Ministry of Higher Education
and Scientific Research

University of Diyala

College of Science

Investment Projects Optimization using Data Mining Technique

A Thesis Submitted to Council of College of Science, University of Diyala in Partial Fulfillment of the Requirements for the Degree of Master of Computer Science

by

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2020A.D IRAQ 1442 A.

بسم الله الرحمن الرحيم

وَقُلِ اعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ ۖ

صدق الله العلي العظيم

[سورة التوبة105]

Dedication

I dedicate this research

To the Prophet And the savior of the nation Muhammad Abdullah Abdul-Muttalib,To the Commander of the Believers Ali bin Abi Talib, To our Lord Imam Al – Mahdi,To the mother of believers Fatima Zahra peace on them.

To my parents whose their prayers and words always inspired and encourage me to give more and pursuit of excellence.

To my beloved husband Ahmed for his support, encouragement to complete this thesis with his concern.

My Sister and Brothers , who always encourage me to give the best and supported me.

Acknowledgments

I would like to express my deepest thanks and gratitude to my supervisor Prof. Dr. Dhahir Abdulhade Abdulah. Through his vast experiences in this field of study, he has offered a valuable time, expertise, guidance, and encouragement.

I also would like to acknowledge the Department of computer science – University of Diyala for all of the support that they have offered.

Linguistic Certification

This is to certify that this thesis entitled " Investment Projects Optimization using Data Mining Technique" was prepared under my linguistic supervision. It was amended to meet the style of English language**.**

Signature :
Name :
Date: / / 2020

Supervisor's Certification

I certify that this thesis entitled "Investment Projects Optimization using Data Mining Technique", was prepared under my supervision at Department of Computer Science\ College of Sciences\ University of Diyala by Atezaz Ahmed Abduljaleel, as a partial fulfillment of the requirements for the degree of Master of Science in Computer Science

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(Head of Computer Science Department)

ABSTRACT

Data mining processes are used to build machine learning models that power applications including search engine technology and website recommendation programs. The aim of this thesis is to form a system and regard an operative to accomplish the investment projects objective in term of both duration and charge by using the techniques: genetic algorithm (GA) and gravitational search algorithm (GSA).

To achieve the research aim of the research a system was built in order to optimize the solution for the investment projects problems and increase the number of projects to be implemented.

The results show that the there is confusion in the work of the Iraqi governments and the national Investment Commission in creating a favorable investment environment that holds the elements of a successful investment environment. GSA find the objective function according to its round from 4 to 5 iteration while GA more than 8 iteration.

GSA algorithm operative method in determining the greatest solution and it shorter time. GA technique consume a lot of time in finding the solution and managing the investment projects and sometime yield to non-optimal solution.

As comparing to GSA, the value of the objective function for the profit that is chosen is very low and leads to reduce the number of the project implemented , as GA is fall in under fitting and the steps as selection, cross over and mutation lead to this value. The difference between GA and GSA is also very

clear in the effectiveness of the solution, as xij also has lower value than GSA which lead to reduce the effectiveness. In most of the governorate the number of the projects that can be maximize increase more than its originals as they reach 91 projects as in Baghdad with profit more than 4 billion dollar. The number of project to be implemented by using GSA in National governorate about 101 projects comparing with GA which only give 51 projects.

In Diyala Governorate, 5 projects were taken and each project has three significant problems with each one of them has three solutions, GSA found the best solution with effectiveness of 0.89 and the same for GA and its seem to be equal in number of problems which mean show an equal effect.

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LIST OF ABBREVIATION

Abbrev.	Total Name
AI	Artificial Intelligence
GSA	Gravitational Search Algorithm
GA	Genetic algorithm
PSO	Practical Swarm Optimization
ANN	Artificial Neural Network
PSPLIB	Project Scheduling Problem Library

CHAPTER ONE

INTRODUCTION

Chapter one

Introduction

1.1 An Overview

The process of mining the necessary information from data that are previously exist called data mining, in addition it was given different name as extraction of knowledge, detection of information, harvesting of information, data archeology, and processing of data pattern[1].

The main aim of data mining is to recognize a useable novel, likely consider valuable, and capable to be understood and there must be associations and existing data patterns [2]. The statisticians mostly used data mining term as well as researchers of database, and business communities as it aids them to get clear idea about hidden pattern and it is necessary for understanding.

There is a gap between the traditional construction industry and using data mining in construction as when it compares with other industries. This could be return to the reason that construction process is an impermanent and specific action that means the one project data can rarely be used for alternative project. But one can ask it may not be all the time true, as though products of the construction are exceptional but some resemblances can be exist among them and processes of construction and management skills are typically common to all projects[3].

In spite the fact that the construction industry did not applied the data mining application, researchers of construction management have been examining its ability to be implemented to different problem regions [4].The investment in the industry of construction face an issue in contemporary economic circumstances. Construction is a fragment of the

real sector economy, that point to the evolving capital construction position in the country. The fact that the economy of the country is going through of some difficulty there is an depletion of foreign investment[5].

Various project in the investment construction stages application require needs financial investments, that are resolute by the processes of cost management[6]. The preparation and conduction of business operations contain the following:

• Focus on approach of quantitative

• Focus on the process

• Focus on working groups [7] .

1.2 Literature Review

Below is a review of some researches which are related to our work:

Abraham Warszawski, F and Rafael Sacks [2014] [8] : Introduce a useful approach in the risk that originate in the investment construction project that can calculate with input information of different detail levels. The suggested multifactor approach comprises concern of project‘s risk factors interdependence.

Sofia Kaiafa and Athanasios P. Chassiakos [2015] [9] : They introduce a method for reducing the cost from over allocation of the resource project exceedance of the deadline, and fluctuations of resource. As there are large number of alternatives for activity implementation, a genetic algorithm was used for the optimization process. The algorithm

has been verified with number of test cases and there were comparison with those established by the Microsoft Project. The evaluation shows that the suggested algorithm can offer satisfactory and balanced solutions with respect to the three objectives and that these solutions are improved than those offered by commercial project scheduling software.

Jia Liu, et.al (2018) [10] : Introduce (GA) for the RCPSP. The suggested algorithm provide number of variations in the paradigm of the GA, as innovative selection operator to choose parents to rebound; an improved two-point operator of crossover with a precise crossover imperative. The suggested algorithm was verified by problems of standard level of size J30, J60, and J120 from "Project Scheduling Problem Library" (PSPLIB) and associated with 19 research in the met heuristics in the previous studies. The finding validate that the proposed algorithm is an inexpensive algorithm for RCPSP solving .

Panagiotis M. et.al [2018] [11]: developed optimization model of multi-objective dynamic for construction and moving facilities costs, resources transportation costs moving from different facilities or to workplaces, a genetic algorithm has been applied as it has the ability to strongly search within a great solution space. Numerous case studies and working scenarios have been applied through the software of Palisade‘s Evolver for analyzing the model and evaluation. The finding show acceptable model response to input of the time data with quality of solution and calculation time. The model can offer decision sustenance to managers of the site, allowing them to inspect substitute scenarios and best solutions conferring to their knowledge by producing necessary preferences.

Victoria Borkovskaya, et.al [2019] [12] : they presented an approach to improve the investment construction efficiency of given endless danger of new risks. examine the kinds and reasons of risks, make conclusions about the risks rank related with the investment attraction of projects. Development and vicissitudes in the surrounding area are the leading direction in the modern society development**.**

Jingkuang Liu et.al [2019][13]: GA algorithm was used for the choice of site of a recycling plant. The study reveal the best solution gained on enhancing the choice of the site of a construction and destruction plant of waste recycling by GA imitates the real examination. The best solution by GA was gained after 200 repetitions, at point the value of fitness converges at a steady value of 1.8×10^{-5}, which verifies the judiciousness and workability of the model of the site-selection optimization. Though, given the slow speed of the evolutionary GA, it is easy to drop into a local finest.

Seyed Kamal Chaharsooghi et.al [2019] [14] : the project cash flow problem was solved by Genetic algorithm optimization. The key hypothesis that project inputs and outputs can be assessed in terms of project cash flow. the model, the objective function is present value of project cash flow maximization . Then, after addition of the constraints. It is supposed that the suggested approach may also be valuable for both managing of project cash flow and for control of project.

Peng Rong and others [2020] [15] : provide model from project cost analysis and data mining depend on the estimate of massive feasibility study, initial enterprise estimate and final explanation data of power grid infrastructure projects, backup the amount estimate of the investment in

the stage of planning, the estimate review of the investment in the stage of the feasibility study, and the prediction of the investment control target in the stage of planning, so as to enhance the investment efficacy of electric grid project.

Naji Mutar et.al [2020] [16] : they study the issues through the pre-construction phase by using PSO and GSA. The finding show GSA and PSO are both used and show outstanding results in solving problems, the algorithm of GSA shows improved results in both the velocity and in the accuracy.

Mohammed K. Al Mhdawi [2020] [17] : Improve methodology for integrated decision support for risk factors managing in Iraq oil and gas construction projects.. The suggested methodology involves of the following phases: analysis of risk using a model of multi-criteria risk analysis based on fuzzy set theory, prediction of risk effect on project time and cost using artificial neural network (ANN), risk response selection using (GSA) optimization technique. The implemented methodology will enable decision makers to evaluate the risky events of oil and gas projects, provision their decision through planning and stages of work implementation.

The previous studies show that the investment projects are mostly is been managed without using data mining techniques or decision making techniques but algorithm as GA and GSA are rarely used. Therefore the authors used data mining techniques as tool for decision making in investment projects to increase the profitability of the projects.

1.3 Problem Statement

In Iraq, investment projects aspect several issues as the most projects are being built in an unbalanced situation in term of price and

period and thus most of the investment projects are either not be awarded or stooped in early stages which lead to rise of finical crises.

The thesis problem can be explained as follows:

1. Iraqi instruction and rules regard the investment cause undesirable environment to the investors in term of profit which require a system to manage the investment projects.
2. The size of investment projects and its difficulty need to the existence of a system in order to increase the awarded projects .
3. The unstable environment of the investment make the investor without any profit which requires a system to increase the profit for the investors.
4. The cost and time of the discovery of the optimal solution for the problems of investment projects is high and consequently it needs an integrated system.

1.4 Thesis Aim and Objectives

The aim of this thesis is to form a system and regard an operative to accomplish the investment projects objective in term of both time and cost. Attaining the aim, there are some purposes should be gained as follows:

1- Investigate the number of stooped investment projects.

2- Examination and documentation of the difficulties in construction projects.

3- Determining the consequence of these difficulties on cost and time of the investment projects.

4- Find the solutions for these problems with effect on both cost and time using GA and GSA.

5- Maximize the profit for the investors using GA and GSA.

6- Build system to accomplish these solutions by using the techniques: GSA and GA.

1.5 Thesis Structure:

The research includes several chapters, which are:

Chapter Two: Deals with the investment definition, investment projects, their type the problems associated with the investment along with the techniques that used.

Chapter Three: Presents the proposed system in the design of the system to manage investment project problems, the system consist of several parts and two type of algorithms which are GSA and these will be explained in this chapter.

Chapter Four: The results obtained from applying the proposed algorithms for the investment projects in terms of number of the project to be proceed ,profit gain and the solution for the problems.

Chapter Five: This chapter comprises conclusions that obtain by the researcher as well as commendations and proposals for subsequent research.

CHAPTER TWO

Investments Projects and its Techniques

CHAPTER TWO

Investment project and its techniques

2.1 Introduction

In the previous chapter, the problem of the project was explain with brief introduction on the investment and the previous studies with the concern, in this chapter the investment projects will be discussed more deeply and the problems associated with the investment along with the techniques that used.

2.2 The Concept of Investment

The effectiveness of the investment is risk function, profit and investment management cost, effected by the restrictions in which investors should work.

These limitations involve elements of financial and non-financial as a time of the investor to accomplish the provisions of investment, responsibility as a fiduciary, or need of legislative[18].

Structure of investment organization can be given a definition of structure which utilize how assets of investment must be separated between diverse approaches of investment and altered managers of investment. The methods of investment can include various predictable danger, profit and characteristics of the style[19]. In order to have a clear understanding for the meaning of investment it's very important to study the definitions of investment. Many researchers have definzed investment, everyone from different point of view.

Some of the definitions regarding investment are listed in table (2.1):

Table (2-1) Investment Definitions [20:28]

No	Researcher Name	Year	Country
1	Ibn Mandhour	1977	Beirut
	Investment means using money and operating it, in order to get profit from this operation, so, the money become more and grows along time.		
2	Al Zahawi	1990	Iraq
	Investment means the movement of capital from any country without a direct regulation, whether it is a short-term or long-term funds that have the nature of the continuation, and usually accompanied by the intention of the investor to transfer the capital with the return in any form, whether profit or interest or shares to the original home.		
3	Ramadan	1998	Oman
	Investment is the abandonment of funds owned by the individual at a certain moment of time, maybe prolonged or shortened and linked to one or more assets for that period of time in order to obtain future financial flows.		
4	Iraqi Investment Law No. 13	2006	Iraq
	Investment means the employment of a capital in any activity or economic project that returns a benefit to the national economy.		
5	Al- Taan	2006	Iraq
	Is the transfer of capital, techniques, and developed foreign management, In order to make a developed economic, social, and management. To contribute to the development of the host country through the nascent companies with the participation of national capitals.		
6	Al Fatlawi	2007	Iraq

	Investment in general is any economic movement that benefits the owner directly or indirectly or increases the capital of the investor by employing that money in the purchase of goods or machinery or the establishment of industrial or service projects within a specified period of time.		
7	Muchlinski et al.	2008	
	The term investment covers every kind of asset (movable and immovable property, shares in companies, claims to money that has been used to generate an economic value, business concessions under public law)		
8	Ajeel	2009	Iraq
	Investment is a financial issue aims to get the profit that could be gained in the long term in the future.		
9	Al huri	2013	Egypt
	Investment is a complex process consists of a several elements, including the law, economic and international.		
10	Amina, Khadija	2015	Algeria
	Investment is the employment and use of capital to be productive or directing the savings to areas of production which meet the economic need on the one hand and provide a return on the other hand.		
11	Baba	2004	Algeria
	Investment is all expenses that generate new income in the long term and the financier defines it as long-term or so-called permanent assets.		

2.3 Investment Objectives

Investment is the basic need of every individual for their financial well-being. Practically everybody makes investment in different investment avenues based on needs and goals. Every investment avenue has certain characteristics which impact its risk and return and aid in achieving different investment objectives of the Investors. Some of the key objectives of investment are safety of principal invested, capital growth, generation of regular income, tax saving, need of liquidity, quick returns. As per traditional financial theories, investors are assumed to be rational thinkers and aim for wealth maximization based on the risk and return trade-off. However, as per behavioral finance the risk profile and attitude of every individual investor differ depending on various factors like demographic profile, objectives of investment etc. like some investors may prefer liquidity over returns; some may desire for quick returns taking extra risk or some may invest for tax benefit[29]. Thus, there are several objectives and expectations of investors which may impact the individual behavior towards their choice of investment avenues as listed in table (2.2).

Table (2-2) Investment Objectives [30:33]

	Author	**Year**	**Country**
1	**Khalid**	**2014**	**Jordan**
	1. Protect money from the decrease of purchasing power as a result of inflation. 2. Achieving continuous wealth development with an acceptable return. 3. Achieving the highest current income.		

	4. Protection of the Income from taxes. 5. Achieving the greatest possible growth of wealth. 6. Securing the future.		
2	**Essa**	**2015**	**Jordan**
	1. Achieve an appropriate return that helps the project to continue. 2. Maintain the value of real assets. 3. Continuity of income generation and increase.		
3	**Tavares et al.**	**2016**	**Columbia**
	1. Job creation. 2. Technology and skills transfer. 3. Research and development.		
4	**Tokan**	**2017**	**Jordan**
	1. Achieving a suitable return on capital. 2. Maintaining the value of real assets. 3. Benefit from the return on increased equity. 4. Guarantee continuous cash flow.		

2.4 Investment Climate

Foreign direct investment(FDI), especially inflows, has been seen as an important source of technology spillover, improvement in efficiency and growth[34].

The investment climate refers to a set of factors specific to a given location, that defines the form of opportunities and incentives to enable companies to invest productively, create jobs and expand their business[35]. Arab Investment Guarantee Corporation defines the investment climate as a set of legal, economic, political and social conditions in which the environment in which the investment

is made. The components of this environment are variable and highly interdependent[36]. The investment climate is a complex concept because it is linked to several aspects, some related to the availability of infrastructure facilities, some institutions and others to policies. Therefore, it is a dynamic concept that is constantly evolving to pursue political, technological and regulatory changes[37].

2.5 The Elements of an Investment Projects:

Any investment project consists of some elements. ; The elements can be set as divided into three elements [38].

1.Share: means the participation of the investor in the framework of the investment project in the host country, and the purpose of the share is to make a profit.

2.Time element: Means the need for a period of time in the life of the project to be considered an investment project in the economic sense, the purpose of that is to distinguish between investment operations and business operations.

3.Risk element: Means the possibility of achieving profit and achieve loss, and also means in the framework of the distinction between investment work and business that the profitability of the project is achieved with a periodic form and frequent increase or decrease, while the business in which the return of revenue at once.

2.6 Classifications of Investment Projects

Investment projects are many in types, but they can be classified according [39].

1- Duration of investment: Short term investment, medium term investment, and long term investment.
2- Geographical criterion: Local Investment, International Investment.
3- Equity capital: Real investment, cash investment, financial investment.

4- Depending on the sector making the investment : Public sector projects, private sector projects.

Investments can be classified in many ways according to its nature, duration or other categorizations[40] has divided investment categories into four divisions:

1. Nature of investment: There are two main types of investment, which are commercial investment and financial investment.

- Commercial investment: This is what can be called e investment in commercial markets such as (commercial investment, industrial, service, agricultural, mining and oil).

- Financial investment: What can call investment in financial markets (investment in shares, investment in bonds, investment in checks, investment in portfolios).

2. Investment duration: Classification of investments based on duration
3. Return on investment: Investments vary according to the return on capital of each, and the return varies according to the size of the capital and depending on the nature of the company's work.

2.7 Investment in Iraq

Iraq is characterized by having supporting elements to attract the capitals and investments to the country, depending on the availability of natural resources such as oil and gas, human resources (as consumers and workers),the work force are well educated (21% are graduated from preparatory school and colleges, 14% are graduated from technical and academic qualifications)[41].

2.8 Investment constraints

Land availability in various uses, as well as the large size of the Iraqi market, geographical location, which creates opportunities for production, expert and import. Iraq has airports and ports of strategic importance, In addition to the

many incentives and facilitation provided by the Iraqi Investment Law. All the above are attraction factors that reflects abundance and diversity of investment opportunities of various economic sectors[42]. The large state intervention in economic life has restricted the economy, so the private sector today has a limited role , the constrains are shown in table (2.3).

Table (2-3) Investment Constraints [43:47]

No	Author	Year	Country
1	**Al Saadawy**	**2018**	**Iraq**
	1. The procedural obstacles resulting from the formulation of laws and based on non-economic basis. 2. The electronic signature is not taken in consideration, but only by the real signing. 3. Economic fluctuations. 4. Beliefs and culture in the country, in particular the overview of the foreign investor within the country.		
2	**Cited in Milford et al.**	**2000**	**Stellenbosch South Africa**
	1.Political (orientation, uncertainty, commitment of successor governments). 2.Conflicting opinions within government. 3.Economic (market size, affordability, payment risks, economic stagnation, shortage of foreign exchange, high costs, inflation). 4.Structural (underdeveloped or inadequate supply of infrastructure, lack of supporting industry, shortage of local finance, personnel shortages). 5.Nationalization –Expropriation (Discrimination against foreign).		

	6.High overhead cost. 7.Mismatch between the national economic growth and the goals. 8.Leak law application. 9.Cancellation in giving loans. 10. Exceeded loan. 11.Complicated and difficult bureaucracy in giving construction/ operational permission. 12.Exceeded investment in unsuitable time. 13.Uncontrolled inflation.		
3	Bin Hasan	**2009**	**Algeria**
	1.Inappropriate investment environment characterized by administrative bureaucracy. 2.Failure to comply with the legislative framework. 3.Weak and inefficient information and communication systems.		
4	Al-Battat et al.	**2016**	**Iraq**
	Lack of an appropriate investment environment to achieve domestic investments and attract foreign investors. Instability and volatility of political and security conditions. Deteriorating of economic conditions. Deterioration of infrastructure. Obstacles to the application of laws and legislation.		
5	Al-Asrag, H.	**2006**	**Egypt**
	1. Economic factors (Slow implementation of economic reform programs, limited privatization processes, especially in the services sector). 2. Political factors (Stability in the Arab region, the wars witnessed in the Gulf region and the US invasion of Iraq, the spread of many		

	terrorist operations).		
6	Mohammad, T.	2009	Algeria
	1. Inadequate investment environment characterized by bureaucracy. 2. Failure to comply with the legislative framework. 3. Weak and inefficient information and communication systems.		
7	Siham	2013	Algeria
	1. Economic constraints (limited local market, lack of commercial and economic information centers, lack of infrastructure , slowdown in value market operations, lack of competition market, property obstruction). Political obstacles (political instability and security(. Social obstacles (low standard of living impede investment(Financial obstacles (Lack of professional and experience of the supervisors of Algerian banks, manual working, weak processing of modern technology, absence of specialized banks, the bank takes a long time to grant the loan, the bank requires a high guarantee from the contractors, the bank's inability to finance the project in hard currency) Administrative obstacles (Routine, lack of specialized technical expertise in the field, lack of advanced information systems, multiple devices supervising investment and lack of coordination between them(Legal obstacles (many laws and inconsistencies, restrictions on the ownership of property and land, instability of investment laws)		

2.9 Investment and Decision Making

The investment decision maker should take into consideration a set of principles as a base for decision making:

First: The principle of selection, the various more alternatives are varied and various, it gives provide the decision-maker with more flexibility and enable him to make the right decision and the investor is able to making clear a comparisons between alternatives and choose the best alternative that which matches the aimed goals.

Second: The comparison principle, comparison between the available investment alternatives to choose the appropriate ones and the comparison is

done by using the fundamental analysis of each alternative and compare the results of this analysis to obtain the best alternative from the point of view of the beneficiary.

Third: The principle of appropriateness, the investor applies this principle when he chooses between the fields and tools of investment to suit his desires and tendencies determined by his income, work and social status.

Fourth: the principle of variation, investors resort to diversify their investments in order to reduce the risk of investment[48].

2.10 Investment and Evaluation Process

The process of evaluating projects is defined as the process of setting the necessary criteria by which to choose the appropriate alternative or project among several proposed alternatives, which ensures the achievement of the specified objectives[11].

2.10.1 The Principles of Projects Evaluation Process

1.The project evaluation process must find some sort of consistency between the criteria included in that process and the objectives of the proposed projects.

2.The project evaluation process must ensure that a certain level of compatibility is achieved between the objective of any project and the objectives of the national development plan on one hand and between the specific objective of the proposed project and the material, human and technical resources available to implement it.

3.In order to ensure the success of the evaluation process, it is necessary to provide accurate and comprehensive information and data[49].

2.11 Artificial intelligence in the investment

In the beginning of computing, computer program classic task was a computation of nature of numerical, like computing the bullet trajectory. In recently, computer program classic task may include backup number of people in significant decisions. These tasks become more complicated to be implemented as the decisions grow sophisticated, the programs of computer performance progressively suggested features that people is being link with intelligence. So this, a program gain the name of "artificial intelligence". reaction from program that is an intelligent from the person response [50].

Application of (AI) in many parts of investing, mostly the investment is coming from areas of non-AI. For example, techniques of computational not seeing mainly techniques AI that involve arithmetical evaluates, operations research[51].The previous studies that include the using of AI as follow [52]:

1. Research on machine learning, that was called awareness and research with systems of self-organizing, considerably from1955 to 1975.

2. Knowledge-based, or systems that are expert considerably from1975 to 1995.

3. Research on machine learning, now called NN or GA , considerably from 1995 to the current date.

As the investment use AI, the used technique has inclined to be the technique popular at the time. The recent literature is rich with neural network applications to investing, but a new direction merging techniques of knowledge with NN and GA techniques. For example, [53] use NN which can be straight assumed by people. programming with GA modifies the logic neural net architecture by nodes adding or deleting of the network.

Bhattacharyya [54] have added constraints of knowledge-rich to the GA operators in their application for markets with foreign exchange investment.

2.12 Gravitational Search Algorithm

Rashedi et al. in 2009 create GSA and envisioned to solve problems of optimization. The algorithm of type of population with heuristic depend on the gravity law and mass interactions. The algorithm is encompassed of searcher agents group that create reaction with each other by the force of gravity [56]. The agents are regard as objects and masses represent their performance . The global transfer of all the agent to each other and to the objective is caused by force of gravity. The masses are really submitting the gravity law as shown in Equation (1) and the law of motion in Equation (2)

$$F=G(M1M2/R2) \qquad (2.1)$$

$$A=F/M \qquad (2.2)$$

as in the eq (1),

F : Signifies the gravitational force magnitude

G : Constant of gravitational, first and second objects

M1 and M2: Mass

R : Objects distance.

Eq (2), law of newton‘s the second demonstrations that when a force, F, is used to object, its speeding up, based on the force and its mass, M. The steps of GSA are as follows:[57]

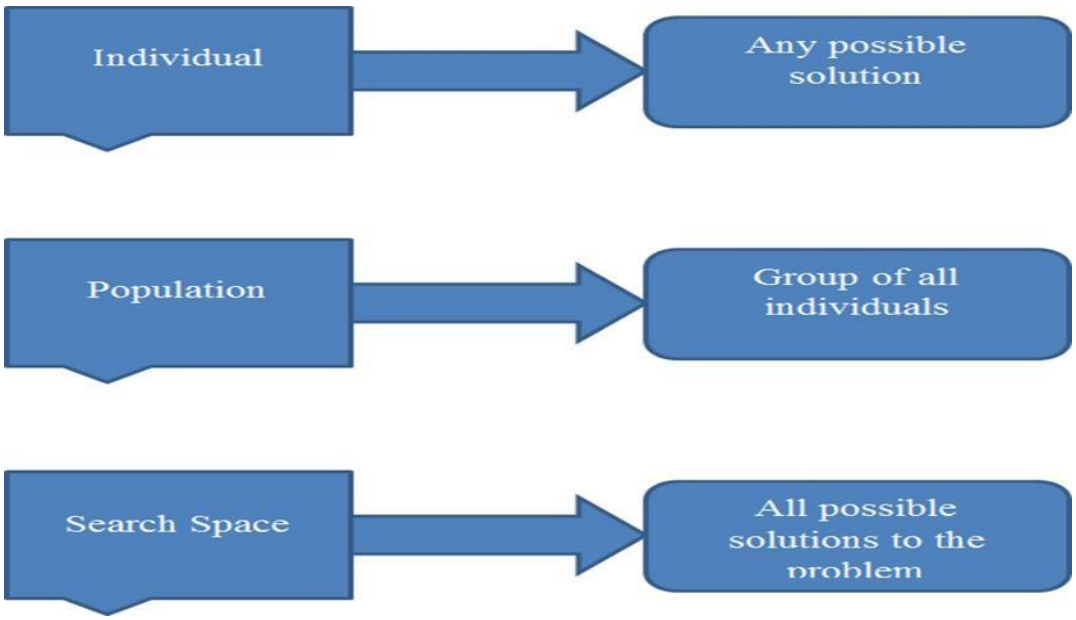
Table (2-4) The steps of GSA[57]

Stage	Equation	Explanation
Agents initialization: The positions of the N number of agents are initialized randomly	Xi = (xi1,…xid, …, xin), for i= 1,2,..,N.	xid represents the positions of the ith agent in the dth dimension, while n is the space dimension.
Fitness evolution and best fitness computation: For minimization or maximization problems, the fitness evolution is performed by evaluating the best	best(t) = min fit j(t) worst(t) = max fit j(t) best(t) = max fit j(t) worst(t) = min fit j(t)	fit j(t) represents the fitness value of the jth agent at iteration t, best(t) and worst(t) represents the best and worst fitness at iteration t.
and worst fitness for all agents at each iteration		
Gravitational constant (G) computation: Gravitational constant G is computed at iteration t	$G(t) = G_o e(-\alpha t/T)$	G_0 and α are initialized at the beginning and will be reduced with time to control the search accuracy. T is the total number of iterations.
Masses of the agents' calculation: Gravitational and	Mai = Mpi = Mii = Mi, i = l, 2, ... ,N	Mai and Mpi are the active and passive gravitational masses
inertia masses for each agent are calculated at iteration t		respectively, while Mii is the inertia mass of the ith agent
Accelerations of agents' calculation: Acceleration of the ith agents at iteration t is computed	Fid(t) = Fid(t) / Mii(t)	Fid(t) is the total force acting on ith agent
Velocity and positions of agents: Velocity and the position of the agents at next iteration (t+1)	vid(t+1) = rand (i) * vid (t) + aid(t)	
Repeat steps 2 to 6 Steps 2 to 6 are repeated until the iterations reach their maximum limit.		

2.13 Genetic Algorithm

The evolution of the biological was used to create the programming of GA[62].

GA is essentially used as method for providing solution to the problem to offer the best solution. GA has the ability to work fit in any space of search as they form a very overall algorithm, a genetic algorithm will produce a solution with high quality. GA use the selection and evolution principles to generate many solutions to a specified problem[58].



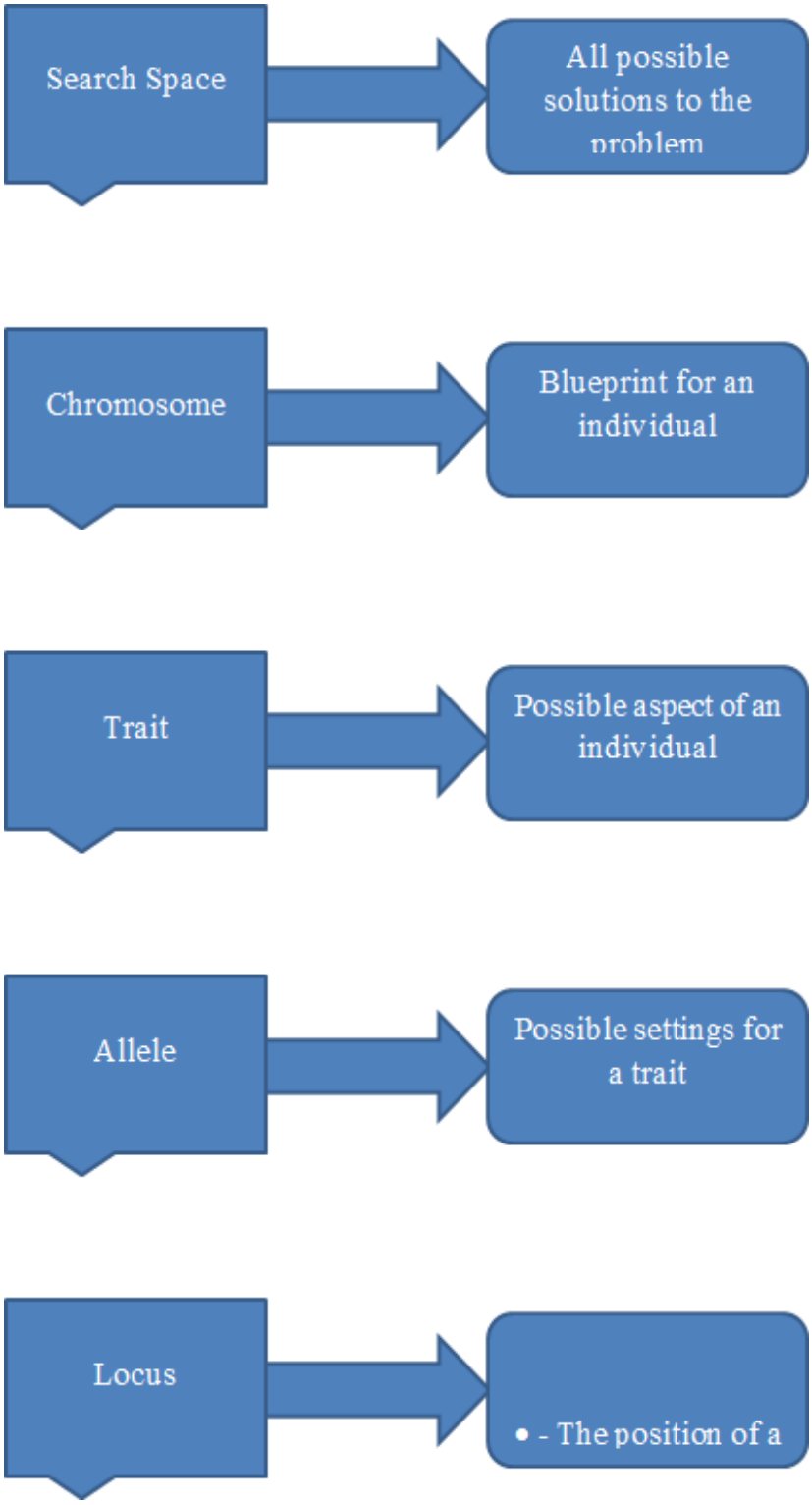


Figure (2.1) GA Features

GA is a model that consist of number of steps to find the solution for problem and has the ability to deal with large of search powerfully. In tasks of the classification, it look for the best feature subset that reduces the input space dimensionality and exploits the accuracy of classification. Every subset of feature is encoded to a vector named chromosome and every chromosome contains of genes which are equal to features[59, 60].

The well-known kind of GA used in the features of subset search can work as : initial randomization of the individuals are chosen to produce the initial population. After that 2 individuals are chosen through the fitness function evaluation. the ultimate fitness is selected, while if we need to regenerate these individual, the crossover operator can be used to generate more offspring, lastly, these offspring can randomly mutated[61].The GA principle as follow:

A. Types of Encoding Schemes

The number of schemes that used for encoding are 5 types, that can be categorized to 1D and 2D. These kinds of 1D are Hexadecimal, Binary, Octal, permutation and encoding of value. Alternatively, encoding by tree is the kind of 2D [62].

B. Fitness Function (FF)

The value of fitness is calculated for the random inhabitants. The effectiveness of the crossover, selection and mutation are evaluated by fitness function [62].

C. Parents Selection

One of the key operator is the choice of the parent, that is used to generate the next generation. Selection of parent can be measured by FF. There are number of methods for selecting the optimal chromosomes[63].

1. Roulette Wheel Selection (RWS).
2. Random Selection.
3. Boltzmann Selection.
4. Rank Selection.
5. Tournament Selection.

❖ **Roulette Wheel Selection**

RWS is the modest selection method, all the individuals in the inhabitants are retained on the roulette wheel according to their value of fitness. Every individual is allocated a roulette wheel section. Every section size in the roulette wheel is relative to the fitness value of the individual. The process is repeated till the anticipated individuals number is carefully chosen[64].

D. Crossover Operator

The crossover is applied among chosen individuals or the rightest individual. The new generations are produced from the crossover. These new generations inherit some features from parents.

E. Mutation Operator

The last operator is mutation. It causes the representation of the individual genetic to be altered according to some machinery. Mutation includes substituting a chromosome single bit with a small value from the mutation probability. The assessment of chromosomes using a fitness function and the optimal one is reserved [65].

CHAPTER THREE

The Proposed System Design

Chapter Three

The Proposed System Design

3.1 Introduction

This chapter presents the proposed system in the design of the system to manage investment project problems, the system used two type of algorithms which are GSA and GA and these will be explained in this chapter .

3.2 The Proposed System Design

The proposed approach depends on three main steps to manage the investment projects problem . The input to the system is data that are used to analyze the investment project problems . In this thesis, two type of algorithm were used , (the first with GSA) and the second with (GA).

The first proposed system has several main stages and each stage has several steps that work together to achieve the first system goals. The system divided into stages that contain the following: data acquisition, preprocessing, data analysis , management of investment .Figure (3.1) shows the general diagram of the proposed system to managing the investment projects problems.

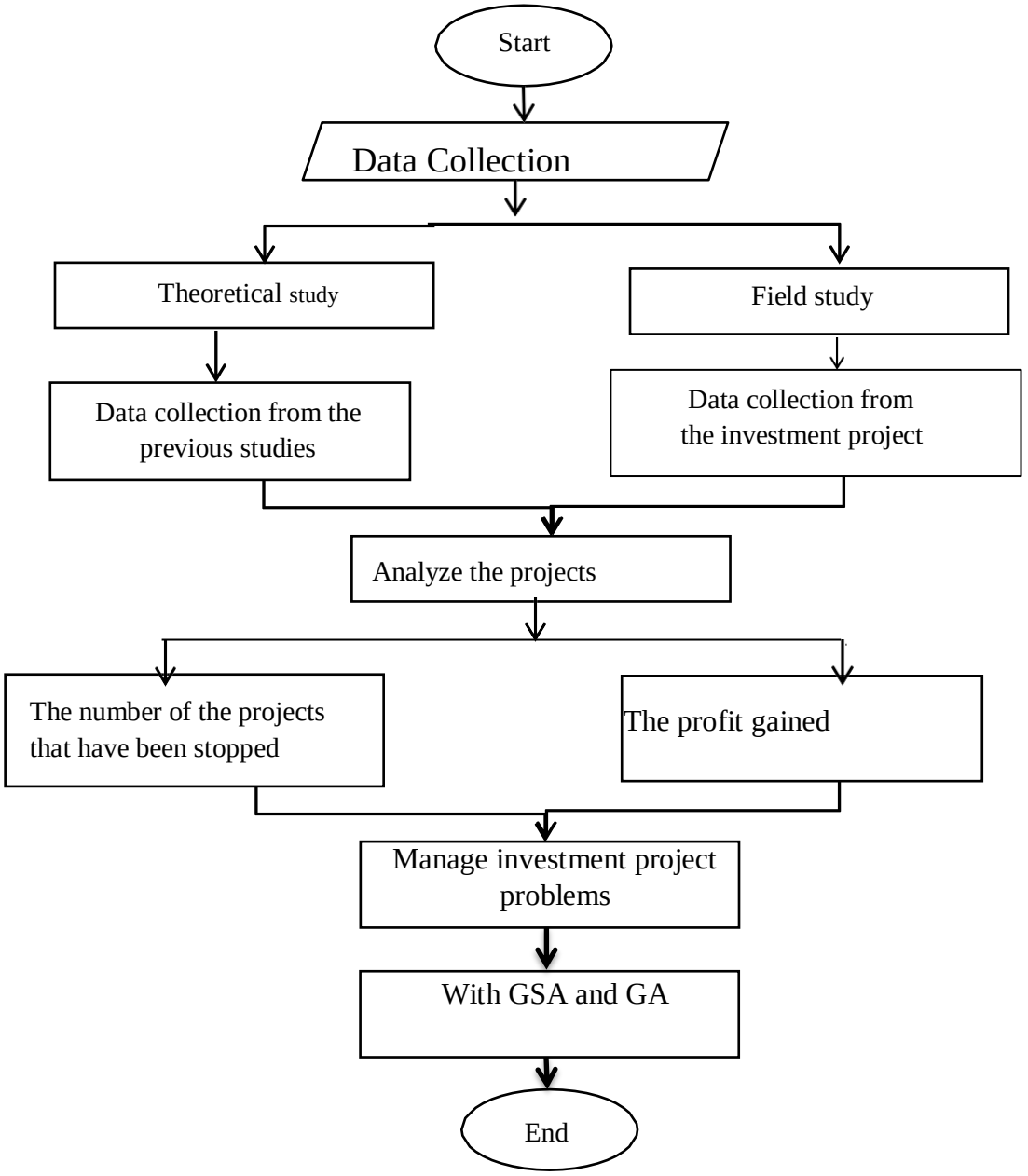


Figure (3.1) Flow Chart of the Proposed System

3.3 Data Acquisition Stage

In order the method for manage the investment projects problem for the proposed system data was collected from different methods, first from the previous studies as stated in chapter two. Next the data were collected from the field study into two sources, paper data and questionnaires. The data represented as follow:

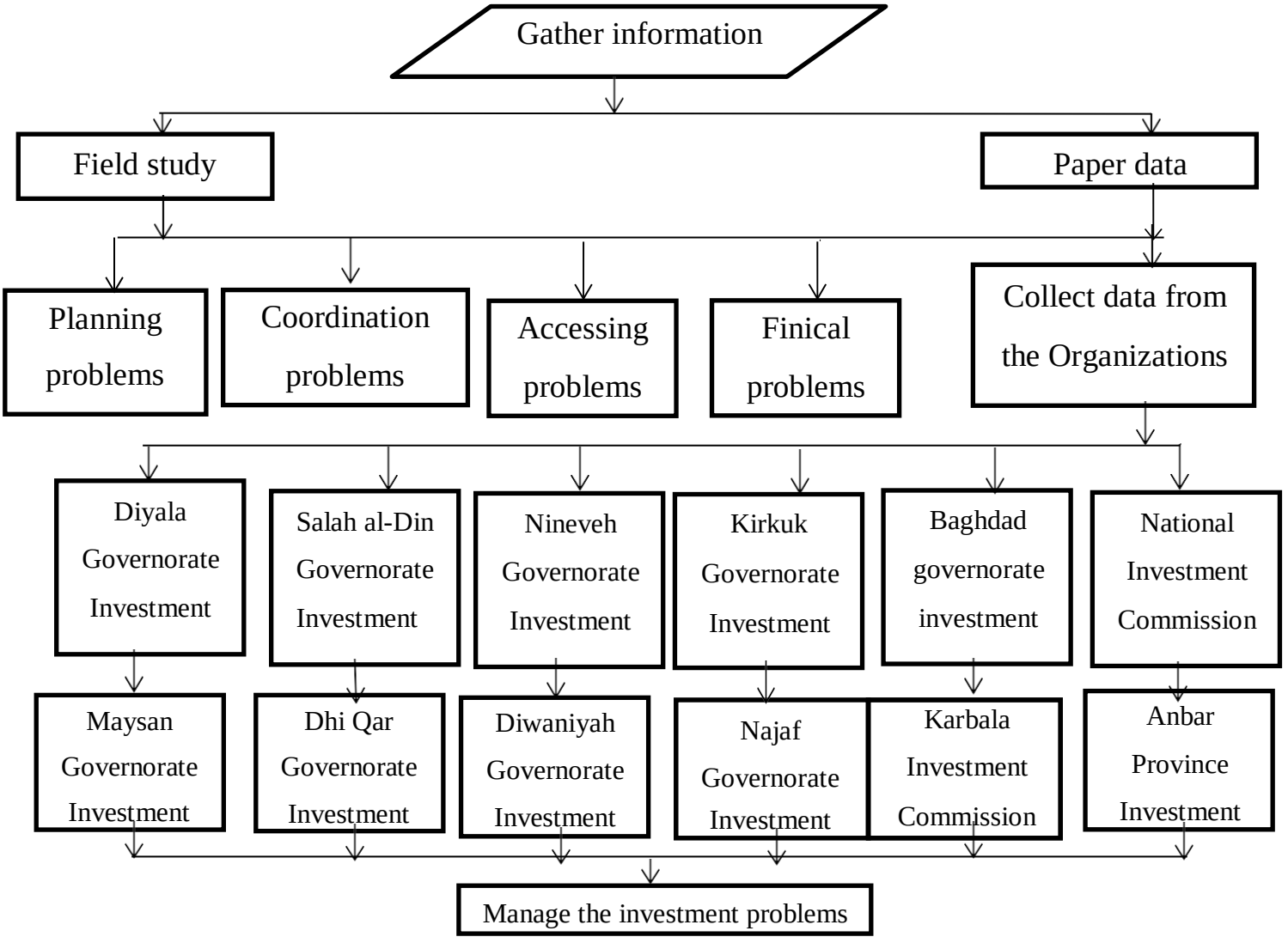


Figure (3.2) Diagram of the Data Acquisition

3.3.1 Paper Data

The data were collected from the governorates that stated in the diagram , the results will be explain in chapter four :

3.3.2 Field Survey

The chief step comprises a group of experts questionnaire, also contain the formulating the questionnaire aspect and prepared the queries connected to the survey that inferred from the hypothetical revision. This step also comprises the technique that routines to choice the sample supporters, classify the types and then show the questionnaire result. The parts of the survey as follow:

A- Questionnaire Design

The design form formation in two phases:

3.3.2.1 Open Questionnaire

This phase includes many experts meetings. The meetings also comprise managers and professors of university, these meetings have a significant part in helping in the advanced phase, also disagreement about the survey which was initially set that taken the preceding readings and makes changes to the process and enhances other enquiries with the aid of the experts to make sure the achievement of the procedure and enquiries accessible as the following:

A- Problems in the investment project that effect on cost.

B- Problems in the investment project that effect on time

C- Solutions for these problems.

3.3.2.2 Closed Questionnaire

This phase includes :

A- Preliminary survey: when the meetings is done with many experts, the survey is dignified in its preliminary form, this survey has been spread to eight specialists as a unpretentious test, to know the uncertainties

and the flaws of the survey.

B-Final Survey: This phase comprises the reception of the surveys from the eight specialists and studying the observations and decision from every professional. Thus the survey is finished and distributed. The survey includes the following parts:

Part 1: General Information

The aim of this stage is to gain the data and general facts about the sample that include, sexual category, the department or company , area, specializations of engineering, ages of experience.

Part 2: Problems that Effect on Cost

This part investigates the problems in investment projects that effect on the cost of the and different governorate.

Part 3:Problems that Effect Time

This part investigates the problems in investment projects that effect on the quality of the and different governorate.

Part 4 :The Problems Solutions

The main aim of this stage is to determine the maximum significant solutions that cause to reduce the influence of both cost and time defect in the investment projects.

B-The Research Sample Election

The sample selection procedure is significant and the sample must comprise the engineers who are, expert. The researcher allocates into 45 questionnaires connected to issues that influence on the cost and the quality in the investment projects.

These questionnaires were spread straight to clarify what are the secrecies of the questionnaire, only 40 were reinstated. The research sample is been subjected to the normal distribution on the base of theorem of central limit.

C-Methods of the Mathematical and Statistical

The discipline of statistic comprises scientific approaches to gather, establish, show and data analysis to get acceptable results. A numeral measures is used comprising the following:

A- Central Tendency Measures

The researcher rest these procedures as they are classic value used to data representation. The author the most common one which is mean that defined as the rate, which if every individual take it in the group the whole new individuals values will be equivalent to the original values sum of, can also defined as the values sum distributed by its number.

Mean( )=$\sum_{i=1}^{h}$ xi . fi /n (3.1)

($\overline{X?}$) Mean

(X_i) Class Center

(f_i)The number of iterations for each class

(n)): Total sample size or duplicates of the varieties

(i)Sequence of class

(h)nmber of class

B-Cronbach Alpha

In 1951 Lee Cronbach provide an evaluation for scale with an internal consistency, it is signified by a number between 0 and 1. Internal consistency show the substances range to in an examination measure has the comparable idea or hypothesis and so it is related to the substances inter- relatedness within the test[37].

3.4 Analyze the Projects

This part include the analyze of the projects in term of both the stooped project and profit gained for the contractor, the algorithm that used to analyze the stopped project is divide in two part as follow:

Algorithm (3.1): Analyze the Project in Term of Stooped Project
Input: Data of the entire projects Output: Plot of the stooped projects
Begin Step (1): Input set collection Step (2): Define the file name Step (3): Define the range of the data Step (4): For the x axis the projects For the y axis the percentage of completion Step (5): Define the axes to be plotted with Step (6) : Plot the data END

While the second algorithm to maximize the number of the project that must be continue by using GSA and GA as follow:

3.4.1 GSA

GSA is an optimization algorithm that used to find the solution for many problems, it's based on newton law, which mean on the mass and velocity.

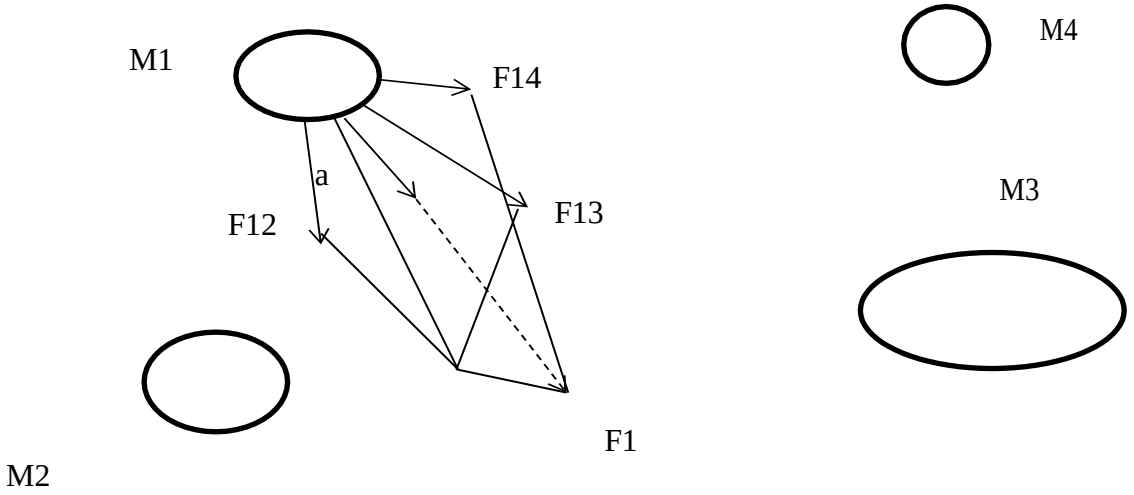


Figure (3.3) GSA Diagram

The figure (3.3) represent the general working of GSA algorithm , which that each particle is moving towards the heaviest mass, in this case is M3 that consider the objective function , the algorithm that has been used is explained in the algorithm (3.2).

Algorithm (3.2): Analyze the Project in Term of Stooped Project Using GSA
Input: Data of the entire projects Output: Maximize the number of project to implement
Begin Step (1): Input the GSA parameters Step (2): Define the file name Step (3): Define the range of the data Step (4): Calculate the mass, velocity and acceleration Step (5): Define the mathematical model Tt= D*pc*xij Tt≤ 0.2*Dt Tc= ci * pc*xij Tc ≤0.2 * Ct N is the number of the project Dt is the total time for the entire D is the duration for one project xij from 0-1 which is risk variable

pc is the percentage of completion for one project

Tc cost constrain

Tt Time constrain

ci cost for one project

Ct cost for total projects

Step (6): Define upper and lower limit for Xij which is range from 0-1

Step (7) : Calculate the objective function according to

Max y= N* xij

Step (8) : Update the mass , velocity and acceleration

Step (9) : Optimize the projects

END

3.4.2 GA

GA is an adaptive technology of global-optimization searching, based on Darwin‘s fittest principle and simulates the behavior of the evolution process in nature. The fittest principle states that an initial population of individuals evolves through natural selection in such a way that the fittest individuals have a higher chance of survival. The algorithm is based on three principle, selection , crossover and mutation as shown in the figure (3.4).

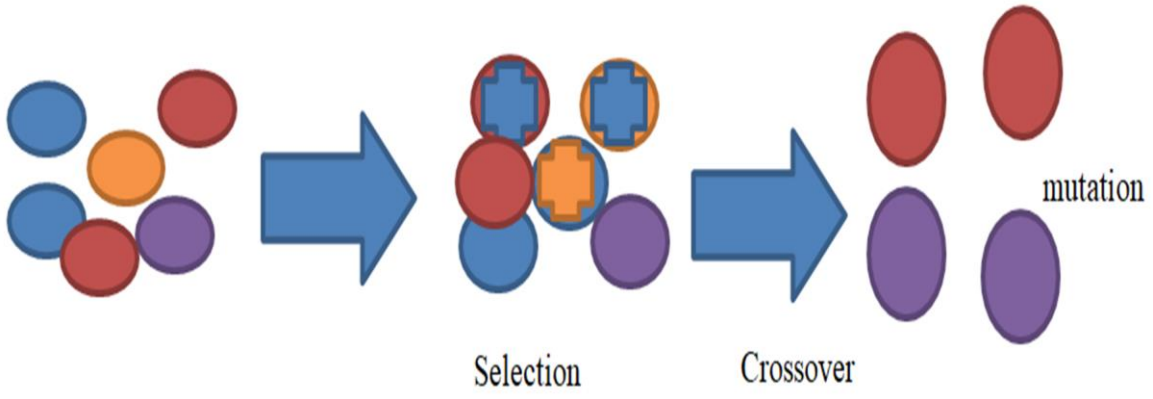


Figure (3.4) GA Diagram

Algorithm (3.3): Analyze the Project in Term of Stooped Project Using GA
Input: Data set of the entire projects Output: Maximize the Number of Project to Implement
Begin Step (1): Input the GA parameters Step (2): Define the file name Step (3): Define the range of the data Step (4): Define the mathematical model Tt= D*pc*xij Tt≤ 0.2*Dt Tc= ci* pc*xij Tc ≤0.2 * Ct N is the number of the project Dt is the total time for the entire projects D is the duration for one project pc is the percentage of completion for one project Tc cost constrain Tt Time constrain Ct is the total cost for the entire project ci cost for the one project Step (5): Define upper and lower limit for xij from 0-1 which is risk variable Step (6): Select Parents Fcn (Cost, Selection Num, Sel Method) Pop Size = size(Cost,1); switch Sel Method case 1 R = randperm(PopSize); ParIndexes = R(1:SelectionNum); Step (7):Cross over Switch Cross Method case 1

```
        Beta1 = rand;
        Beta2 = rand;

        Off1 = Beta1*Par1 + (1-Beta1)*Par2; Off2
        = Beta2*Par1 + (1-Beta2)*Par2;
    case
```

Step (7) : Calculate the objective function Max

y= N* xij

Step (8) : Update the population By

repeating the step 4 to 7

Step (9) : Optimize the projects by determining the number of non-stooped project

using mathematical model in step4

END

While in the term of the profit, the GSA and GA algorithm as follow:

Algorithm (3.4): Analyze the project in term of profit Using GSA

Input: Data of the entire projects
Output: Maximize the profit for the contractor

Begin
Step (1): Input the GSA parameters Step (2): Define the file name
Step (3): Define the range of the data
Step (4): Calculate the mass , velocity and acceleration
Step (5): Define the mathematical
Cm= ci*pc* max (xij)
Sm=Dij*pc* max (xij)
M1ij=0.1*D
M2ij=0.1*Ct
R1≤ M1ij R2≤ M1ij
p is the Profit of the project Cm cost constrain
D is the duration for projects
Ct is the cost for projects
pc is the percentage of completion for one project Sm time constrain
Dij duration for one project
M1 , M2 uncertainty constrain
R1 time constrain R2 cost constrain
Step (6): Define upper and lower limit for Xij Xij from 0-1
Step (7) : Calculate the objective function
Max y= P* xij
Step (8) : Update the mass , velocity and acceleration
Step (9) : Optimize the projects by finding he optimal profit according to step 5
END

The GA algorithm

Algorithm (3.5): Find the Profit Using GA
Input: Data of the entire projects Output: maximize the Begin Step (1): Input the GA parameters Step (2): Define the file name Step (3): Define the range of the data Step (4): Define the mathematical model Cm= ci*pi* max (xij) Sm=Dij*pc* max (xij) M1ij=0.1*D M2ij=0.1*Ct R1≤ M1ij R2≤ M1ij p is the Profit of the project Cm cost constrain D is the duration for projects Ct is the cost for projects pc is the percentage of completion for one project Sm time constrain Dij duration for one project M1 , M2 uncertainty constrain R1 time constrain R2 cost constrain Step (5): Define upper and lower limit for Xij Xij from 0-1 Step (6): SelectParents Fcn(Cost,SelectionNum,SelMethod) PopSize = size(Cost,1); switch SelMethod case 1 R = randperm(PopSize); ParIndexes = R(1:SelectionNum); number of project to continue

Step (7):cross over

Switch Cross Method

case 1

Beta1 = rand;

Beta2 = rand;

Off1 = Beta1*Par1 + (1-Beta1)*Par2;

Off2 = Beta2*Par1 + (1-Beta2)*Par2;

case 2

Step (7) : Calculate the objective function

Max y= P* xij

Step (8) : Update the population

By repeating the step 5 to 7

Step (9) : Optimize the projects by finding he optimal profit according to step 5

END

3.5 Manage the Investment Project

This part include the management of the investment project by using two algorithm , GSA and GA in order to find the solution to the problems investment projects as follow:

Algorithm (3.6): Find the Solutions Using GSA
Input: Data of the entire projects Output: Find the Solutions Using GSA
Begin

Step (1): Input the GSA parameters

Step (2): Define the file name

Step (3): Define the range of the data

Step (4): Calculate the mass , velocity and acceleration

Step (5): Define the mathematical

D= Tij-tj* xij

D $\leq$ 0.2*Dt

C= Cij *xij

C $\leq$0.2 * Ct

q is the quality of the problem solution

D is the time constrain

Dt is the duration for one

project

Tij time of the solution

tj time of the problem

C is the cost constrain

Cij cost of the solution

Ct the total cost for the project

Step (6): define upper and lower limit for Xij

Xij from 0-1

Step (7) : calculate the objective function

Max y= q* xij

Step (8) : Update the mass , velocity and acceleration

Step (9) : Optimize the projects by finding the best solution for

.each problem according to step 5

END

While the GA algorithm that used to optimize the problems

Algorithm (3.7): Find the Solutions Using GA
Begin Step (1): Input the GA parameters Step (2): Define the file name Step (3): Define the range of the data Step (4): Define the mathematical model D= Tij-tj* xij D ≤ 0.2*Dt C= Cij *xij C≤0.2 * Ct q is the quality of the problem solution D is the time constrain Dt is the duration for one project Tij time of the solution tj time of theproblem Cij cost of the solution Ct the total cost for the project Step (5): Define upper and lower limit for Xij Xij from 0-1 Step (6): SelectParents Fcn(Cost,SelectionNum,SelMethod) PopSize = size(Cost,1); switch SelMethod case 1

```
        R = randperm(PopSize); ParIndexes = R(1:SelectionNum);
Step (7):cross over
 Switch Cross Method
    case 1
        Beta1 = rand;
        Beta2 = rand;

        Off1 = Beta1*Par1 + (1-Beta1)*Par2;
        Off2 = Beta2*Par1 + (1-Beta2)*Par2;
    case 2
Step (7) : Calculate the objective function
Max y= q* xij
 Step (8) : Update the population
By repeating the step 5 to 7
Step (9) : Optimize the projects optimize the projects by finding the best
solution for each problem according to step 5
END
```

Chapter Four

Experimental Results and Discussion

4.1 Introduction

The results obtained from applying the proposed algorithms for the investment projects in terms of number of the project to be proceed, profit gain and the solution for the problems, the algorithms were implemented by using MATLAB . The experiments were perform on an Intel Core i7, 64-bit Operating System, 2.20-GHz processor and 4-GB RAM.

4.2 The Proposed System Design

This section include the results of the proposed system by using GSA and GA in the investment projects.

4.2.1 Data Collected

This part include the data collected in order to build the system , the data were gathered from two source , the first from paper data and the second from the survey , the results of the paper data as shown in table (4.1)

Table (4.1) Data Gathered from the Organizations

Cost	NO of Stooped projects	Cost	NO of Invested projects	Cost	Number of given project	Organization
1603288142	9	42463451154	103	1035214745	15	National Investment Commission
8 395981943	144	3919037089	91	734063530	56	Baghdad governorate investment commission
868130356	88	1869649389	52	209282203	22	Kirkuk Governorate Investment Commission

2019281546	52	14991544	6	43239829	11	Nineveh Governorate Investment Commission
790912791	57	713956230	39	32440000	7	Salah al-Din Governorate Investment Commission
273455000	10	168445000	11	10600000	3	Diyala Governorate Investment Commission
1 147565 797	20	1531768132	44	12 706 005	11	Anbar Province Investment Commission
1677532599	38	779092571	13	314428336	14	Karbala Investment Commission
353023958	16	190374832	12	153033805	25	Najaf Governorate Investment Commission
7691049659	68	2189807139	156	794473832	42	Diwaniyah Governorate Investment Commission

219657940	4	349682406	5	26320195	8	Dhi Qar Governorate Investment Commission
209564140	2	835295551	13	24305206	10	Maysan Governorate Investment Commission
279991703	9	430004890	10	72067000	2	Wasit Governorate Investment Commission
66 675 235	6	313094233	9	45093773	8	Muthanna Governorate Investment Commission
1353458 874	37	3019336824	41	311631572	38	Basra Investment Commission

The projects with different completion percentage and some of them have zero percentage as shown

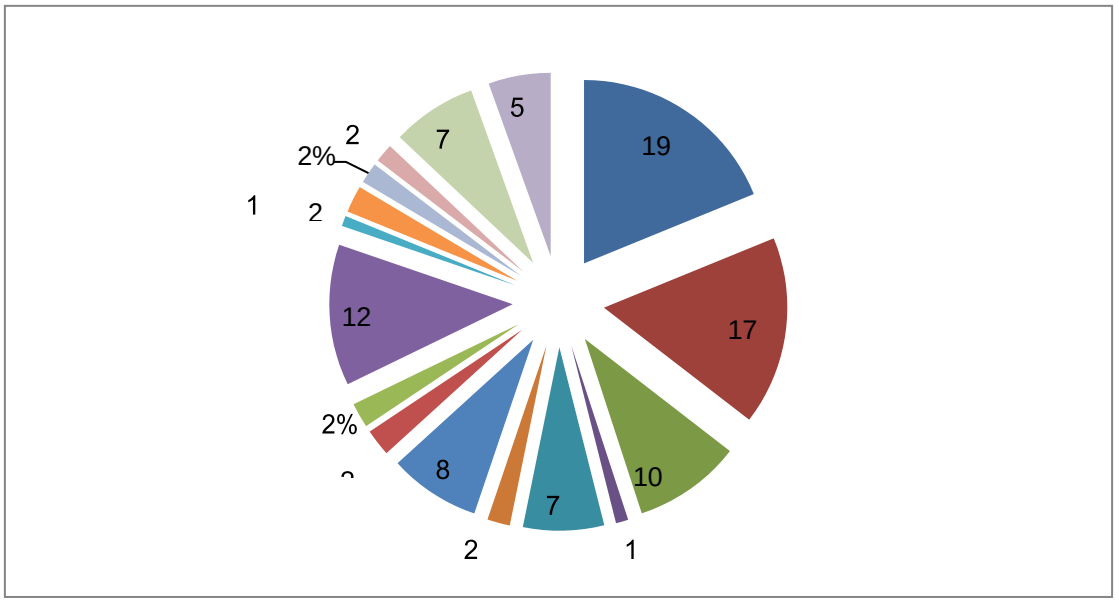


Figure (4.1) Scheme showing the Projects Granted Investment License with (varying) Completion Rates.(Planning Ministry)

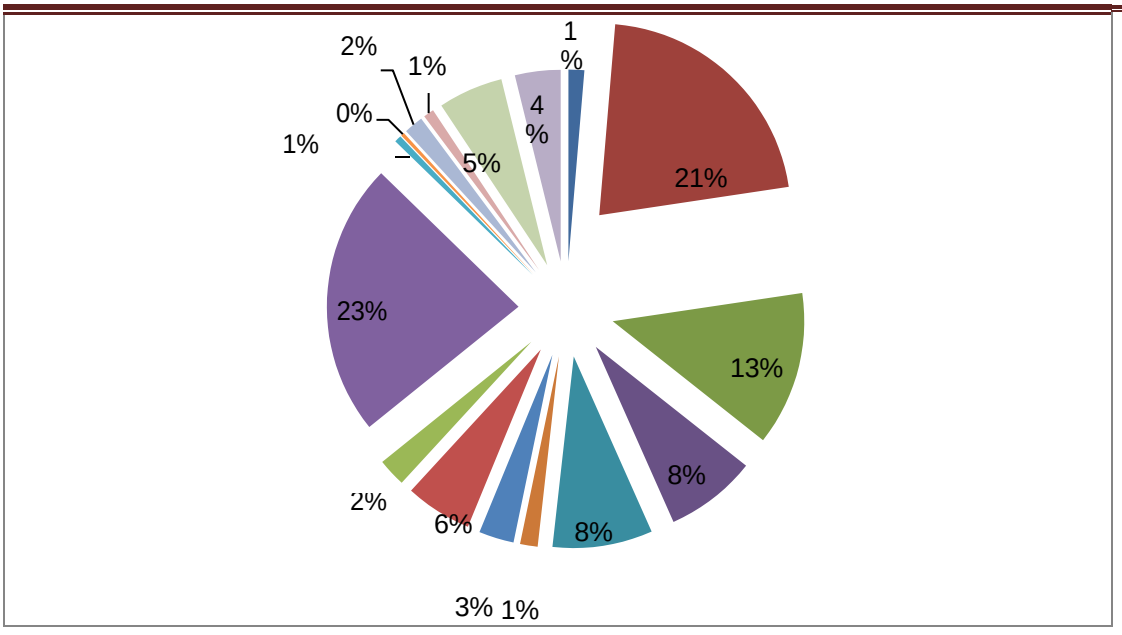


Figure (4.2) Shows the Projects Granted Investment License with Completion Rates (0%).(Planning Ministry)

While the second part the results from the survey

Data Analysis

The surveys were gathered and then tabularization of the data established from the surveys by using the program of statistical PSPP as subsequent:

Part one : General Information

This stage includes the general info as shown :

1- Gender

This part shows the distribution of the gender in the sample Table (4.2) shows the Gender of the Sample

Table (4.2) Gender of the Sample

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
male	1.00	26	65.00	65.00	65.00
female	2.00	14	35.00	35.00	100.00
Total		40	100.0	100.0	

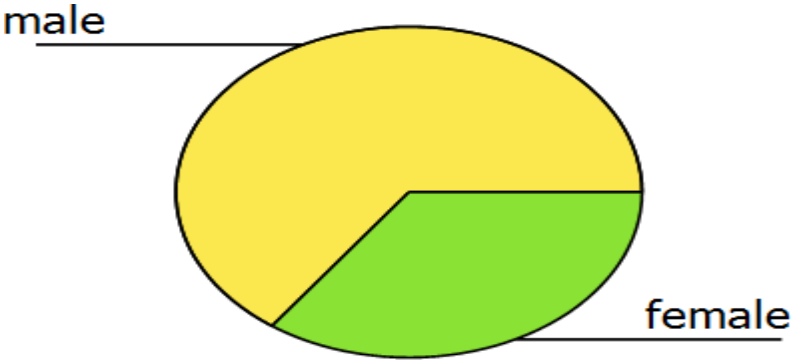


Figure (4.3) Shows the Gender of the Sample

The gender in sample represent by 65% male and 35% female

2- Position

The second part represent the position whether its owner or contractor and the results shown below:

Table (4.3) Position of the Sample

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Owner	1.00	20	50.00	50.00	50.00
Contractor	2.00	20	50.00	50.00	100.00
Total		40	100.0	100.0	

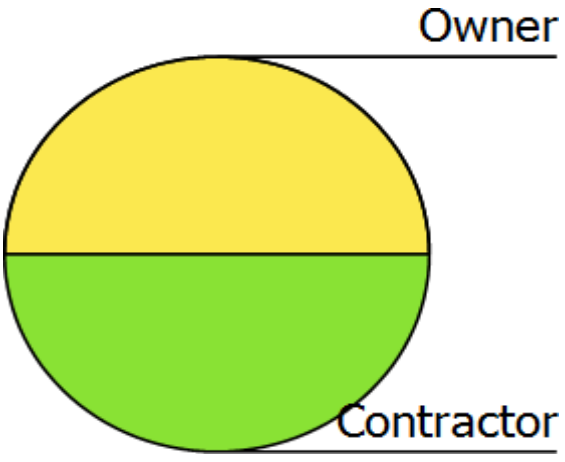


Figure (4.4) Shows the Position of the Sample

The position in sample represent by 50% owner and 50 % contractor.

3- Academic Degree

The third part represent by the academic degree , whether its master or others.

Table (4.4) Academic Degree of the Sample

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
BA	1.00	16	40.00	40.00	40.00
MA	2.00	15	37.50	37.50	77.50
PHD	3.00	6	15.00	15.00	92.50
others	4.00	3	7.50	7.50	100.00
Total		40	100.0	100.0	

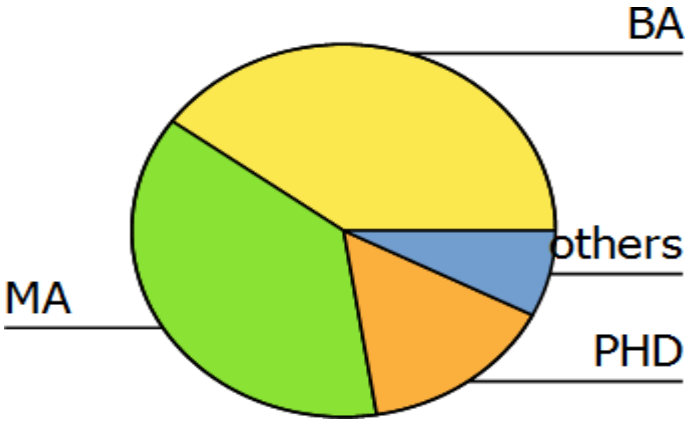


Figure (4.5) Shows the Academic Degree of the Sample

The results show that the sample consist of 40% BA , 37.5 of MA , 15% of PHD while 7.5 from the others.

4- Experience

This shows the experience of the sample as follow:

Table (4.5) shows the Experience of the Sample

Value Label	*Value*	*Frequency*	*Percent*	*Valid Percent*	*Cum Percent*
Less than 5	1.00	10	25.00	25.00	25.00
5-10	2.00	20	50.00	50.00	75.00
10-20	3.00	10	25.00	25.00	100.00
	Total	40	100.0	100.0	

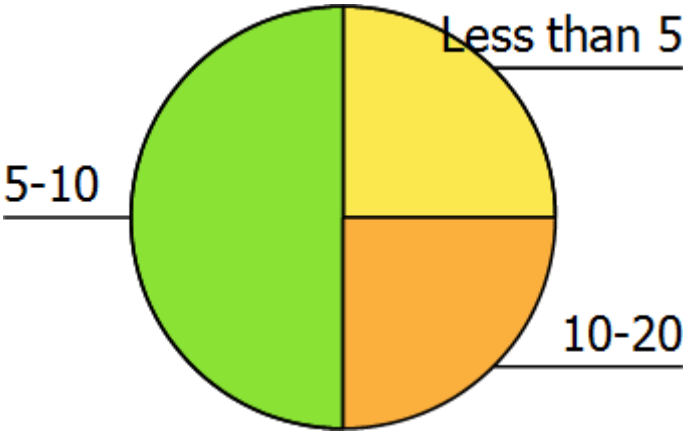


Figure (4.6) Shows the Experience of the Sample

The results show that 25% of the sample with experience less than 5 years , 50% with experience 5-10 years while 25% from 10 to 20.

5- Specialization

The last information regard specialization , mean civil or others

Table (4.6) shows the Specialization of the

Value Label	*Value*	*Frequency*	*Percent*	*Valid Percent*	*Cum Percent*
Civil	1.00	23	57.50	57.50	57.50
Arch	2.00	8	20.00	20.00	77.50
Mech	3.00	5	12.50	12.50	90.00
others	4.00	4	10.00	10.00	100.00
Total		40	100.0	100.0	

The results show that the sample consist of 40% BA , 37.5 of MA , 15% of PHD while 7.5 from the others.

Part 2: Problems that effect on Cost

This part include the results of the problems that effect on cost ,by using Likert scale as shown

Table (4.7) shows the Norms and Standard

Scale	Numerical
Very high	5
High	4
Medium	3
Low	2
Very low	1

This is the most famous that used to express the questionnaire . the sample of the results for the second part as follow:

Table (4.8) Shows the Effect of Problems on Cost

Problem	type	Mean	Linguistic
Weakness in the procedures of some government departments and the lack of a rapid response	Coordination problem	3.4	High
Not window	Planning problems	3.5	High
Weak financial and banking system	Finical problems	3.9	High
Lack of allocations in the investment budget	Finical problems	2.9	Medium
The presence of overtakes in most of the lands	Planning problems	3.8	High
The owners have been late in signing legal action contracts on the ground	Accessing problems	4.1	High

The owners have been late in handing over the lands to the investors despite the long passage of approvals	Accessing problems	4.2	Very high
Owners approving minutes of appreciation for real estate designated for investment	Accessing problems	3.9	High
In design did not fit the requirements of modern construction	Planning problems	4.1	Very high
Lack of specialized investment banks to finance investment projects	Finical problems	3.7	High
Lack of stability	Finical problems	3.9	High

The results above show the problem that effect on the cost of the investment project that range from medium to very high according to the Likert scale.

Part 3: Problems that effect on Time

This part include the problems that effect on the quality of the investment projects.

Table (4.9) Shows the Effect of Problems on Time

Problem	type	Mean	Linguistic
Weakness in the procedures of some government departments and the lack of a rapid response	Coordination problem	3.1	High
Not activating the role of one-window delegates and not giving them the appropriate powers	Planning problems	2.9	High
Weak financial and banking system	Finical problems	3.5	High
Lack of allocations in the investment budget	Finical problems	3.1	High
The presence of overtakes in most of the lands that were allocated for investment projects	Planning problems	3.8	High
The owners have been late in signing legal action contracts on the ground	Accessing problems	4.2	Very High

The owners have been late in handing over the lands to the investors despite the long passage of approvals	Accessing problems	3.9	High
Owners delay in certifying or approving minutes of appreciation for real estate designated for investment	Accessing problems	3.9	High
In some governorates, the basic design did not fit the requirements of modern construction	Planning problems	4.1	Very high
Lack of specialized investment banks to finance investment projects	Finical problems	3.7	High
Lack of stability in the price of construction materials	Finical problems	3.9	High

Part 4: Solutions of the problems

This part include the solutions for each problems with their solutions as explained in the electronic appendix

4.2.2 System Build

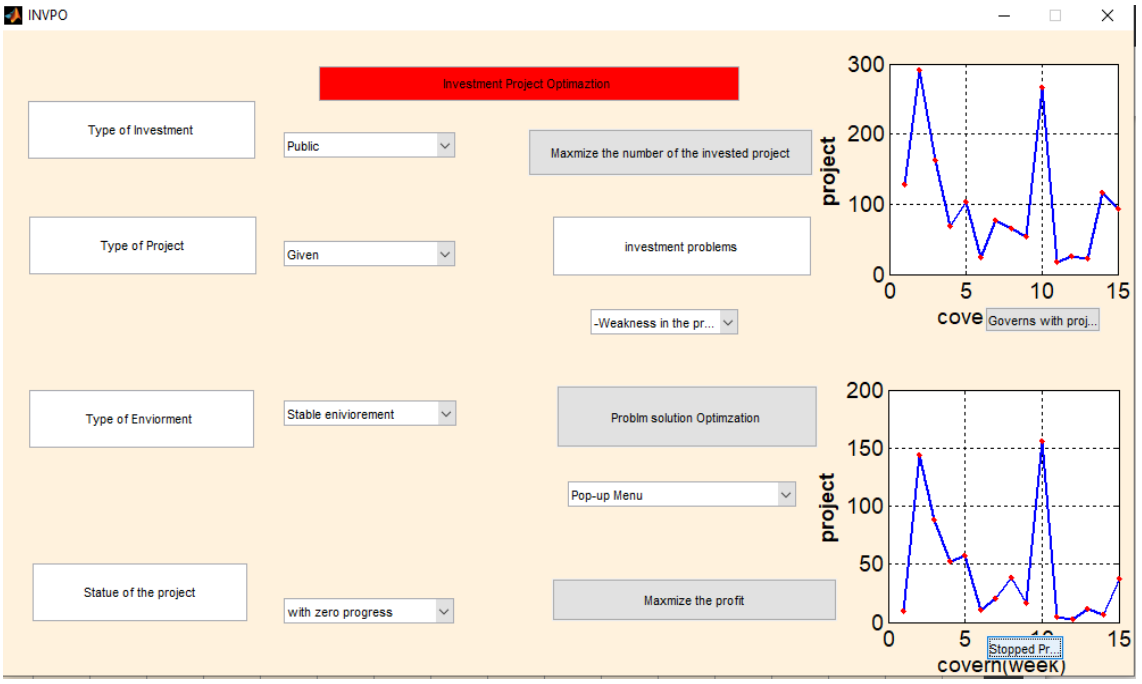


Figure (4.8) Proposed System

Figure (4.8) shows the proposed system for using GSA and GA for the investment projects, after the implementation of system ,each part of the system will be explained.

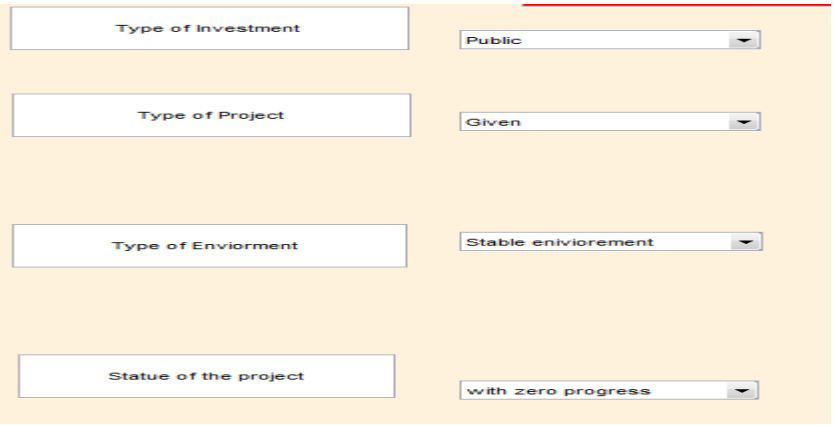


Figure (4.9) Investment Projects Information

The figure (4.9) show the information about the investment projects in term of type of investment whether its public or private, type of the project which mean, stooped, continue or awarded. Finally the percentage of the completion, as there are projects with zero progress, where projects more than 50 present.

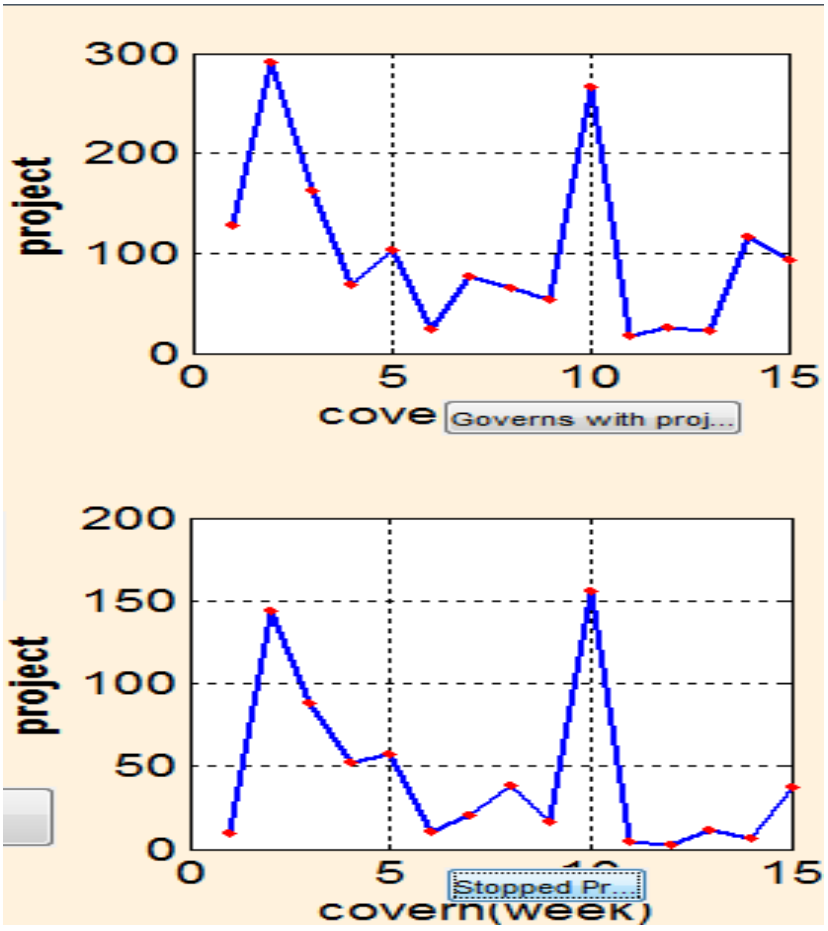


Figure (4.10) Investment Projects

Figure (4.10) show the number of the investment projects as whole for each governorate in term of stopped and as whole . After the general information of the projects were explained .Then these projects will be processed.

Figure (4.11) Investment Projects Optimization

Figure (4.11) refer to the items that will be processed with optimization algorithms, the first item is maximize the number of the project to be proceed, mean that each governorate is awarded for number of projects but not all the projects can be implemented therefore the goal of the optimization is to maximize the number of projects that can be implemented, after that if the projects are implemented there are number of problems that can prevent them from completing thus these problems require solution, finally, if these projects are awarded, the profit must maximize for the investor. Each of items of optimization, two algorithm will be used, GSA and GA .

1. GSA

GSA algorithm is used to maximize the number of the projects to be implemented, according to algorithm (3.3), the mathematical model was explained, the results of the maximization of the number of the implemented projects as shown in table (4. 10).

Table (4.10) Maximization of Implemented Projects using GSA

Governorate	ci($)	pc	D(day)	Ct($)	Dt(day)	N	z	xij
National Investment Commission	42463451154	0.2	365	4.37374E+12	37595	103	101	0.98
Baghdad governorate investment commission	3919037089	0.1	365	3.56632E+11	732	91	90	0.99
Kirkuk Governorate Investment Commission	868130356	0.0001	365	76395471328	732	88	87	0.99
Nineveh Governorate Investment Commission	12746937.5	0.0001	365	1019755000	602	52	51	0.99
Diyala Governorate Investment Commission	546086338	0.2	365	1019755000	602	11	10	0.99
Anbar Province Investment Commission	5148680	0.2	365	3508105250	713	44	43	0.99
Karbala Investment Commission	175405262.5	0.0001	420	3508105250	713	38	37	0.99
Najaf Governorate Investment Commission	1298137584	0.1	365	3508105250	713	25	25	0.99

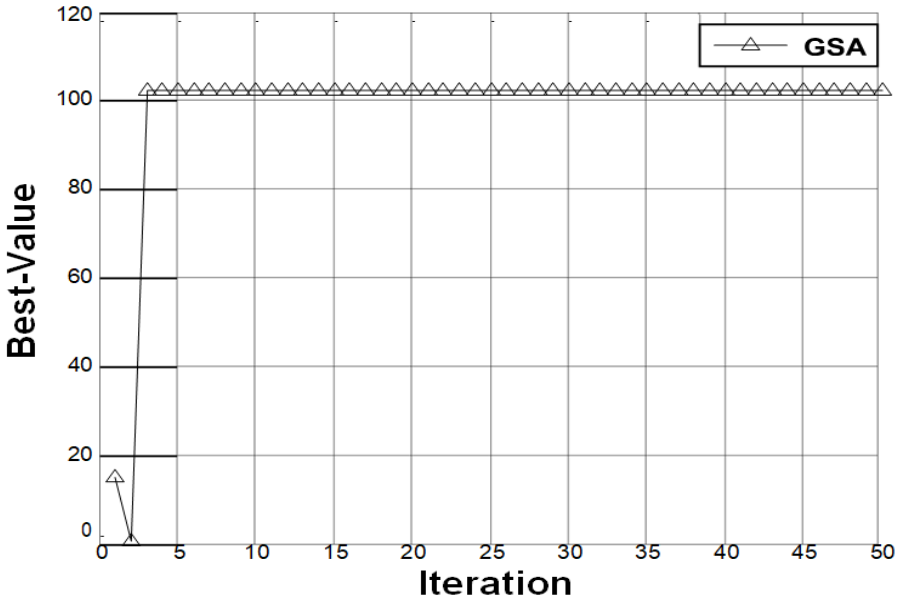


Figure (4.12) Implemented projects for National Investment Commission

Figure (4.12) refer to the number of projects that can be implemented by national investment which is about 100 project and the algorithm find the solution at third iteration.

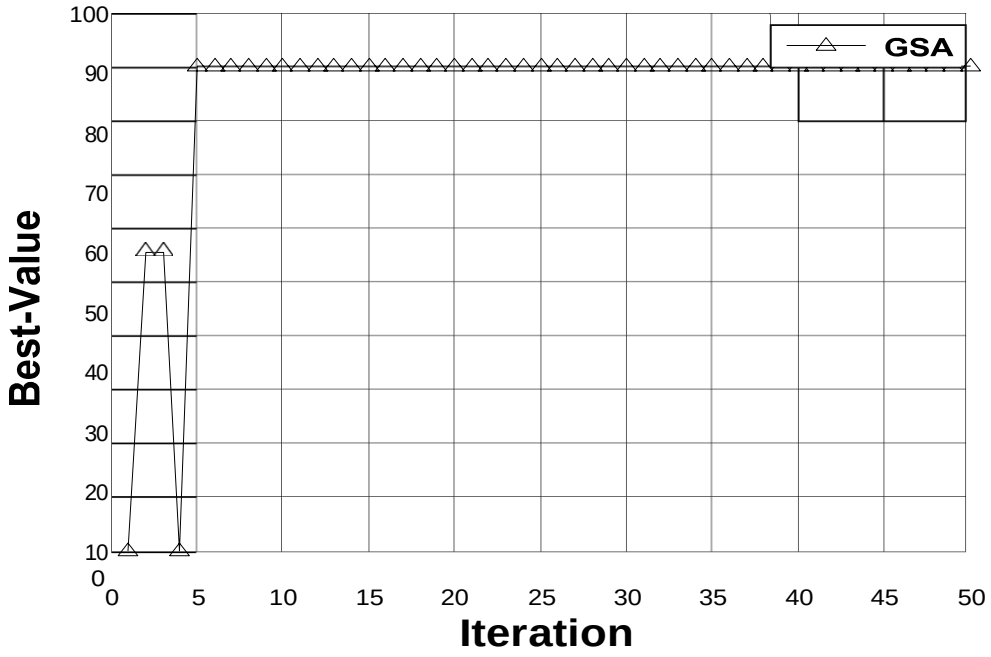


Figure (4.13) Implemented projects for Baghdad Governorate

Figure (4.13) refer to the number of projects that can be implemented by Baghdad governorate which is about 90 project and the algorithm find the solution at third iteration.

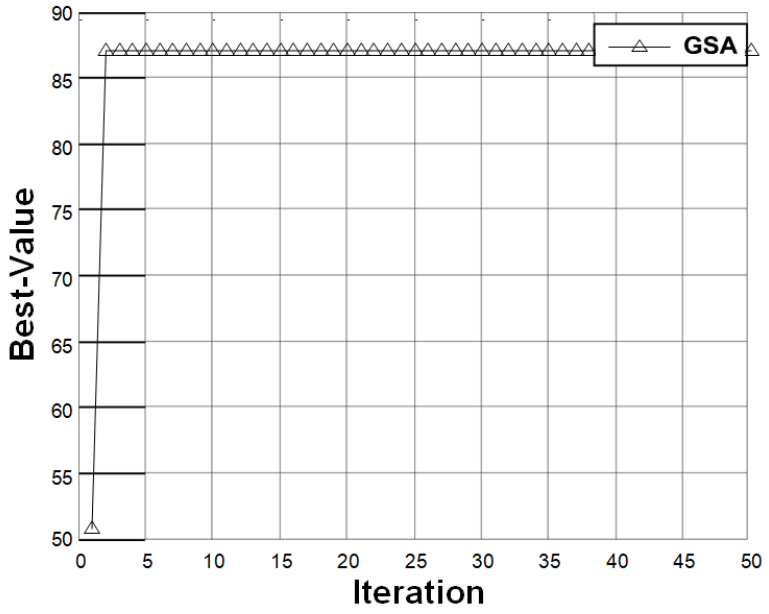


Figure (4.14) Implemented Projects for Kirkuk Governorate

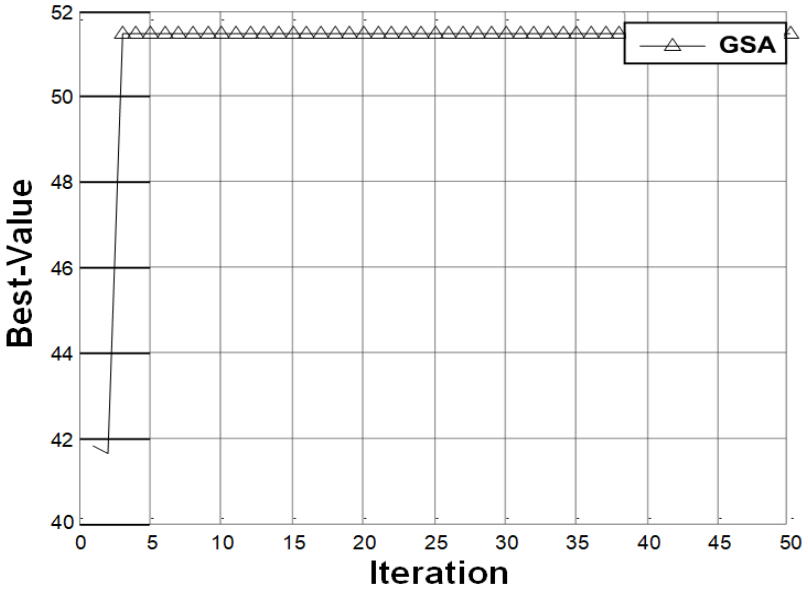


Figure (4.15) Implemented projects for Nineveh Governorate

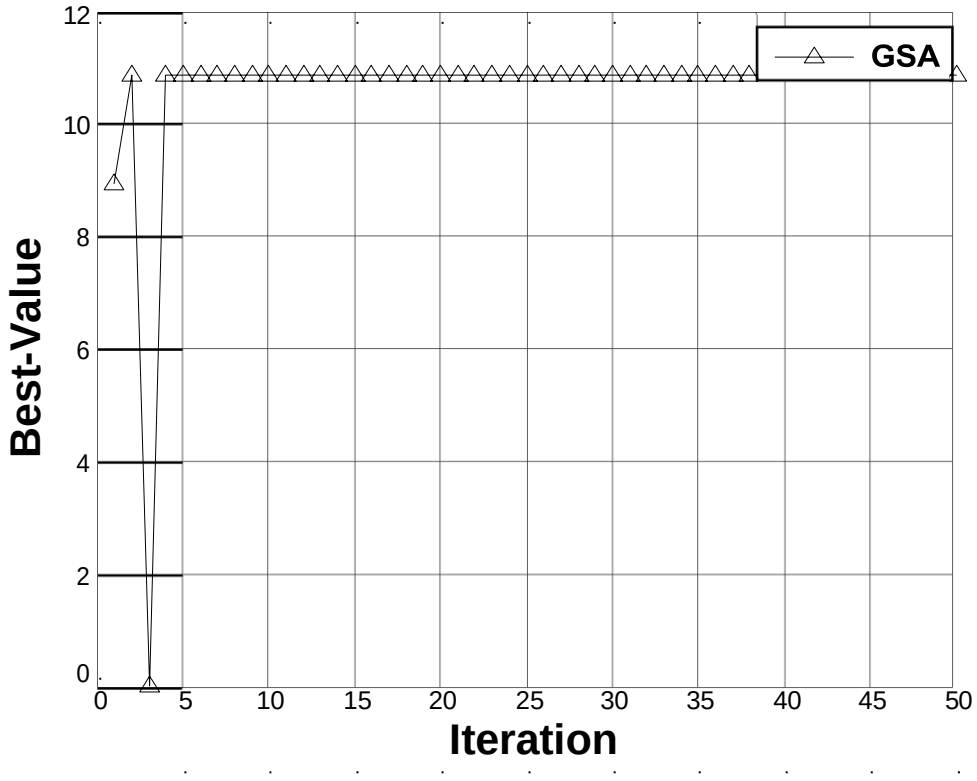


Figure (4.16) Implemented projects for Diyala Governorate

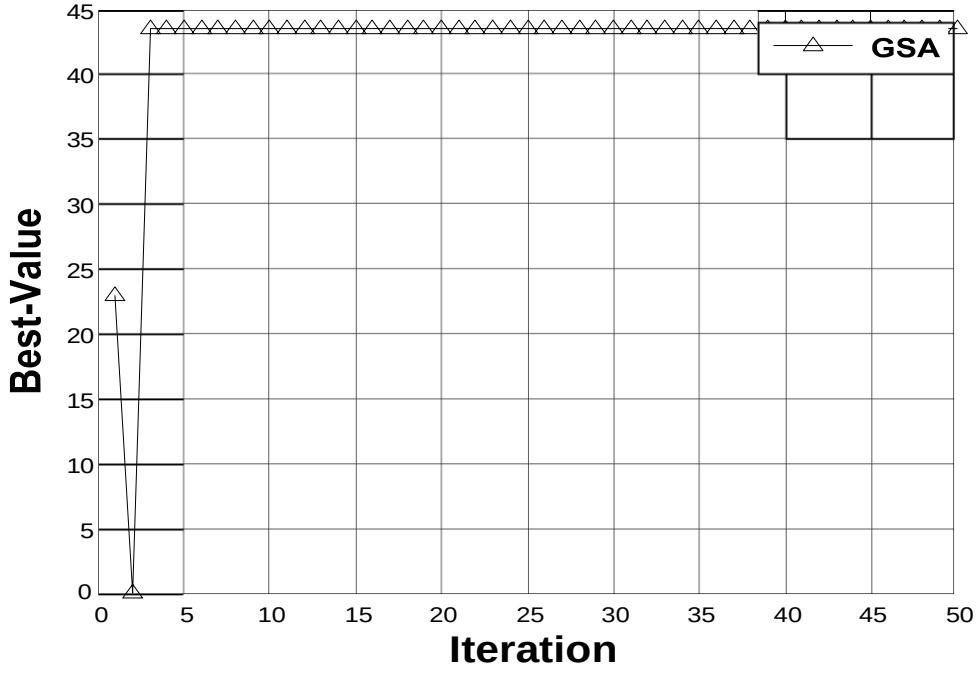


Figure (4.17) Implemented projects for Anbar Governorate

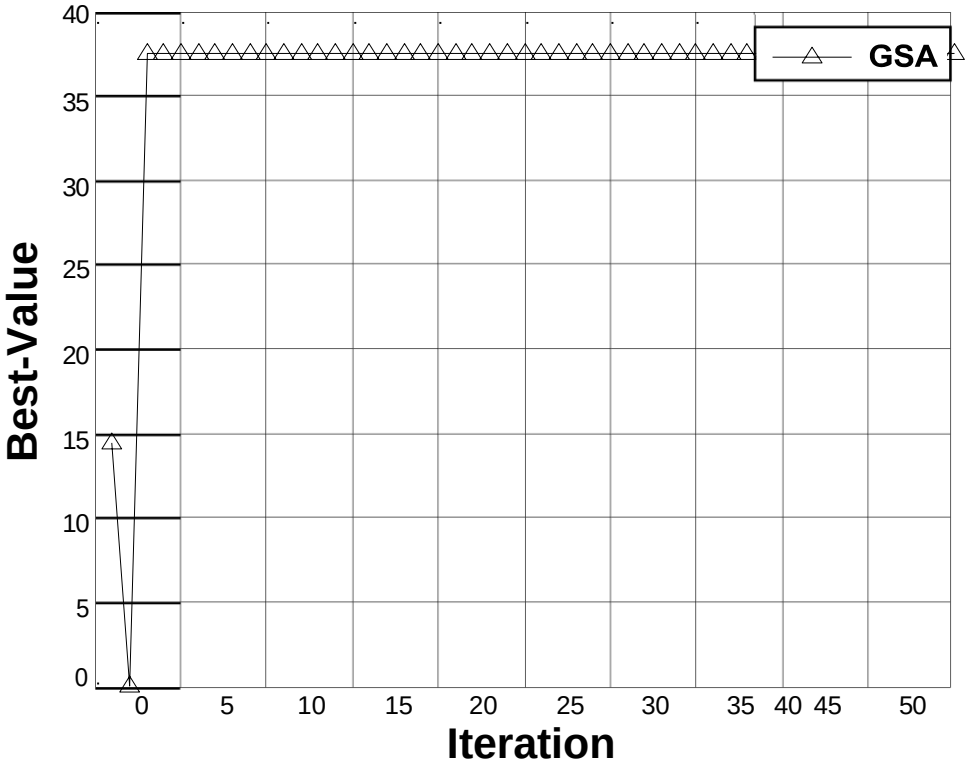


Figure (4.18) Implemented Projects for Karbala Governorate

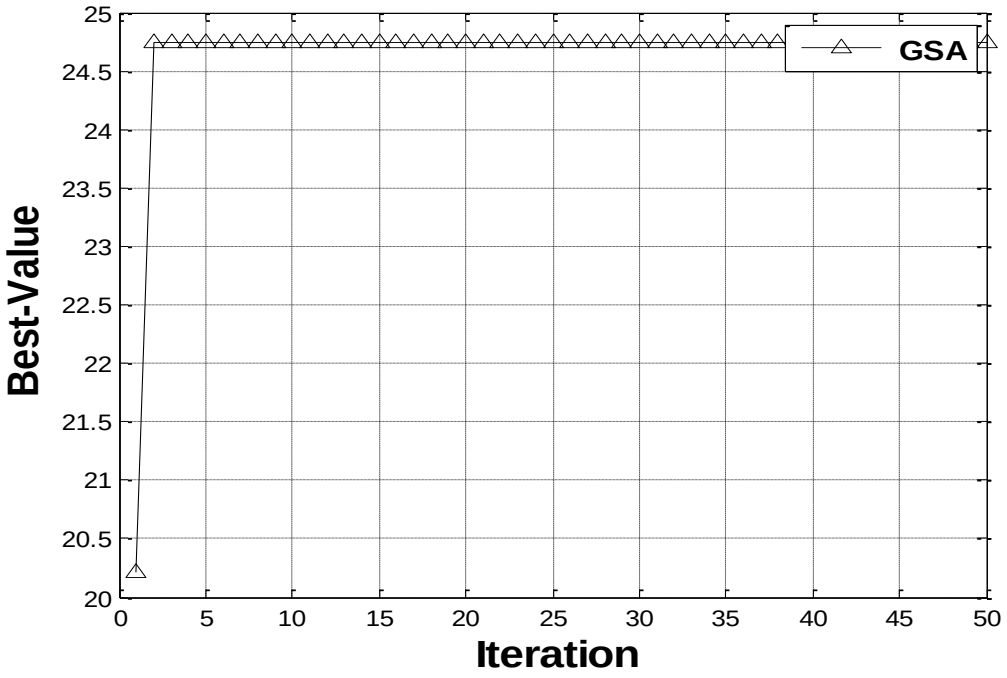


Figure (4.19) Implemented Projects for Najaf Governorate

The figures from (4.12) to (4.19) refer to the iteration that GSA find the objective function according to algorithm (3.3) and (3.4) and its round from 4 to 5 iteration. According to abtehaj (2020) GSA found the solution for the problems in construction projects in iteration 3 and 4 while Naji(2017) used GSA to find the best risk response in construction and find the solution in iteration 3 which approximately to this model GSA then it's used to find the solutions for the problems that the implemented projects face.

Table (4.11) GSA for Finding the solution for problems

Problems	Cij($)	tj	Tij	C(t)($)	D(t)	q	z	xij
1.1	320898340	73.2	0.203333	4584262000	732	0.9	0.891	0.98
1.2	80224585	51.24	0.7	4584262000	732	0.95	0.9405009	0.99
1.3	970850440	146.4	0.222492401	4584262000	732	0.93	0.9207	0.99
2.1	12746937.5	60.2	0.668888889	1019755000	602	0.85	0.8415009	0.99
2.2	9993599	42.14	0.117055556	1019755000	602	0.89	0.8811009	0.99
2.3	318417690	120.4	0.334444444	1019755000	602	0.9	0.8910009	0.99
3.1	87702631.25	71.3	0.672641509	3508105250	713	0.8	0.792	0.99
3.2	175405262.5	49.91	0.702957746	3508105250	713	0.8	0.792	0.99

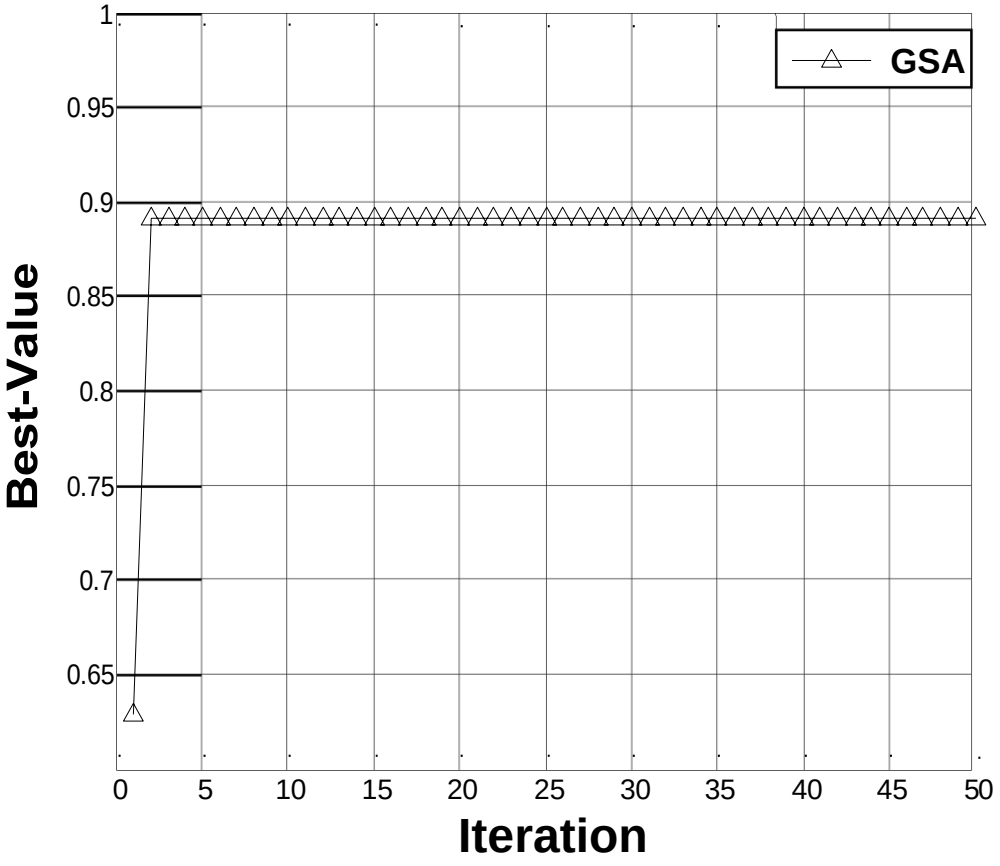


Figure (4.20) Solution of problem 1 project 1

Figure (4.20) represent the chart for finding the best solution for the problem that encounter with project and its found that the solution with effectiveness 0.89 was chosen at iteration 3.

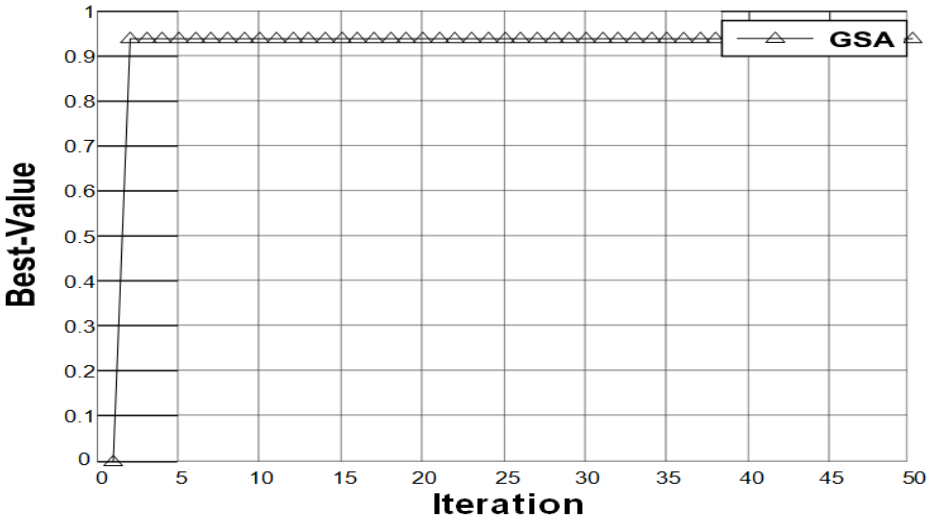


Figure (4.21) Solution of problem 2 project 1

Figure (4.21) represent the chart for finding the best solution for the problem that encounter with project and its found that the solution with effectiveness 0. 93 was chosen at iteration 3.

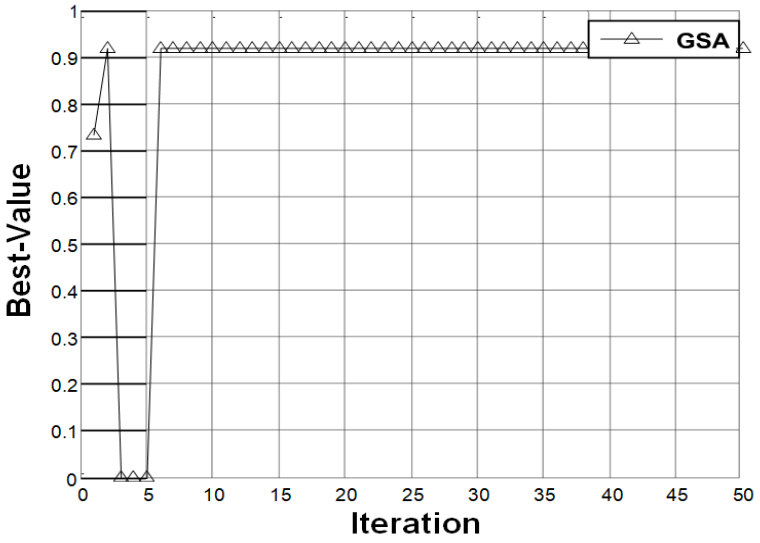


Figure (4.22) Solution of problem 3 project 1

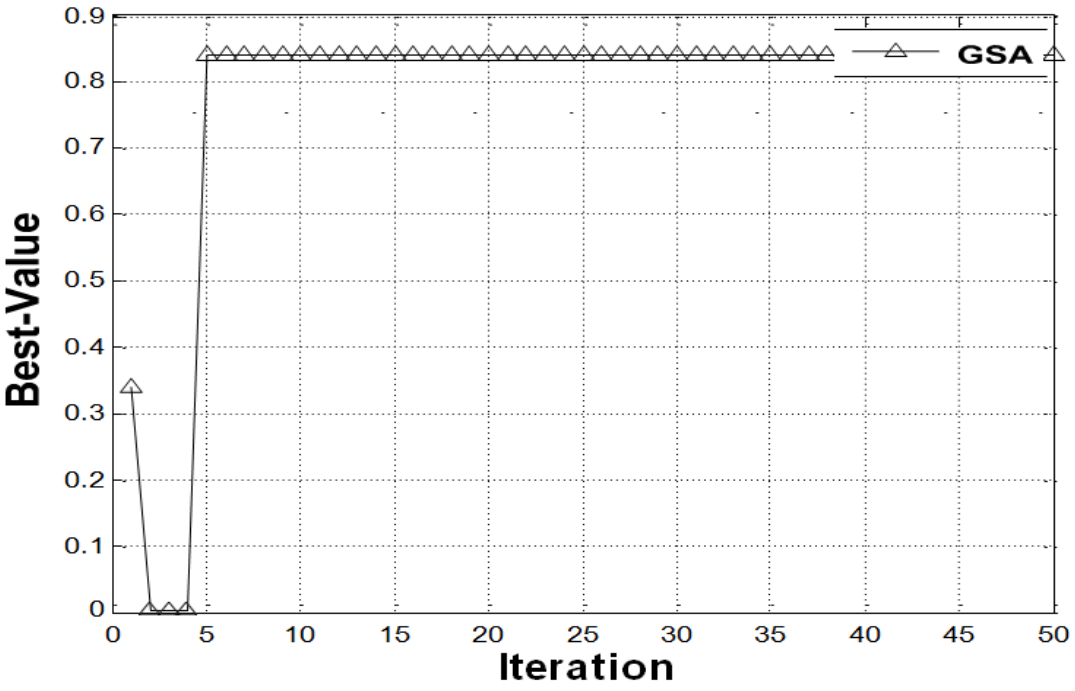


Figure (4.23) Solution of problem 1 project 2

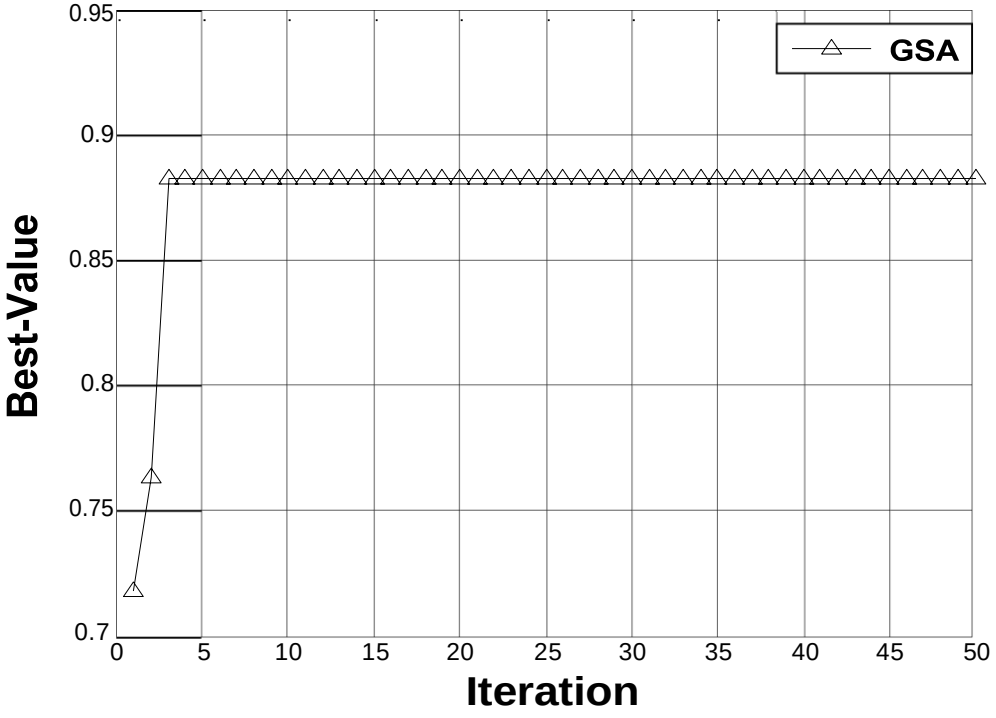


Figure (4.24) Solution of problem 2 project 2

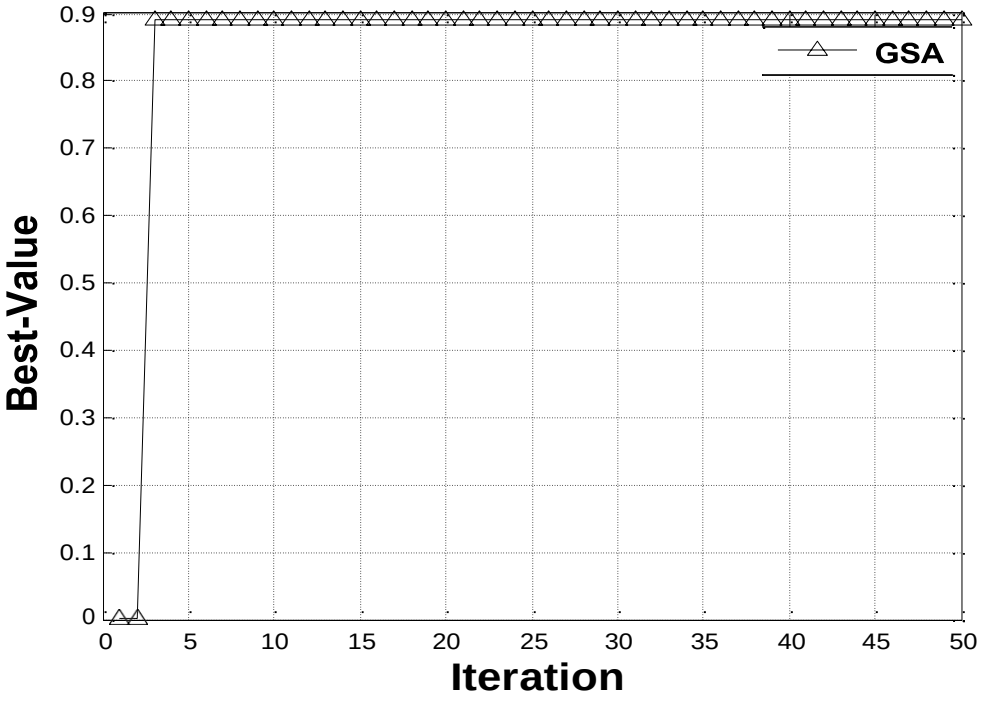


Figure (4.25) Solution of problem 3 project 2

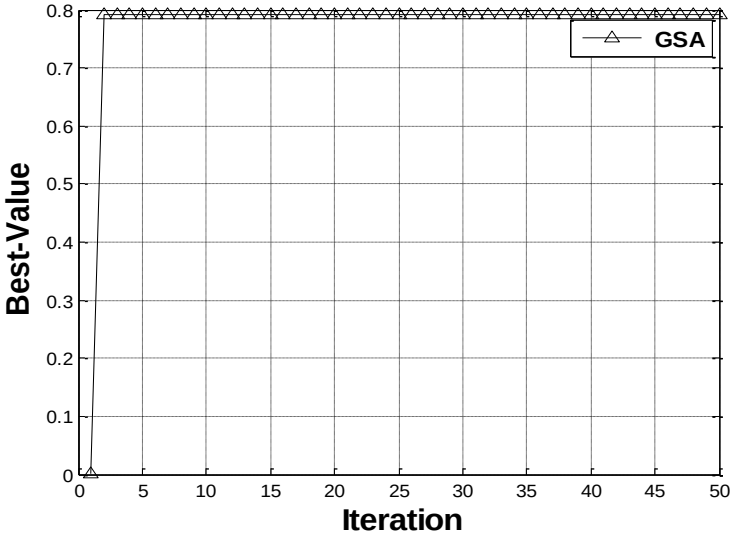


Figure (4.26) Solution of problem 1 project 3

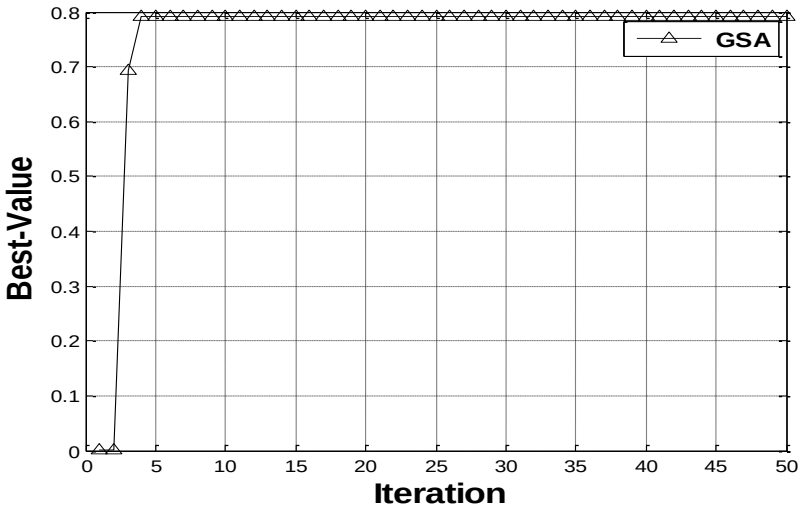


Figure (4.27) Solution of problem 2 project 3

Finally, GSA is used to maximize the profit for each investor according to algorithm (3,6) , in order to know how much benefit will gain for each project.

Table (4.12) GSA for Maximize Profit For Each Project

Governorate	Ci($)	pc	Dij	Ct	Dt	P	R1	R2	z	Xij
National Investment Commission	1035214745	0.1	365	15528221175	33215	155282212	0.5	0.2	5944883161.56	0.99
Baghdad governorate investment commission	734063530	0.2	365	41107557680	732	88087623.6	0.65	0.000260274	4584262000	0.99
Kirkuk Governorate Investment Commission	868130356	0.0001	365	76395471328	732	104175642.7	0.85	0.003541667	224357926.68	0.99

Nineveh Governorate Investment Commission	12746937.5	0.0001	365	1019755000	602	1529632.5	0.89	0.001	6118530.000	0.99
Diyala Governorate Investment Commission	9993599	0.0001	365	1019755000	602	1199231.88	0.9	0.00151	468074004.36	0.99
Anbar Province Investment Commission	318417690	0.0001	365	1019755000	602	38210122.8	0.8	0.002807018	42097263.000	0.99
Karbala Investment Commission	5148680	0.2	365	3508105250	713	617841.6	0.68	0.011267606	84194526.0000	0.99
Najaf Governorate Investment Commission	98226947	0.1	365	3508105250	713	11787233.64	0.66	0.002222222	155776510.080	0.99

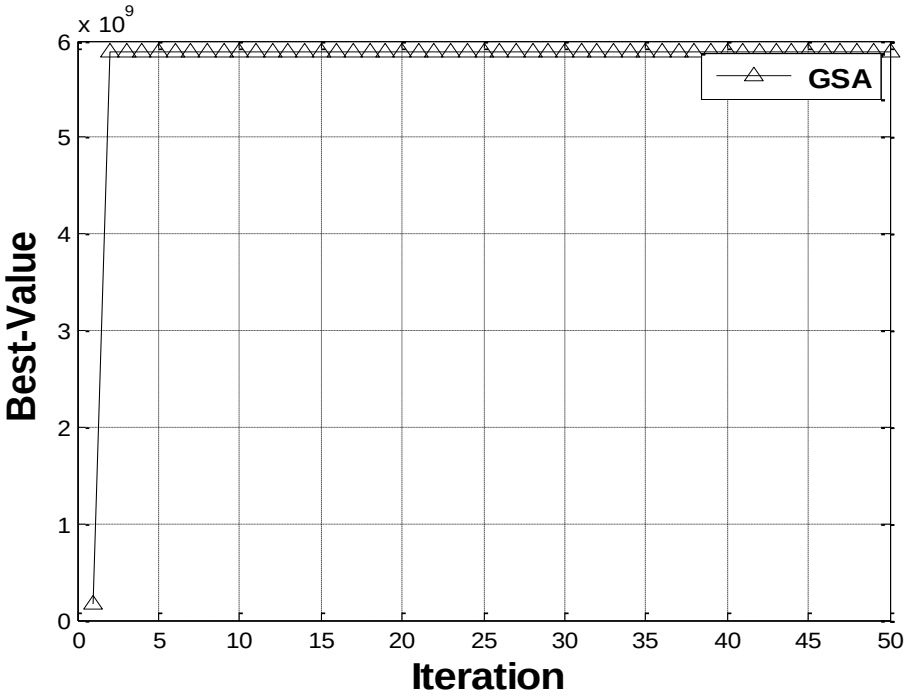


Figure (4.28) Profit of National Investment Commission

Figure (4.28) represent the chart for finding profit for the projects in the national investment in and its found that the profit is about 5 billion dollar was chosen at iteration 3.

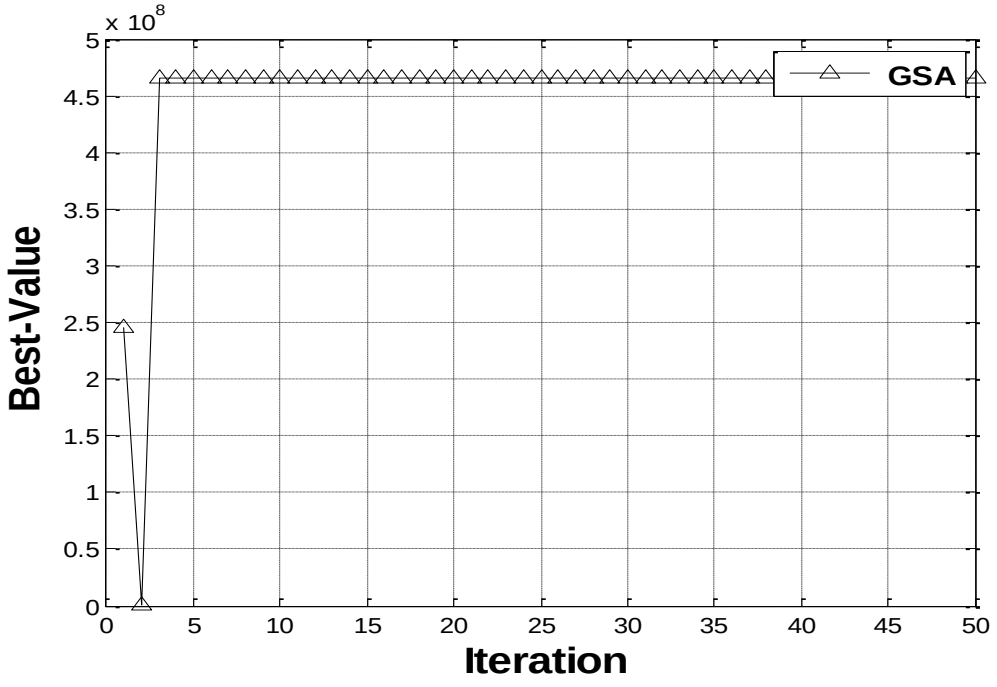


Figure (4.29) Profit of Baghdad

Figure (4.29) represent the chart for finding profit for the projects in the Baghdad governorate in and its found that the profit is about 4.5 billion dollar was chosen at iteration 3.

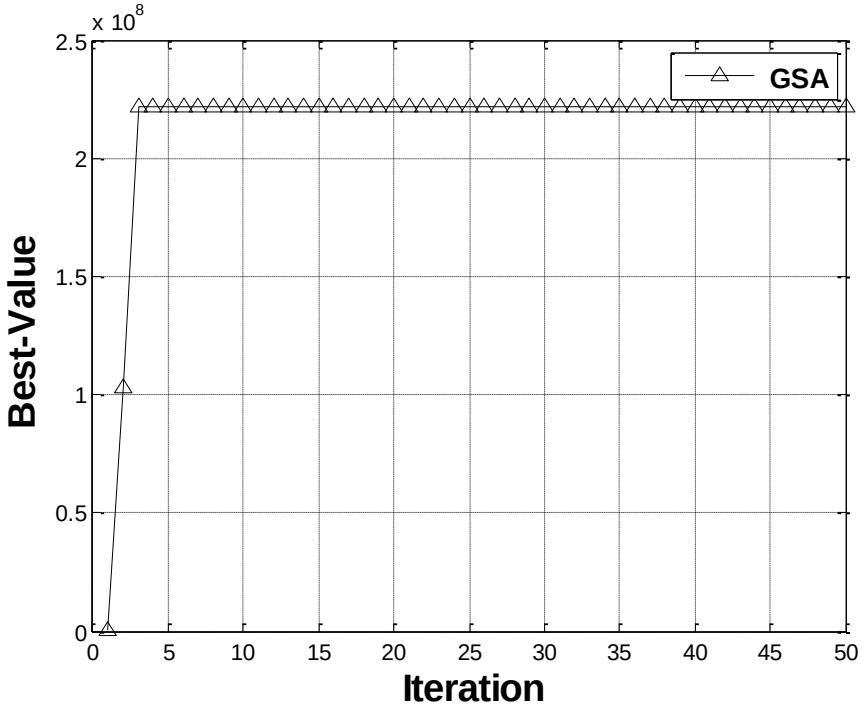


Figure (4.30) Profit of Kirkuk

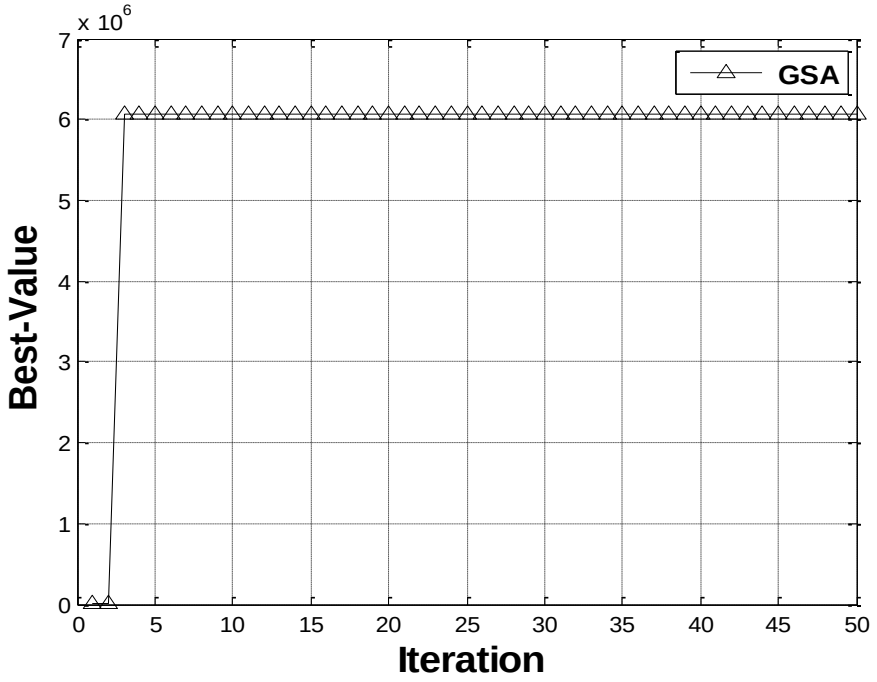


Figure (4.31) Profit of Nineveh

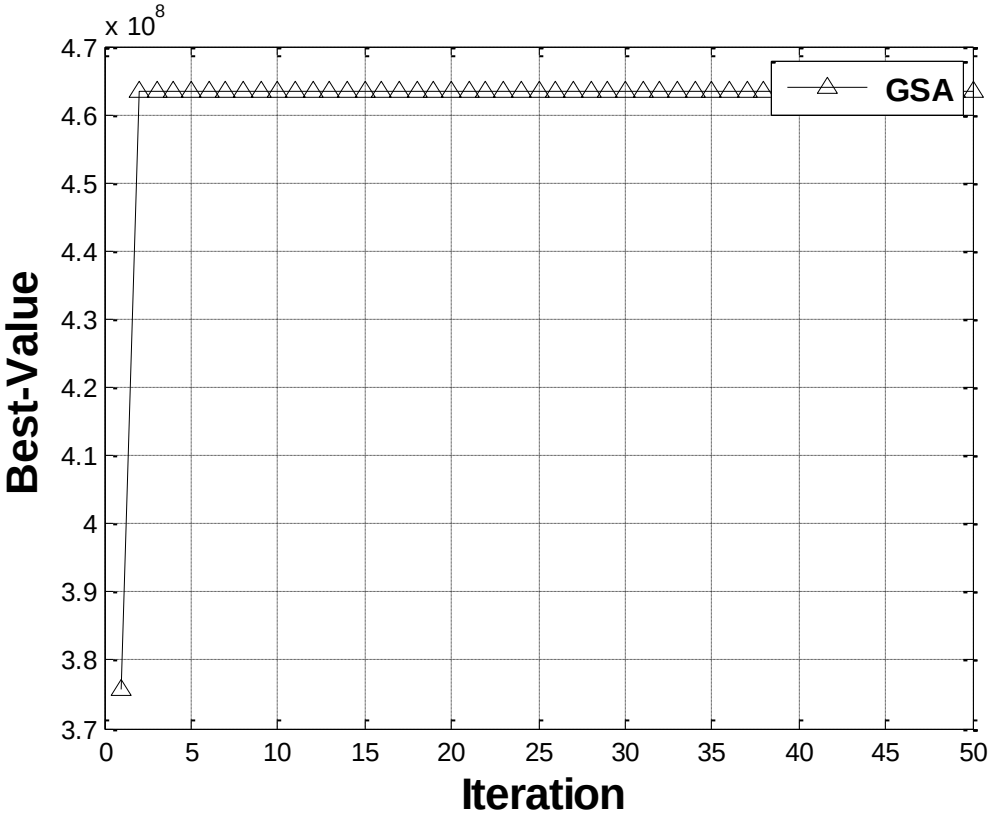


Figure (4.32) Profit of Diyala

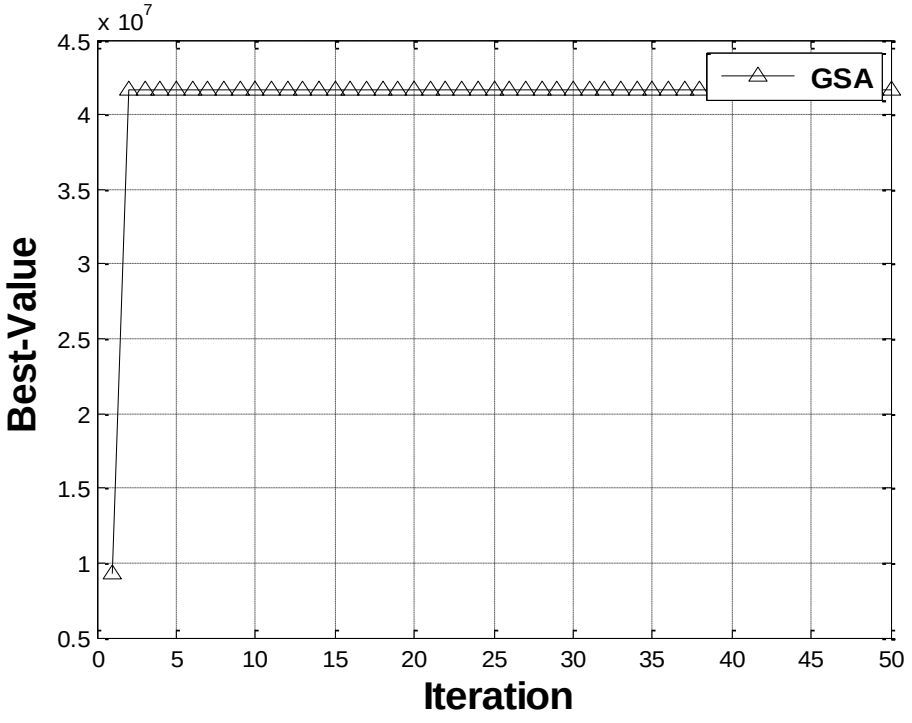


Figure (4.33) Profit of Anbar

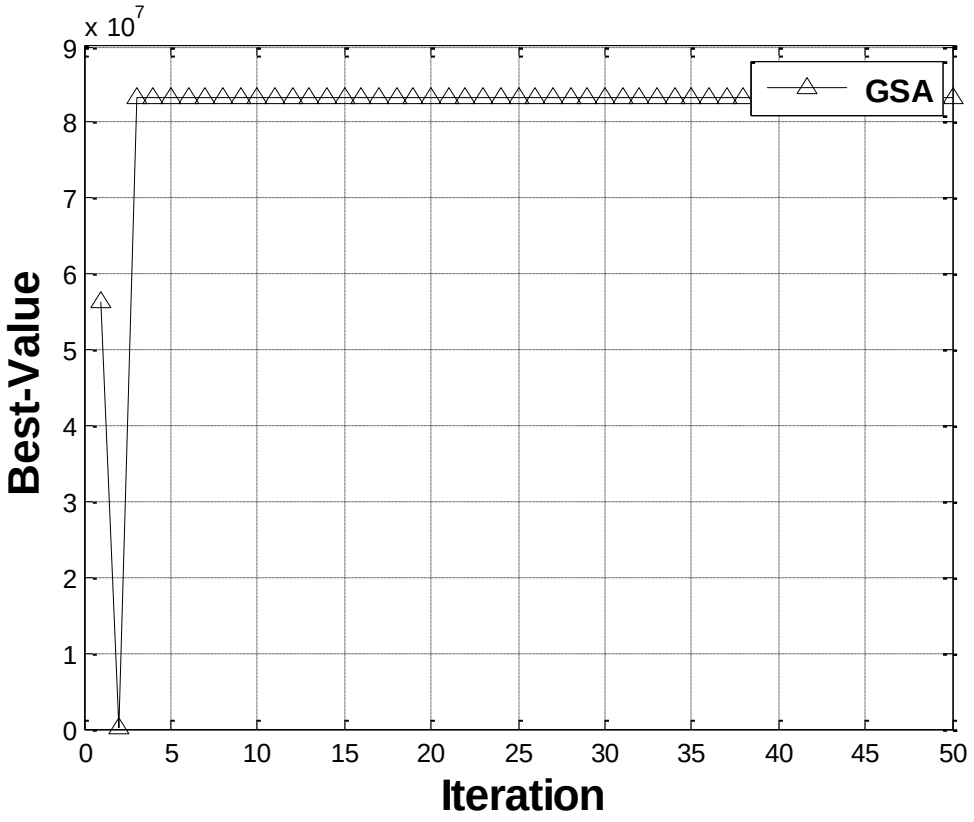


Figure (4.34) Profit of Karbala

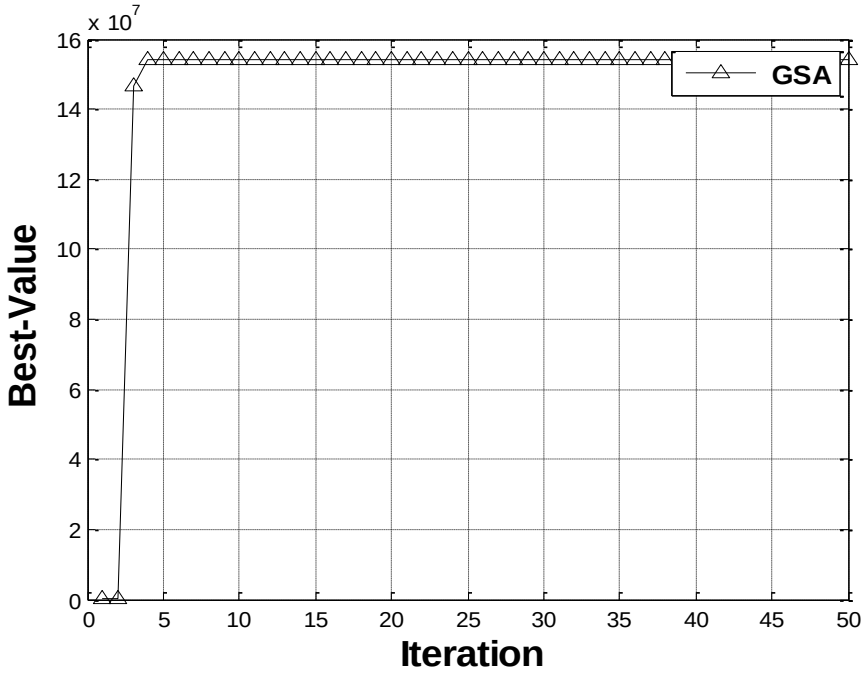


Figure (4.35) Profit of Najaf

Table (4.3) and the figures from (4.28) to (4.35) show the profit for each project gain.

2. GA

GA algorithm was used as the same purpose as GSA using the algorithm (3.3).

Table (4.13) Maximization of Implemented Projects using GA

Governorate	ci($)	pc	D(day)	Ct($)	Dt(day)	z	N	xij
National Investment Commission	42463451154	0.2	365	4.37374E+12	37595	51	51	0.866214
Baghdad governorate investment commission	3919037089	0.1	365	3.56632E+11	732	89	90	0.584021
Kirkuk Governorate Investment Commission	868130356	0.0001	365	76395471328	732	26	87	0.279674
Nineveh Governorate Investment Commission	12746937.5	0.0001	365	1019755000	602	10	51	0.746537
Diyala Governorate Investment Commission	546086338	0.2	365	1019755000	602	38	10	0.453837
Anbar Province Investment Commission	5148680	0.2	365	3508105250	713	22	43	0.051696
Karbala Investment Commission	175405262.5	0.0001	420	3508105250	713	12	37	0.555864
Najaf Investment Commission	1298137584	0.1	365	3508105250	713	24	25	0.873867

As comparing to GSA, the value that is chosen is very low and lead to reduce the number of the project implemented, as GA is fall in under fitting and the steps as selection , cross over and mutation lead to this value.

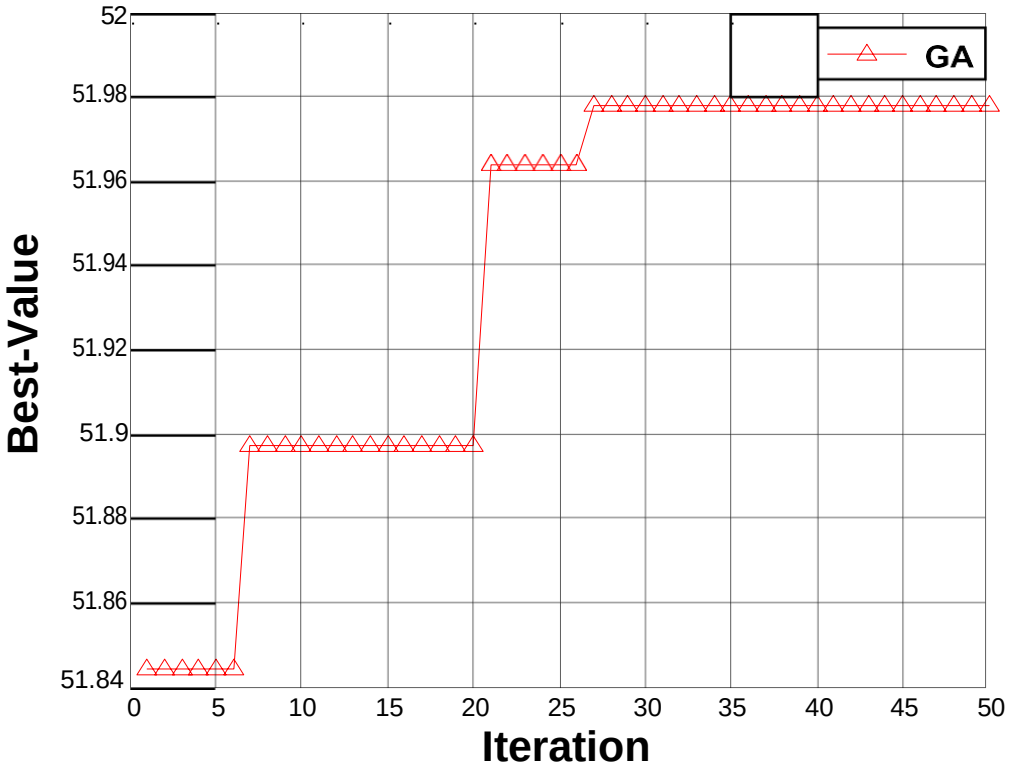


Figure (4.36) Implemented projects for Governorate(1) using GA

Figure (4.36) refer to the number of projects that can be implemented by national investment with GA which is about 51 project and the algorithm find the solution at 25 iteration comparing to GSA which give 100 projects.

Figure (4.37) refer to the number of projects that can be implemented by Baghdad investment with GA which is about 88 project and the algorithm find the solution at 25 iteration comparing to GSA which give 90 projects.

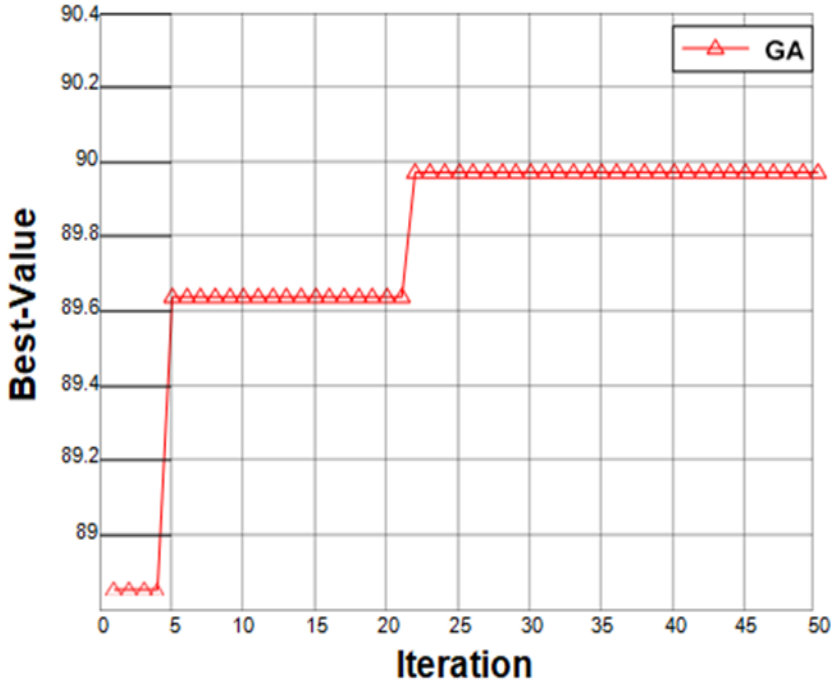


Figure (4.37) Implemented projects for Governorate(2) using GA

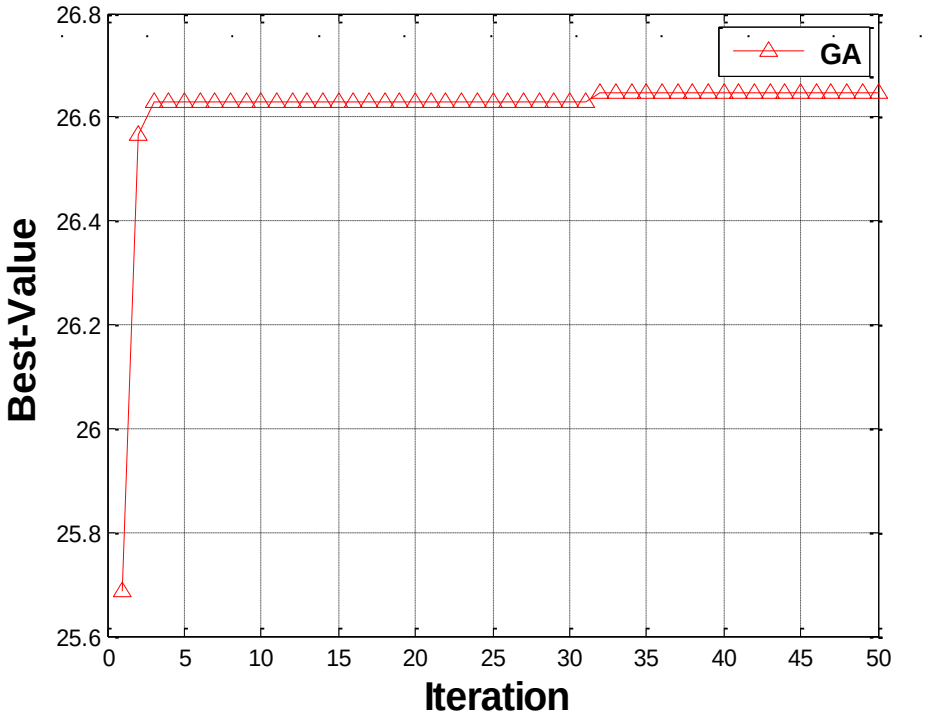


Figure (4.38) Implemented projects for Governorate(3) using GA

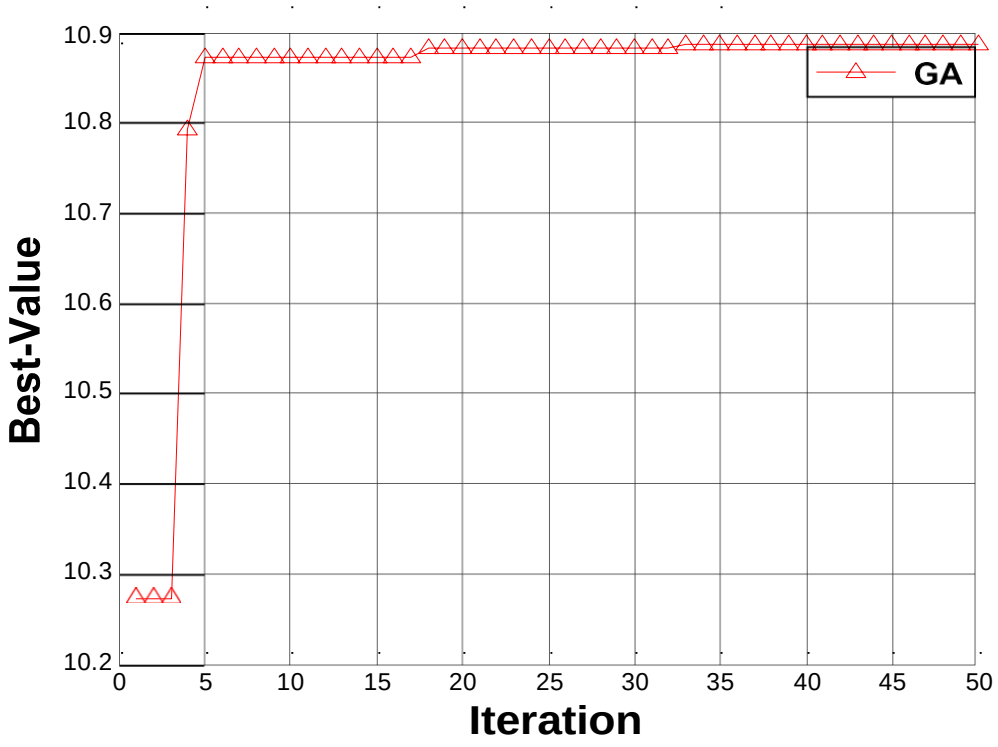


Figure (4.39) Implemented projects for Governorate(4) using GA

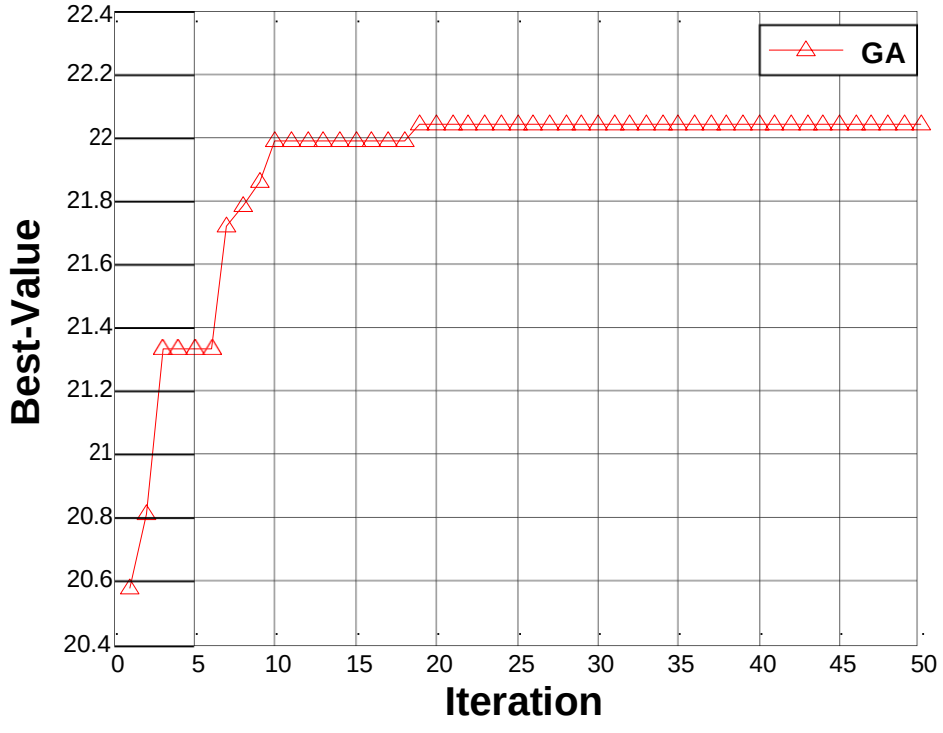


Figure (4.40) Implemented projects for Governorate(6) using GA

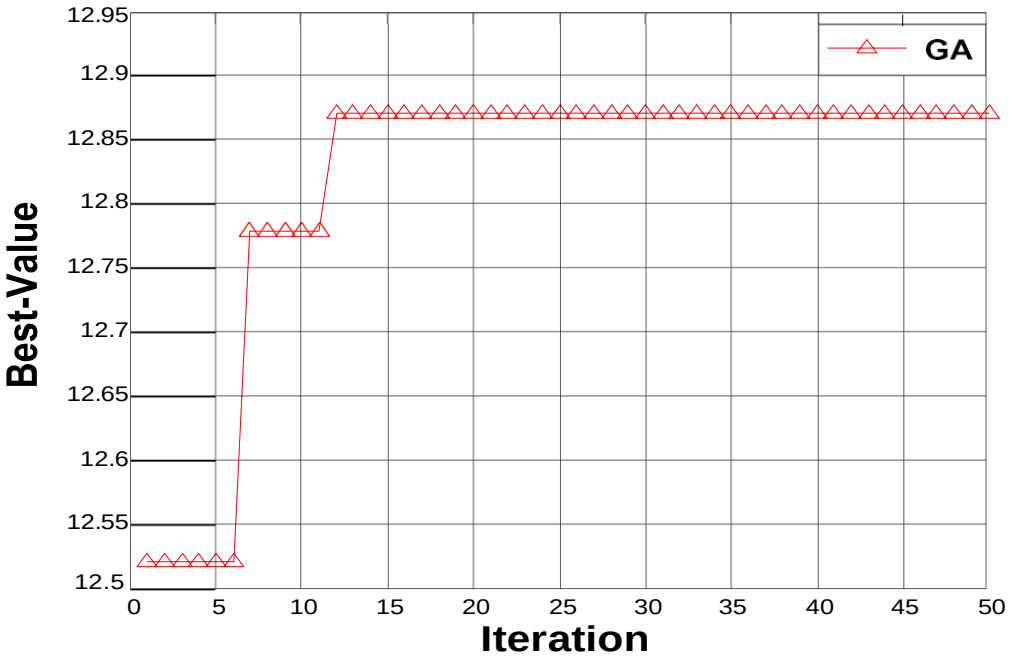


Figure (4.41) Implemented projects for Governorate(7) using GA

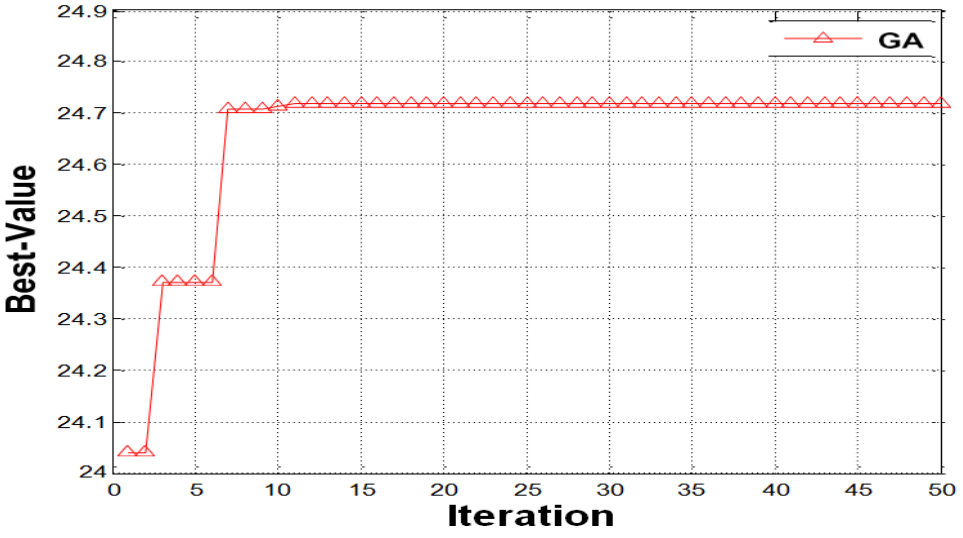


Figure (4.42) Implemented Projects for Governorate(8) Using GA

The figures from (4.33) to (4.42) refer that GA maximize the implemented project from iteration 30 to 35 which mean take longer time. Second GA was used to find the solution for the problem in investment projects as algorithm (3.7).

Table (4.14) GA for Finding the solution for problems

Problems	Cij($)	tj	Tij	C(t)($)	D(t)	q	z	xij
1.1	320898340	73.2	0.203333	4584262000	732	0.9	0.8908179	0.568322
1.2	80224585	51.24	0.7	4584262000	732	0.95	0.9371	0.734027
1.3	970850440	146.4	0.222492401	4584262000	732	0.93	0.9206739	0.75215
2.1	12746937.5	60.2	0.668888889	1019755000	602	0.85	0.831944	0.628288
2.2	9993599	42.14	0.117055556	1019755000	602	0.89	0.879773	0.866352
2.3	318417690	120.4	0.334444444	1019755000	602	0.9	0.8896659	0.983607
3.1	87702631.25	71.3	0.672641509	3508105250	713	0.8	0.9189559	0.543469
3.2	175405262.5	49.91	0.702957746	3508105250	713	0.8	0.7873359	0.97623

The difference between GA and GSA is also very clear in the effectiveness of the solution , as xij also has lower value than GSA which lead to reduce the effectiveness.

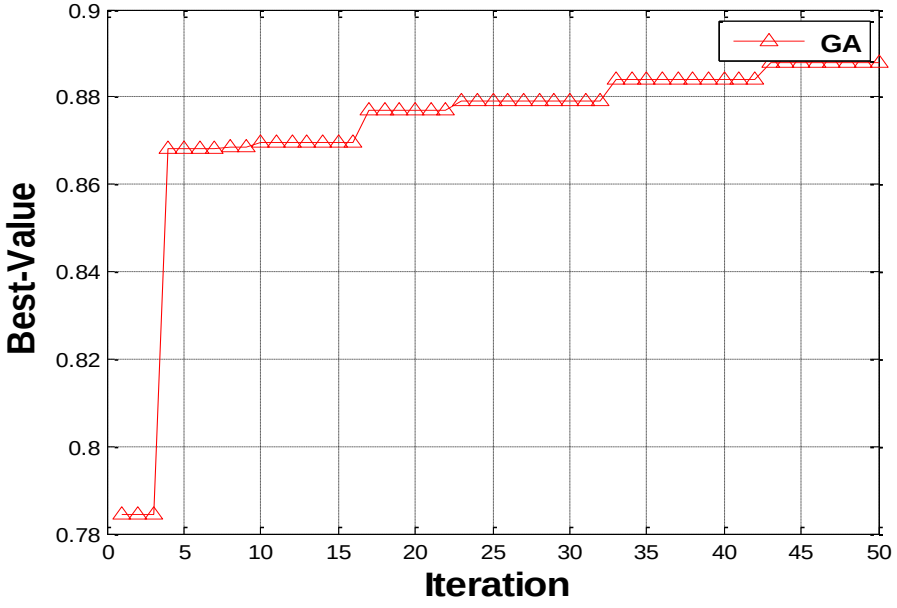


Figure (4.43) Solution of problem 1 project 1 using GA

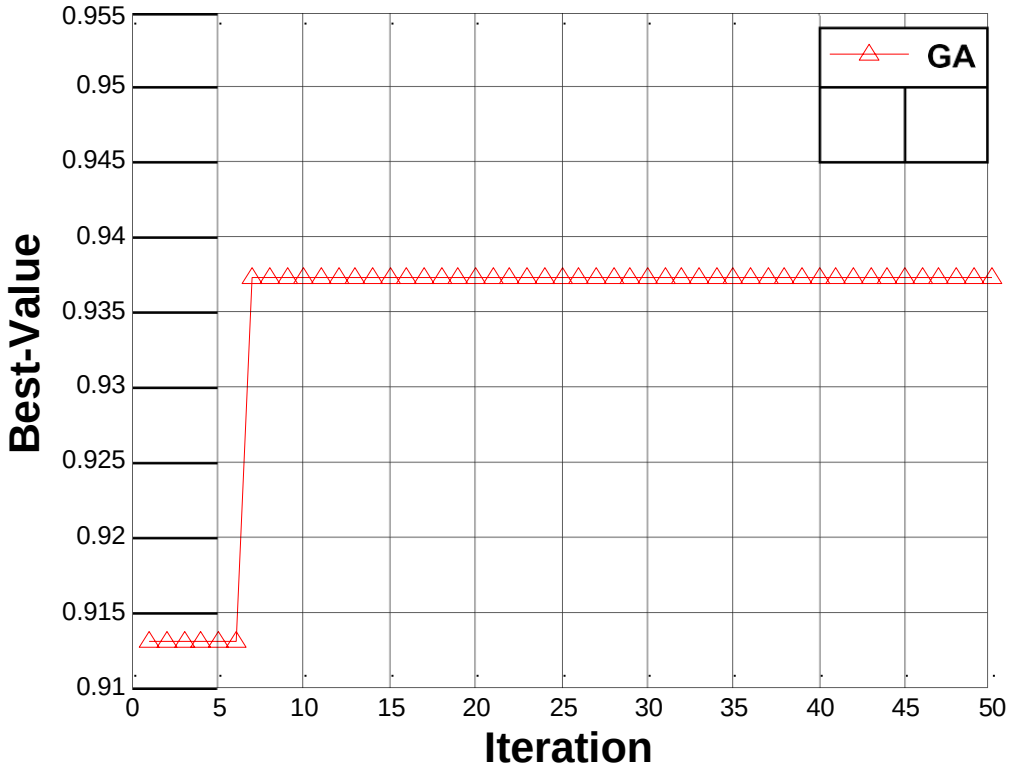


Figure (4.44) Solution of problem 2 project 1 using GA

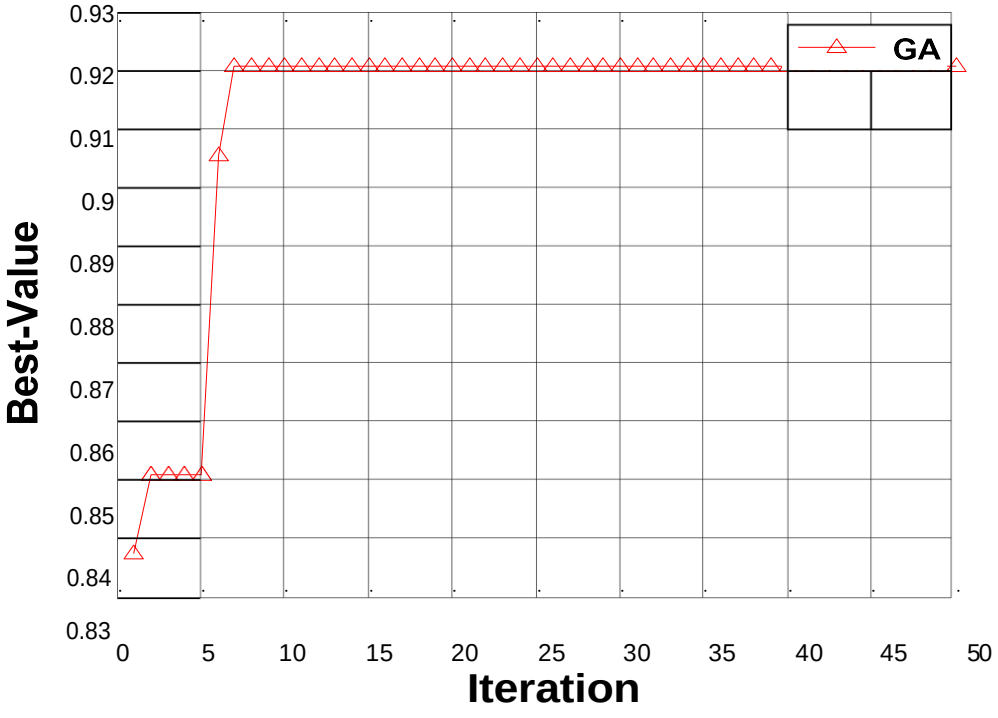


Figure (4.45) Solution of problem 3 project 1 using GA

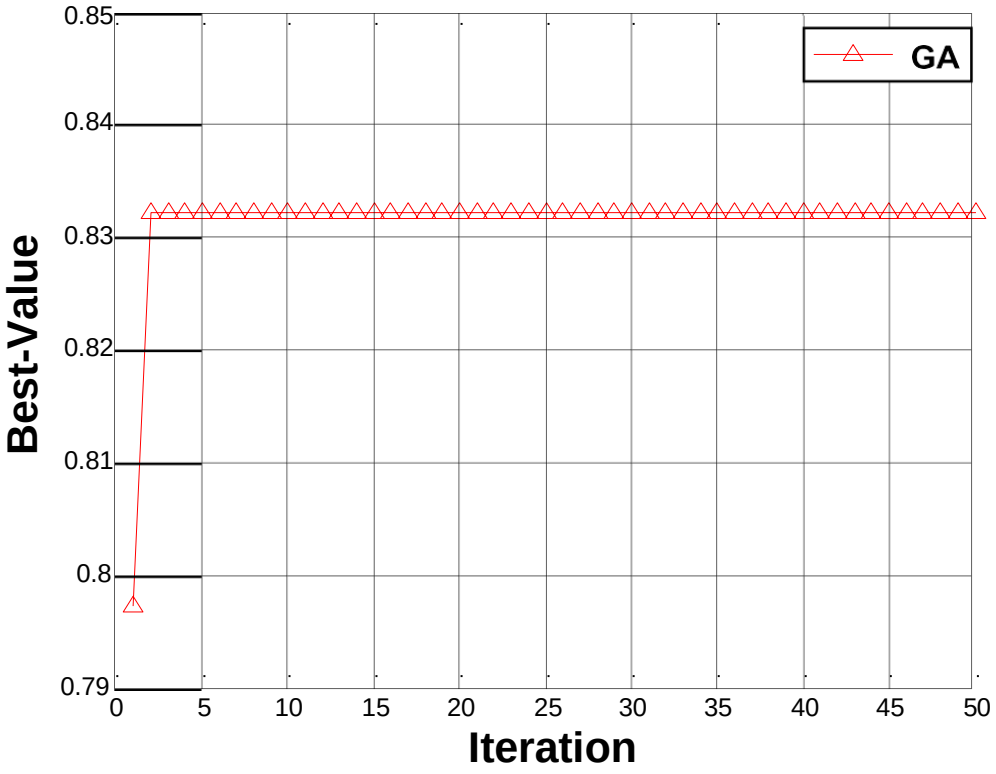


Figure (4.46) Solution of problem 1 project 2 using GA

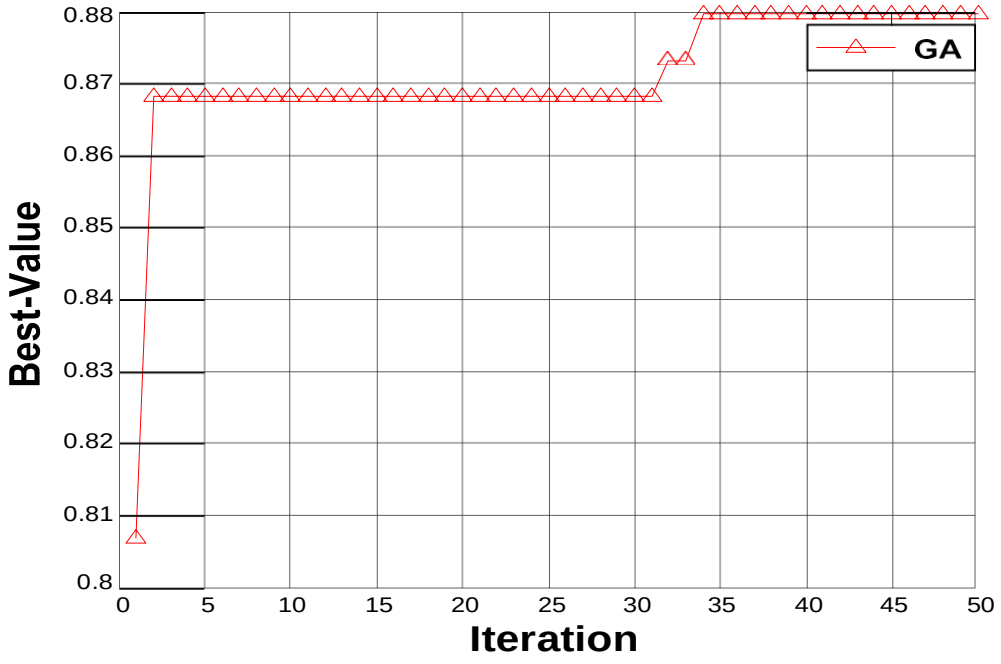


Figure (4.47) Solution of problem 2 project 2 using GA

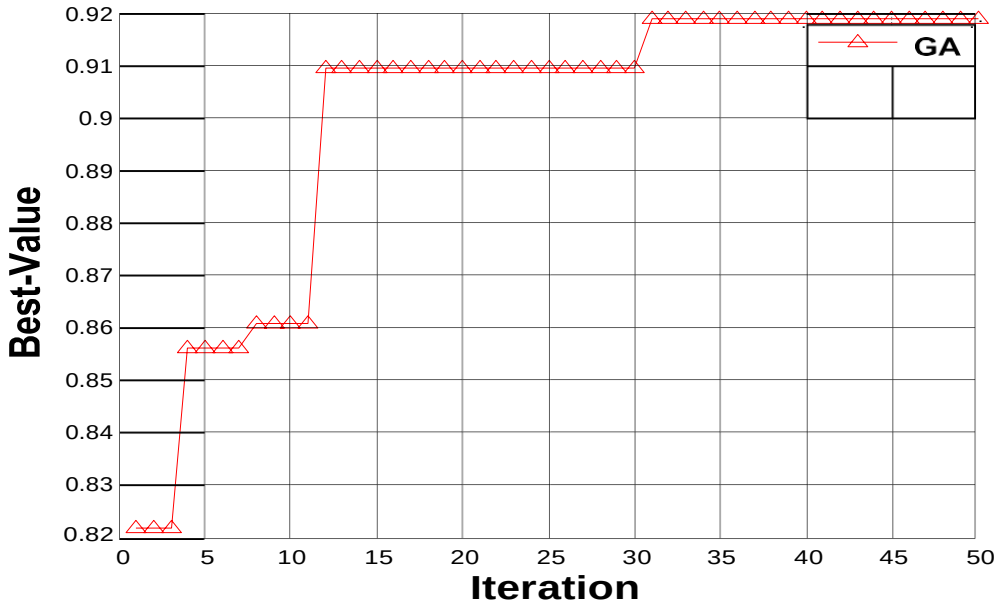


Figure (4.48) Solution of problem 3 project 2 using GA

From figure (4.42) to (4,48) and in comparing between the two algorithms , it's also seen that GA find the solution between iteration 30 to 35 , mean take longer time to find the solution with less effectiveness.

The final step in the GA algorithm is to maximize the profit for the investor according to algorithm (3.5) .

Table (4.15) GA for Maximize Profit For Each Project

Problems	Ci($)	pc	Dij	Ct($)	D	P	R1	R2	z	Xij
1	1035214745	0.1	365	15528221175	33215	155282212	0.5	0.2	30009	0.78882
2	734063530	0.2	365	41107557680	732	88087623.6	0.65	0.000260274	465	0.614092
3	868130356	0.0001	365	76395471328	732	104175642.7	0.85	0.003541667	104175642.72	0.05313
4	12746937.5	0.0001	365	1019755000	602	1529632.5	0.89	0.001	6025152963 2.5	0.736969
5	9993599	0.0001	365	1019755000	602	1199231.88	0.9	0.00151	4604835.4339359	0.709703
6	318417690	0.0001	365	1019755000	602	38210122.8	0.8	0.002807018	462915346.854	0.726336
7	5148680	0.2	365	3508105250	713	617841.6	0.68	0.011267606	41660471.545306	0.411756
8	98226947	0.1	365	3508105250	713	11787233.64	0.66	0.002222222	52606432.105	0.525973

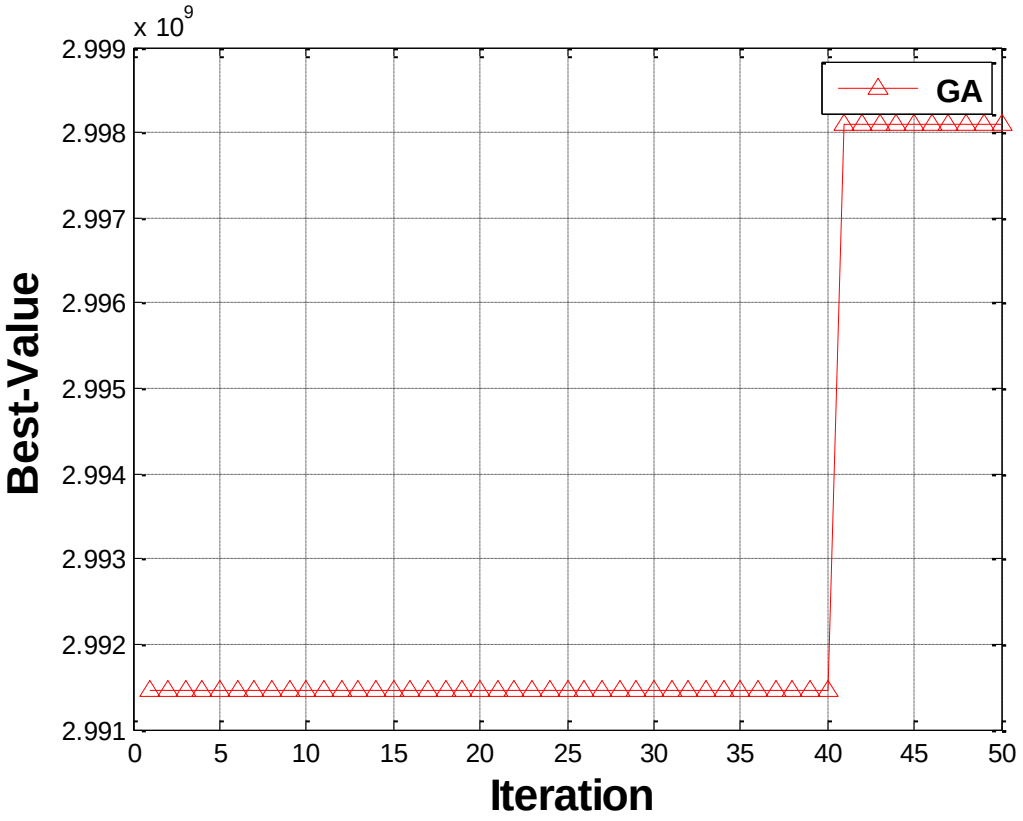


Figure (4.49) Profit of project 1 using GA

Figure (4.49) represent the chart for finding profit for the projects in the national investment in and its found that the profit is about 3 billion dollar was chosen at iteration 40 as compared to GSA which give about 5 billion dollar .

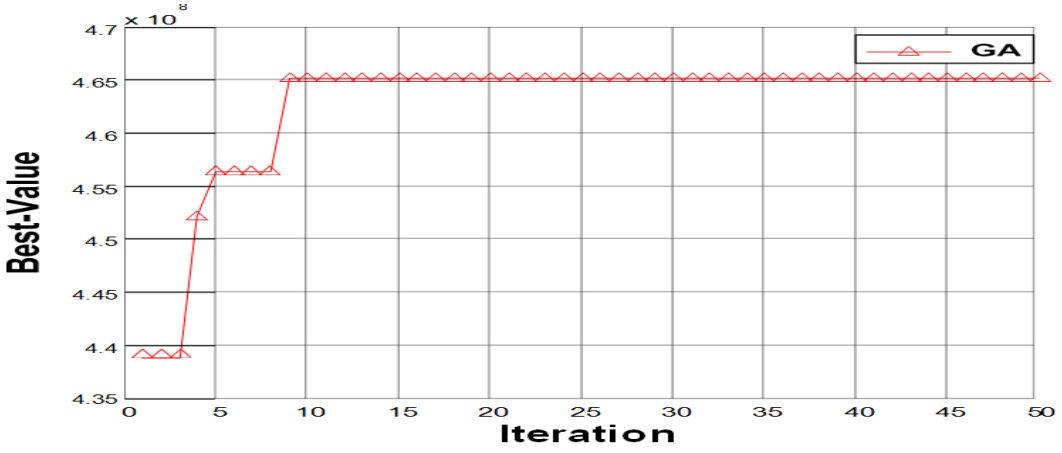


Figure (4.50) Profit of project 2 using GA

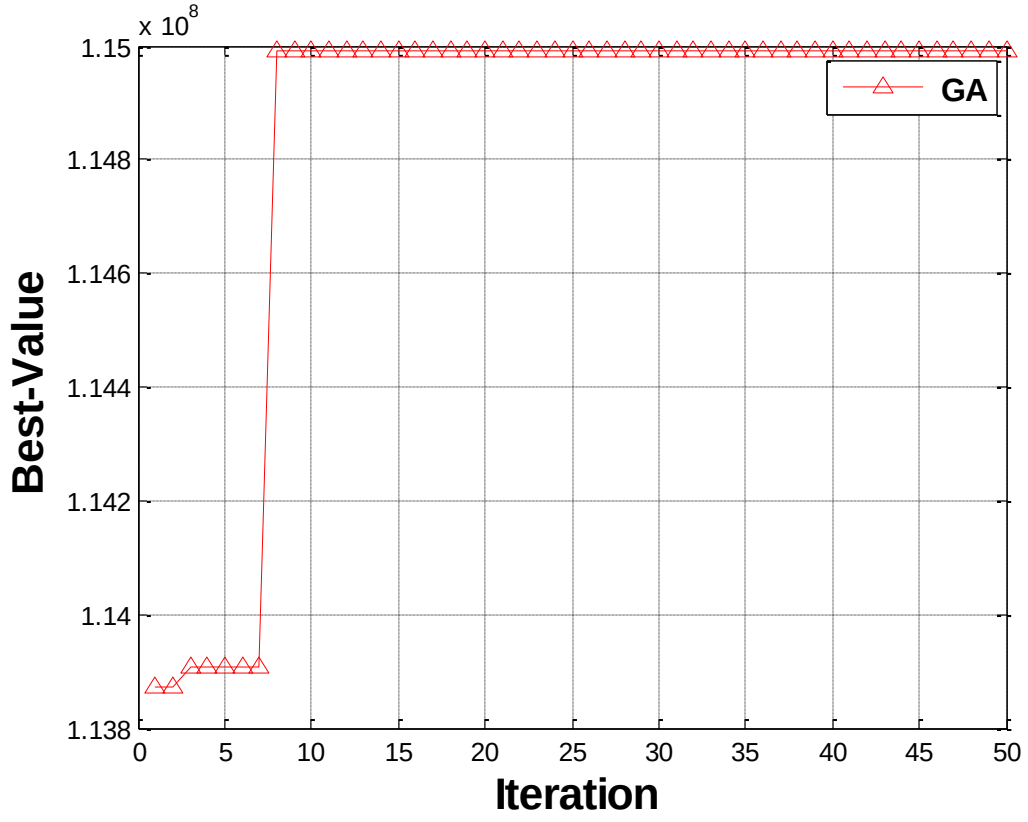


Figure (4.51) Profit of project 3 using GA

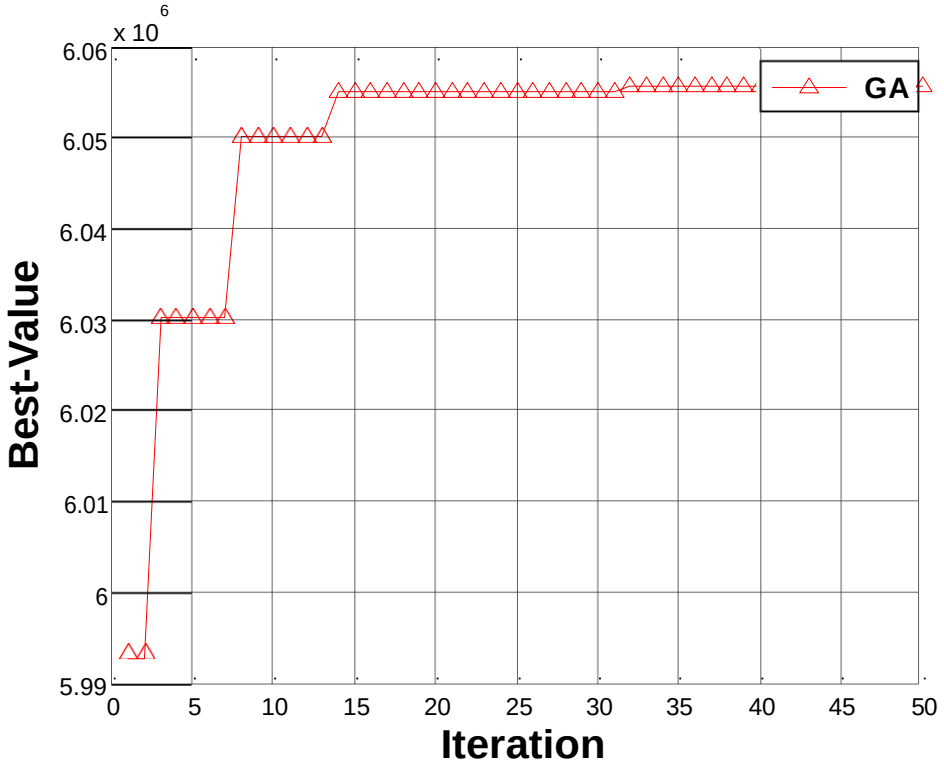


Figure (4.52) Profit of project 4 using GA

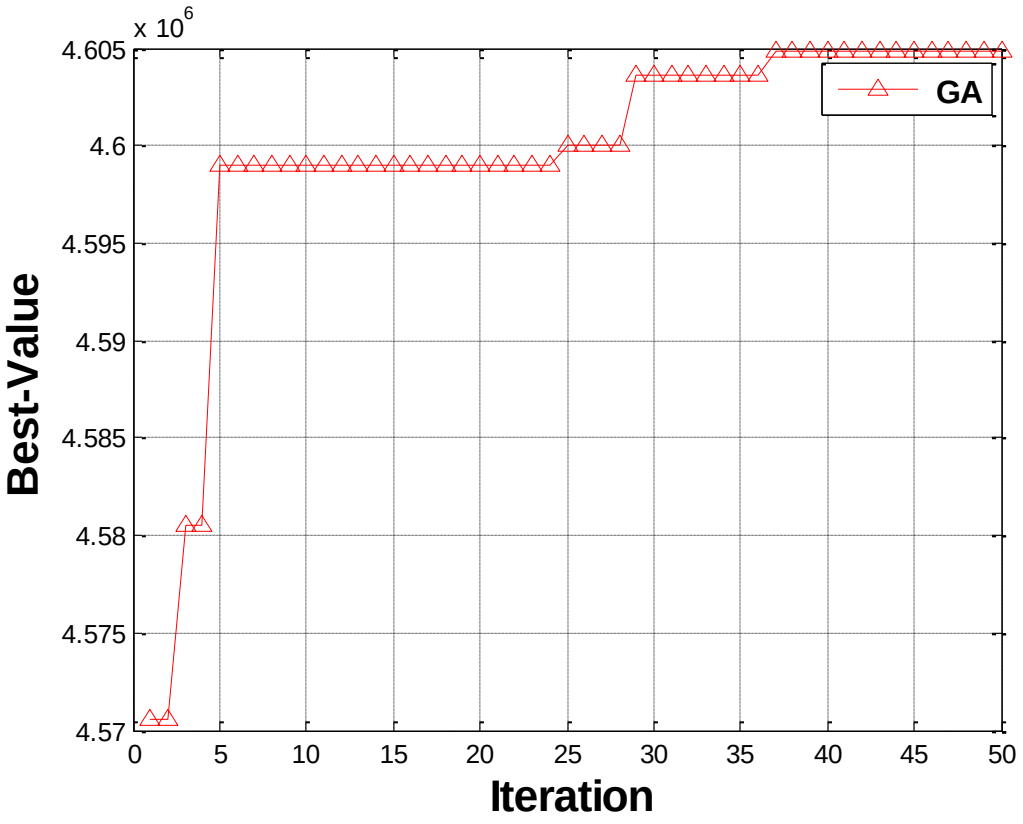


Figure (4.53) Profit of project 5 using GA

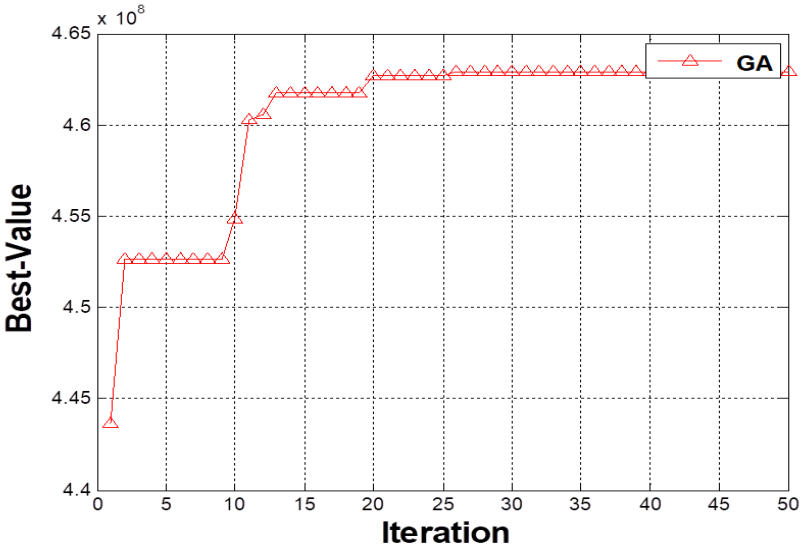


Figure (4.54) Profit of project 6 using GA

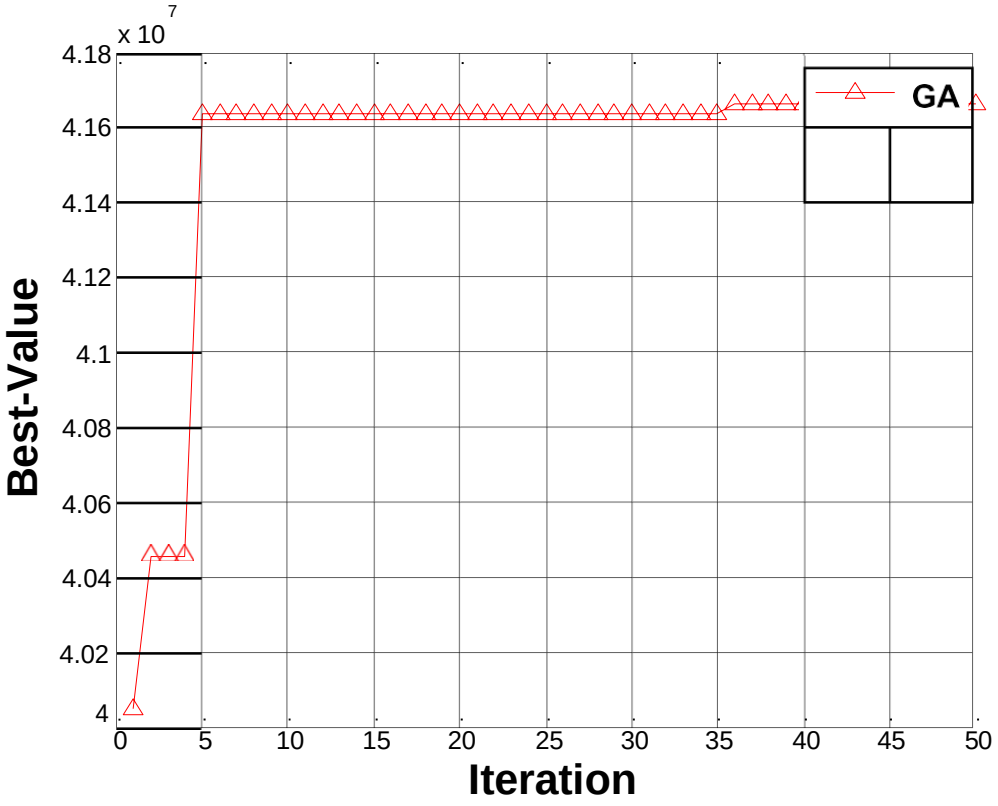


Figure (4.55) Profit of project 7 using GA

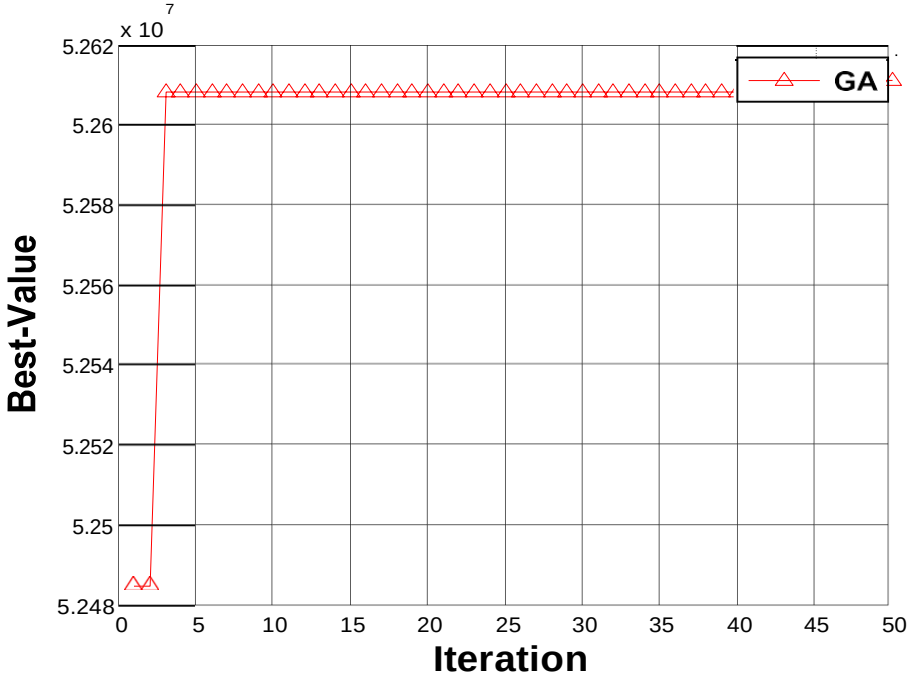


Figure (4.) Profit of project 8 using GA

Ahmed and other (2004) used GA for resource scheduling and the objective function was found at iteration 11, which mean much more greater than this model. Finally table (4.7) show the different between GA and GSA in each step.

Table (4.16) Differences between GSA and GA

Algorithm	Stooped projects	Profit	Optimize the solution	Profit Governorate	Stooped projects	Optimize the solution
GSA	3 -4 iteration	3 -4 Iteration	3 -4 iteration	5*10^9	100	0.9
GA	5-10 iteration	5-10 Iteration	5-10 iteration	3*10^9	52	0.89

As comparing between the two algorithms , GSA algorithm find the solution faster and more efficiently as it shown in the number of the implemented projects and in the profit but in the finding the best solution , they relatively equal in value but take longer time.

CHAPTER FIVE

Conclusions and Recommendations

Chapter Five

Conclusions and Recommendations

5.1 Introduction

This chapter provide a collection of the key conclusions of the hypothetical and field study made by the scholar, and the results of the 2 techniques. based on these conclusions, diverse proposals for future studies are set forward.

5.2 Conclusions

Depend on the research work, the conclusions can be drawn:

1. There is confusion in the work of the Iraqi government and the National Investment Commission in creating a favorable investment environment that holds the elements of a successful investment environment.
2. Iraq suffers from obvious deficiencies in investment projects . Despite the implementation of a few projects in the past years. In addition, the consequent negative effects. In addition to the widespread phenomenon of administrative and financial corruption.
3. There are real problems faced by investors during the work related to the financing of these projects by banks, whether public or private. The existence of many obstacles that concern the technical side in the investment projects, including the lack of using advanced computer programs that facilitate work and production, but rely on the old ways so far.
4. The use of Data mining techniques can provide a great solution tool in managing investment projects
5. GSA algorithm operative method in determining the greatest

solution and it shorter time .

6. GA technique consume a lot of time in finding the solution and managing the investment projects and sometime yield to non-optimal solution .
7. The number of projects that can be implemented by national investment with GA which is about 51 project and the algorithm find the solution at 25 iteration comparing to GSA which give 100 projects.
8. The number of projects that can be implemented by Baghdad investment with GA which is about 88 project and the algorithm find the solution at 25 iteration comparing to GSA which give 90 projects.

5.3 Recommendations

1- Working to achieve security and political stability, without it can not any investor can apply for investment inside Iraq. If the investor is able to overcome the security difficulties, he will find it difficult to deal with conflicting policies and unexamined decisions in the absence of a clear direction and political stability.

2- preforming courses of educational and training to perform an data mining techniques in investment projects.

3- Use diverse techniques in the system and make a comparison .

4- Study another projects restrictions projects scope by using the same techniques .

5- Using techniques of simulation in the project planning and putting the poorest of the possibilities for taking protective defenses to manage the uncertainty.

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المستخلص

تُستخدم عمليات تنقيب البيانات لبناء نماذج التعلم الآلي التي تدعم التطبيقات بما في ذلك تكنولوجيا محرك البحث وبرامج توصية مواقع الويب. الهدف من هذه الأطروحة هو تشكيل نظام والنظر إلى عامل لإنجاز أهداف المشاريع الاستثمارية من حيث المدة والكلفة باستخدام التقنيات: الخوارزمية الجينية (GA) وخوارزمية البحث بواسطة الجاذبية.(GSA)

ولتحقيق هدف البحث ، تم بناء نظام من أجل تحسين الحل الأمثل لمشاكل المشاريع الاستثمارية وزيادة عدد المشاريع التي سيتم تنفيذها.

وأظهرت النتائج أن هناك ضعف في عمل الحكومات العراقية وهيئة الاستثمار الوطنية في خلق بيئة استثمارية مواتية تحمل مقومات بيئة استثمارية ناجحة. يجد GSA دالة الهدف وفقًا للتكرار من 4 إلى 5 تكرار بينما GA أكثر من 8 تكرار.

خوارزمية GSA تعتبر طريقة فعالة في تحديد الحل الامثل وفي الوقت الأقصر. بينما تستهلك تقنية GA الكثير من الوقت في إيجاد الحل وإدارة المشاريع الاستثمارية وفي بعض الأحيان تجد العائد بقيمة غير امثلية.

بالمقارنة مع GSA ، فإن قيمة الربح الذي تم اختياره منخفضة للغاية وتؤدي إلى تقليل عدد المشروع المنفذ ، نظرًا لأن GA تقع في الخطأ والخطوات مثل الاختيار والتقاطع والطفرة تؤدي إلى هذه القيمة. الفرق بين GA و GSA كبير أيضًا و واضح في فعالية الحل ، حيث أن xij له أيضًا قيمة أقل من GSA مما يؤدي إلى تقليل الفعالية. وفي اغلب المحافظات ازداد عدد المشاريع التي يمكن تعظيمها اكثر من اصلها حيث وصلت الى 90 مشروعا كما في بغداد بأرباح تزيد على 5 مليارات دولار. بلغ عدد المشاريع التي سيتم تنفيذها باستخدام المنظمة القومية في محافظة بغداد حوالي 100 مشروع مقارنة مع المنظمة القومية التي تعطي 50 مشروعا فقط.

في محافظة ديالى تم تنفيذ 5 مشاريع ولكل مشروع ثلاث مشاكل كبيرة ولكل واحد منهم ثلاثة حلول ، وجد ان الحل الأفضل بفاعلية 0.89 ونفس الشيء بالنسبة للهيئة العامة ويبدو أنها متساوية في عدد المشاكل مما يعني تظهر تأثير متساو.

جمهورية العراق
وزارة التعليم العالي والبحث العلمي
جامعة ديالى
كلية العلوم

امثلية المشاريع الاستثمارية باستخدام تقنية تنقيب البيانات

رسالة مقدمة الى مجلس كلية العلوم جامعة ديالى وهي جزء من متطلبات نيل
درجة الماجستير في علوم الحاسوب
من قبل

اعتزاز احمد عبد الجليل

اشراف
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