Supposing we want to build a network of bakeries that serve whole Poland, we would like to place as many of them as possible in order to minimizing time of service of each grocery store. On the other side we have building and maintanance costs, so we have to limit the number of built bakeries. Similarly, if we want to place routers, we would like to cover the whole building by wireless access to the Internet. The difference between latter case and former case is that the cost of wireless data transmission increases with distance quadratically (it means that if distance of a computer is twice bigger then it is needed to spend four times more energy for data transmission). In the case of placement emergency medical services we would like to minimize the waiting time for a rescue. It is one of the most important factor in emergency (especially in case of avalanche). These three cases show the application of one clustering problem in three different measures. Additionaly, there can be boundaries on possible locations of an airstrip or a bakery as well as different boundaries on speed limit on different roads.

The main purpose of this research is to understand a structure of the selected NP-hard clustering problems. The second goal is to design efficient approximation and parameterized algorithms that solve the selected problems. NP-hardness of a problem means that we cannot solve the problem in short time using a computer. Running time of calculations could take many months or even years. However, with better understanding of a problem structure we can make fast calculation of a result that is almost as good as the optimal one. For exmaple, by using approximation algorithms one can solve NP-hard optimization problems in efficient time, but a result of such algorithm could be not optimal. During designing such algorithms the basic question is: "how much this solution is worse than the optimal one?". Due to mathematical models and formal methods of reasoning one can prove and make sure what is the largest possible error of an approximation algorithm in respect to the optimal solution.

The main reason of the subject is the fact that research on clustering problems and designing efficient algorithms have a direct impact on practical applications in areas of: artificial intelligence, data mining, Big Data, bioinformatics and logistics.