CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This work proposed the development of a generic model-based synthesis for optimization of water/wastewater networks through the framework of Quaglia (2013) and emphasized on a more efficient design of industrial applications for WWTN with water recycling option.

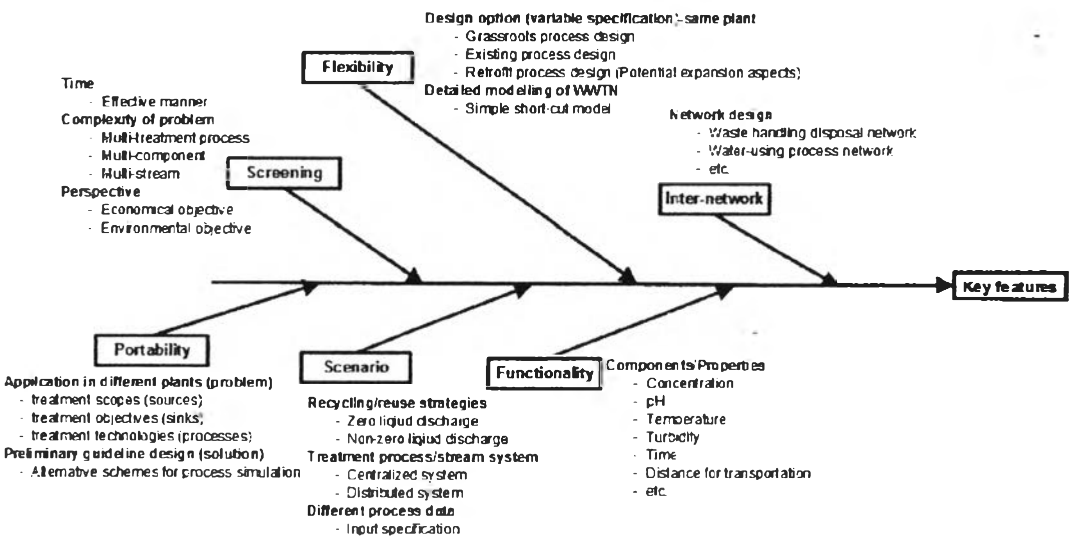

Figure 5.1 Fish bone diagram of key features for developing this approach and further work.

To summarize, the main key features (Figure 5.1—only white boxes) of the developed approach are:

– **Screening:** a large dimension of problem is compared at their optimal point to identify optimal WWTN for different objective in an effective time manner.

– **Scenario:** different process scenarios are rapidly evaluated by varying input data –without modifying the model structure, i.e. new strategies, and even treatment process/stream system.

– **Flexibility:** the model can be used both for new system as well as for retrofit design processes through detailed modelling of WWTN by changing variable specification.

– **Portability**: the model can be quickly adapted to any specific WWTN problem of different plants and their solution can be applied for future detailed treatment process design in process simulation.

Referring to the application from the developed approach, PTT Global chemical wastewater treatment plant (case study) was studied through the method described above by considering both design of the base cases (for existing process and grassroots process) and their retrofit design. The new application of WWTN synthesis and design based on the specific problem of the case study were considered and studied for different scenarios under two main criteria with respect to effluent selection and required structure of the optimal solution.

With respect to the results among all the scenarios, the comparison between two benefit indicators of TAC (main indicator) and WWDR (minor indicator) showed the promising optimal retrofit WWTN design, that is network G4. This design provided lower TAC than network P1 (existing process) and also produced 100% of recycled water (i.e. CW makeup) leading to zero liquid discharge aspect. The result points out the performance of the developed model for the improvement of process/plant scale in terms of economic and environmental impact.

As a consequence, this work proposed the development of WWTN synthesis and design in order to optimize different scenarios from the new system design and the retrofit design with various model formulation techniques and flexible solution strategy. However, in order to develop a more satisfactory design and synthesis model, a further work expansion could be probably integrated with a wide variety of network (i.e. water-using process network or waste handling/disposal network). Furthermore, it should focus on a functionality of model involving other wastewater characteristics (i.e. temperature, pH, turbidity etc.) for a more exact treatment process model as proposed in Figure 5.1—only in grey boxes. In addition, other objective functions of design and synthesis might be concentrated on maximizing recycled water effluent or minimizing wastewater discharge. For the optimized solution, the comprehensive model database, model formulation techniques and solution strategies could be further studied and developed to address effectively any larger dimension of industrial problems. With respect to the modelling of treatment units, more detailed design of those treatment processes (such as removal ratio, conversion efficiency) based on specific design of a plant can be implemented to make the model better represent the real treatment processes.