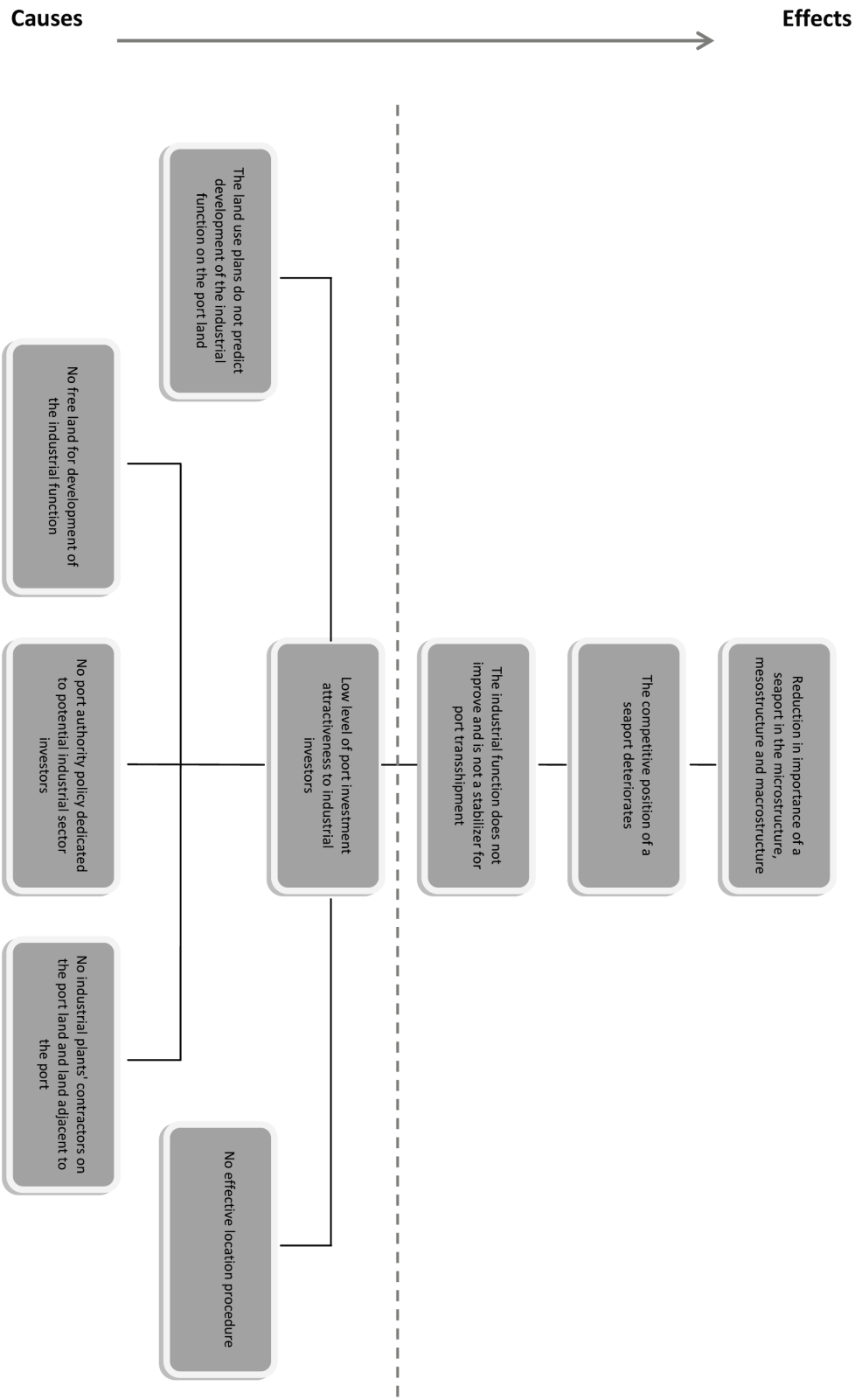

Fig. 1. Example of a problem tree 'weak development of the port industrial function'
Resources: own work

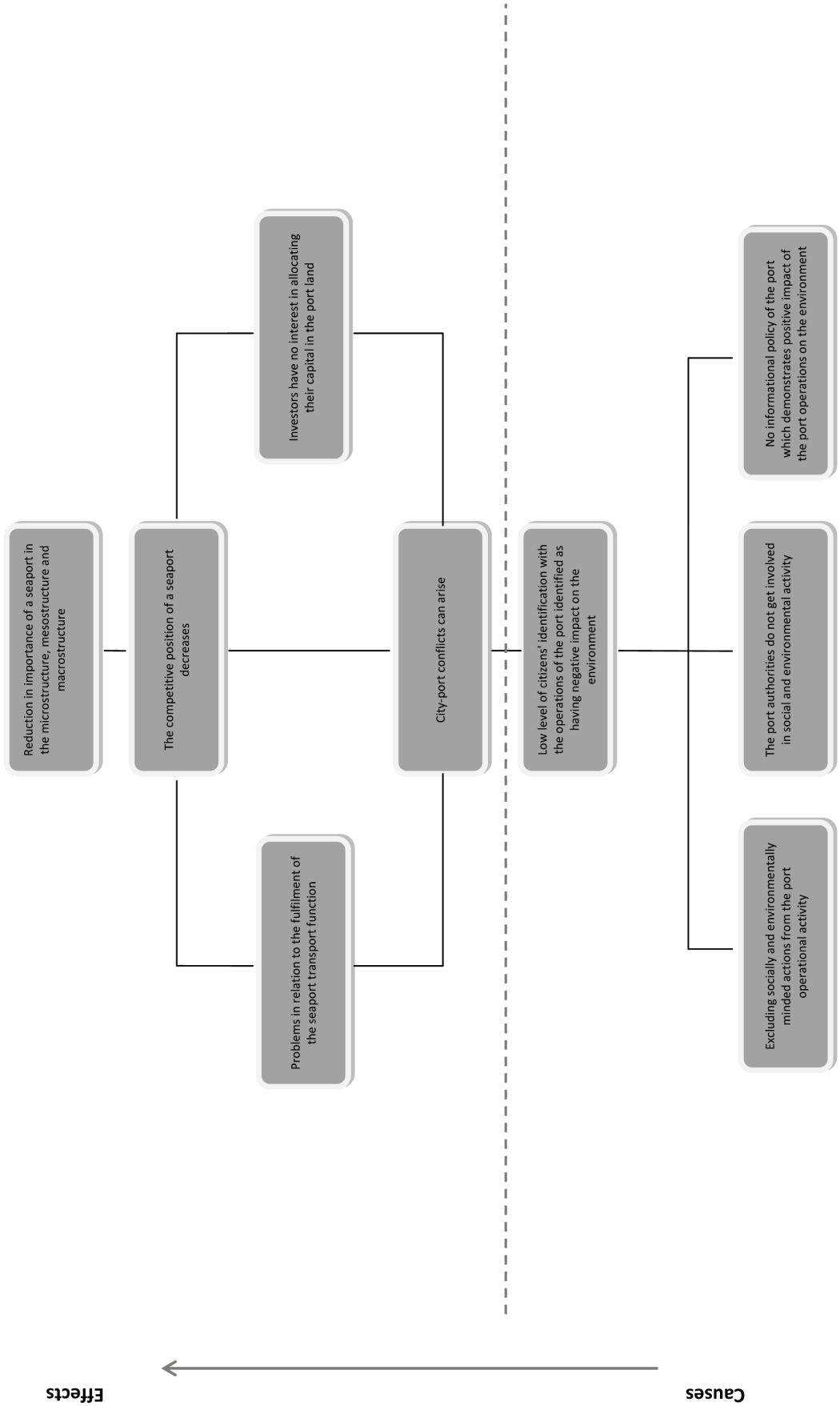

Fig. 2. Example of a problem tree 'low level of the seaport's social responsibility'
Resources: own work

Performing analyses pertaining to the key areas and external stakeholders as well as the resources and internal stakeholders along with formulating opportunities and threats is a basis for conducting a review and complementing goals formulated at the initial stage of planning. One can also adopt a logic of conduct in which at the initial stage of works on planning only a port development vision and mission are formulated, but the remaining goals are defined after the analysis stage is completed.

Normally, in the case of a long-term seaport development plan the primary goal and detailed goals are formulated. The latter goals can be formulated within the framework of analysed planes (functional, attributional and structural). Table 1 includes examples of such formulated goals.

Table 1. Examples of goals of the development of Polish seaports

functional plane	attributional plane	economic structure plane
▪ development of terminals handling port cargo in response to the requirements of cargo administrators ▪ development of industrial plants on the port land ▪ development of distribution terminals and distribution-logistics centres on the port land ▪ development of manipulative-commercial activities in relation to general and bulk cargo terminals	▪ creating favourable conditions for cargo administrators and organizers of complex transport processes in order to use the port ▪ creating favourable conditions for potential investors who are interested in allocating their investments in the port land ▪ reaching a high level of innovative creativity with regard to various areas of port operations ▪ attaining a status of 'socially responsible port'.	▪ reaching a high level of seaport resources utilization ▪ increase in importance of the ports as regional and local poles of social and economic development, ▪ reaching a higher rank of seaports in the national transport system and in the system of international transport corridors.

Resources: own work

Actions which are necessary for achieving the established goals with regard to the analysed group of seaports can be narrowed down to actions taken by the public and private sectors. Actions in the competence field of the public area in the port sector are of primary nature in relation to the actions carried out within the private sector[10].
Functionally and spatially these actions refer to:

- the land of particular ports (within their administration or in the part under port managing entities),
- components of the national transport infrastructure located outside the seaport land but also playing a key role in their development.

Generically, these actions can be divided into[11]:

- investment actions (due to the location of seaports at the junction of two environments - water and land - and the economic functions they serve, investment actions in conjunction with port infrastructure development, restructuring and modernization as well as access to the ports from their hinterland and foreland play a key role),
- non-investment actions (legislative, organizational, promotional and others).

Time integration with regard to the investment action initiatives undertaken both in relation to the port access and the ports themselves is an extremely important issue. Such an approach allows projects in progress to achieve their planned functionality[12].

Appropriately selected indicators are related to the assessment of fulfilment of the formulated goals and tasks (actions) within the framework of identified planes. Table 2 presents examples of indices which will be attained through the fulfilment of planned goals.

[10] A good example is investments of the private sector in the port suprastructure which are rational and economically justified only when infrastructure of specific parameters is established.

[11] The directions of these actions are presented in the Program for the development ... op. cit. and M. Pluciński, Polskie porty morskie w zmieniającym się otoczeniu zewnętrznym [The Polish seaports in the external environment undergoing changes], Wyd. CeDeWu, Warsaw 2013, p. 240 and subsequent pages and p. 269.

[12] For example, deepening the waterway access to a port from the sea should result in deepening its port channel and berths located along the wharves which are used most frequently.

Table 2. Examples of indices relating to the fulfilment of Polish seaports development goals

functional plane	attributional plane	economic structure plane
▪ general port cargo handling volume and with regard to specific cargo groups, ▪ contribution to the general port cargo handling created by the port industrial plants and distribution terminals and centres, ▪ range of manipulative and commercial services provided by the ports, ▪ volume of transit cargo handling or their contribution to the general port handling,	▪ contribution of the ports to port handling performed in a particular market, ▪ number of new, acquired investors (or value of investment) against the background of competitive ports, ▪ number of investments which received a positive approval of communities living in the port vicinity, ▪ number of integrated, land/sea/land transport chains or delivery chains put into operation with the participation of ports researched in the analysis.	▪ volume of port handling in relation to 1 ha of the port land or 1 m of a wharf, ▪ contribution of the Polish seaports to Poland's sea trade handling, ▪ added value volume (or contribution to PRB) created by operations of the port or other related operations ▪ contribution of the port labour market and employment which is indirectly connected to the operations of seaports and the so called induced employment in the labour market of a port industrial area and region.

Resources: own work

Apart from the assessment performed with the use of the above mentioned indices one can assess the influence of undertaken investment and non-investment actions on the fulfilment of the goals (in terms of attributes, functions and structures) which, neglected in the past, made a base for developing a 'problem tree'. The consequences of changes within the range of those factors can be illustrated with a 'goal tree'. Figure 3 and 4 are examples of 'goal trees'.

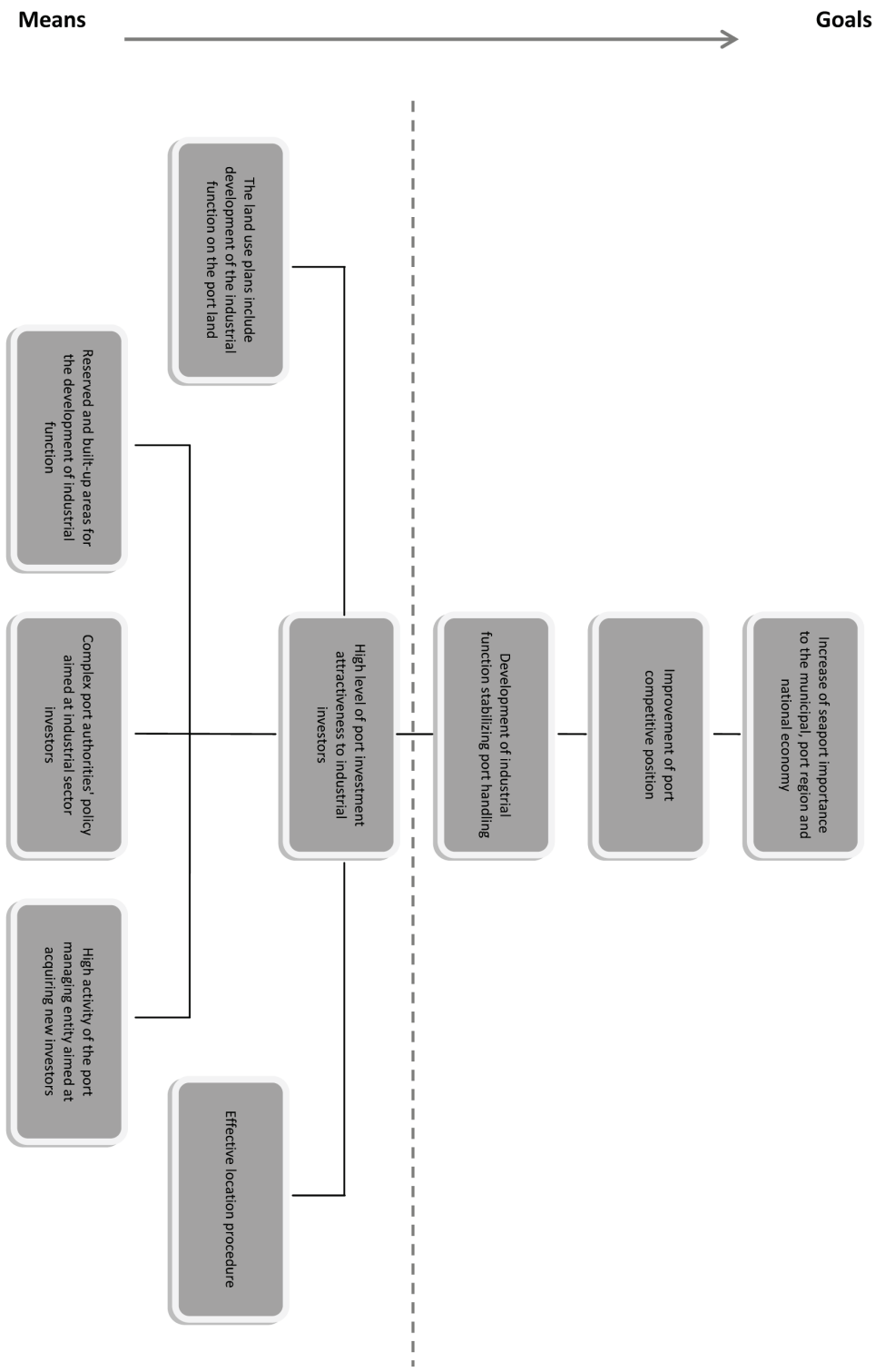

Fig. 3. Example of a goal tree 'development of the port industrial function'
Resources: own work

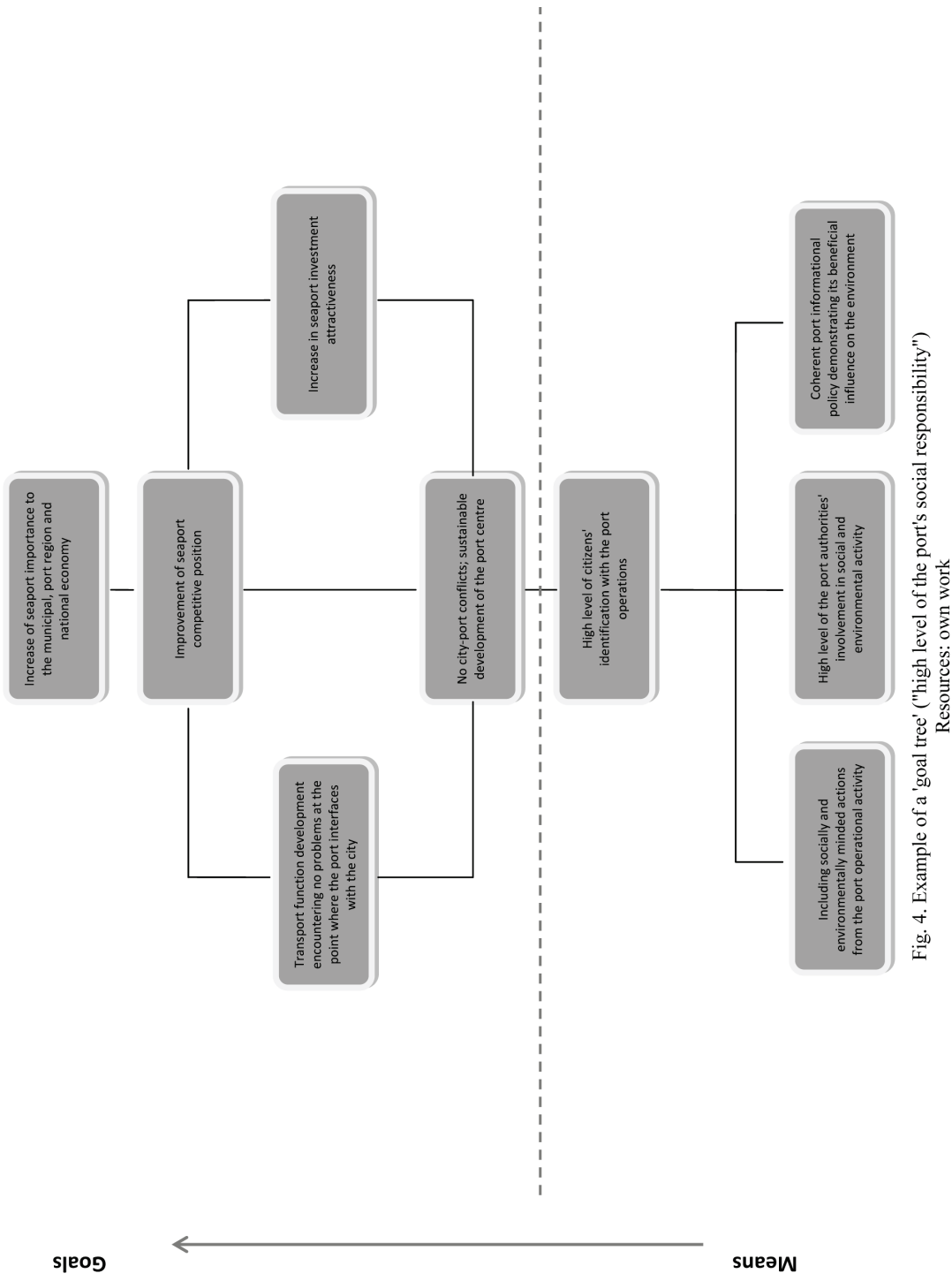

Fig. 4. Example of a 'goal tree' ("high level of the port's social responsibility")
Resources: own work

In these cases applying the 'goal tree' technique can be treated as if it was some sort of a litmus test in legitimacy and cohesion of investment and non-investment actions undertaken both in the seaports themselves and by the public administration decision-makers of different ranks.

3. CONCLUSIONS

Applying the logic of 'problem tree' and 'goal tree' in the long-term planning of the seaport development results from combining economic and non-economic attributes of the seaports, functions they serve and structures, within the framework of which the ports can be examined, into logical cause and effect deliberations. A selective approach to the functions, attributes and structures, within the framework of which the Polish seaports can be examined, used in such analyses as SWOT analysis can be complemented with more complex deliberations and thus providing a better illustration of complexity of the factors affecting increase or decrease in the importance of seaports to the national transport system. One should have hope that such analyses will be used in the future in the plans and programmes for the long-term development of Polish seaports formulated at different structure levels (from the scale of specific ports to the level of programmes for the development of Poland's port system).

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Michał Pluciński
University of Szczecin, Poland
michal.plucinski@wzieu.pl