Proceedings of Business and Economic Studies

Research Article

Project Management Addressed to Iranian Government - A Case Study

Malek Hassanpour

Department of Environmental Science, UCS, Osmania University, Hyderabad, Telangana, India

Abstract: Iranian Government has a unique opportunity to recede many existing difficulties and achieve to promoted productivity, paving the way for competitive and coadaptive developments in running and managing major complex projects. The present study was a combination of literature review, existing research reports, and hierarchical distance-based fuzzy approach to manage projects addressed to Iranian Government as a case study that comprises road and building construction, nuclear power, used oil and petroleum industries, new technologies (nano and plasma), industries, and waste management projects. Underpinning existing trend among frameworks of projects revealed some weakness points to lead the Iranian Government for the reliable establishment and implementation of projects such as resources and partnership management, lack of trust, technology replacement, deficiency of science, technology and additives promotions, and change in the attitude. The evaluation based on hierarchical fuzzy logic revealed the priority for diamond deposition reactors comprising high-frequency plasma = microwave > glow > laser > alternating current > plasmatron > direct current > flame, respectively. Therefore, Iranian Government needs to employ a buttressed support in the implementation of the plasma plants through applying nuclear power energy to reclaim and promote additives and products of industries, redesign and reproduction processes, quality function deployment, and other developing sectors.

Keywords: *project management; Iranian government; project development*

Publication date: June 2018

Publication online: 30 June 2018

Corresponding Author: Malek Hassanpour, Malek.hassanpour@yahoo.com

0 Introduction

Applying techniques and practices to conduct and exploit multiple resources to create a unique media, complex and one-time task, considering outlays, and the qualitative aspects of implementing a project are called project management. In British standards, this definition has been developed as scheduling, monitoring, and integrating the whole structure of a project toward a distinguished target within a given time frame, expenditure, performance, and quality of task[1].

From the operational point of view, many studies have focused on highlighting the importance of production goals and the integrating of research into models and paving the way for innovation in the generation processes, because many organizations today define the production goals in the form of a In project management, pertaining on Project Management Body Of Knowledge (PMBOK) is accommodated in the media of task so that acquisition of knowledge skills, tools, and techniques for procuring involvements or affording the expectations of stakeholders as it is a part of the requirements. Providing stakeholder expectations through balancing competition demand among (1) scope, time, cost, and quality; (2) stakeholders with differing claims, and (3) identified and unidentified demands. These frameworks can be scrutinized in excellence and economic of the project or business[2].

In today's dynamic world, countries are recognizing variety of progresses and environmental transformations that confer them and their growth, survive through employing expert human resources and outlay reduction, and in continue, disclose a optimized level of capabilities. Iran is an enrich country in energy resources, especially oil and petroleum storages, and as a vast country containing lots of developing medias for industries, energy, road, and building construction sectors. Actually, Iranian Government has responsibility against Iranian people to supply the future welfare by considering to manage all the projects according to PMBOK standards. According to PMBOK standards, nine main tasks ruling the projects are included such as: (1) Integrated management to ensure appropriate coordination of the various elements of the project and also encompass the beginning and termination of the project. (2) Project scope management besets all demanded activities and no unnecessary tasks will be done. (3) Project time management undertakes time of the project implementation and encompasses communication activities involve estimations and preparations for a time schedule and schedule to control them. (4) Project outlay management within the approved budget includes cost estimating, budgeting, and handling. (5) Project quality management. (6) Human resource management that defines practices of recruitment, assignment, formation, organization, and team development. (7) Supplies management for procuring commodities and services, including planning, supplies control, and demand planning application. (8) Communication management to take a responsibility for the production, collection, publication, and proper distribution. (9) Project risk management comprises the process that determines the degree of risk and the appropriate response against that[3].

Analytical hierarchy process is a mathematical method for extending and offering a wide range of options to make easy the decision-making process. Especially, project has got lots of factors, criterion and items to classify. . It is able to prioritize options empirically. Fuzzy set theory included a systematic procedure to imprecise real-world systems to be possessed linguistic variables based on Likert scale, etc. By the way, it is a useful procedure for arranging the uncertainty situation into a classified framework of decisions involving complex, ambiguous, and vague phenomena[4]. By the way, many studies have run based on fuzzy logistic approach. In this case, Gul *et al*.[5], Yekta *et al*.[6], Zolfani *et al*.[7], and Cavallaro *et al*.[8] employed fuzzy theory to cope with difficulties of materials selection and to assess the drinking water supply networks of Qom, implementation of a five star hotel in Tehran, Iran, and investigation of combined heat and power systems, respectively. The current research as an incorporation of literature review, existing research reports, and hierarchical distance-based fuzzy approach includes project management comprising road and building construction, nuclear power, used oil and petroleum industries, new technologies (Nano and plasma technologies), industries, and waste management projects addressed to Iranian government.

1 Research methodology

1.1 Project revenue estimation

The costs related to road and building construction were estimated based on annual price appeared in the menu book released for the association of engineers' costs by Islamic Republic of Iran. Project management based on PMBOK is displayed by Figure 1 as a procedure and methodology pattern.

1.2 Fuzzy set theory

The weighing system has set on cardinal method ($\sum_j^n Wj=1$), (j=0-1). It was used scores of 1 (real value: 0.09, 0, and 0.1 and fuzzy number: 0.1362), 2 (0.2, 0.1, and 0.1 and 0.2272), 3 (0.3, 0.1, and 0.2 and 0.3695), 4 (0.5, 0.1, and 0.1 and 0.5), 5 (0.6, 0.1, and 0.2 and 0.6304), 6 (0.8, 0.1, and 0.1 and 0.7727), and 7 (0.85, 0.1, and 0 and 0.8636) for indicators such as very low, low, slightly low, medium, slightly high, high, and very high, respectively. Then, fuzzy system was assigned to investigate the symbols. It is indispensable to shift fuzzy values (M, a, b) as m2+b to m1-a. By the way, according to the type of model applied [Figure 2], each symbol displays a fuzzy number that can be shifted to a real number using equations 1 to 3, N = (m, a, b). Finally, equation 4 was used to prioritize available options[4,9].

$$\mu R(M)=1-\frac{1}{1+\alpha}*(1-m) \quad (1)$$

$$\mu L(M)=1-\frac{1}{1+\beta}*(m) \quad (2)$$

$$\mu T=\frac{\mu R(m)+1-\mu L(m)}{2}*(m) \quad (3)$$

$$A=\{Ai[max]\frac{\sum_j(W_j.W_{ij})}{\sum_j(W_j)}\} \quad (4)$$

1.3 Estimation, control, and observation of cost

The equations of 5-14 were used for calculating financial indices in industries. It needs to be explained that the use of the following equations needs both personal and professional experiences and a full inventory of facilities, equipment, and materials in industries.

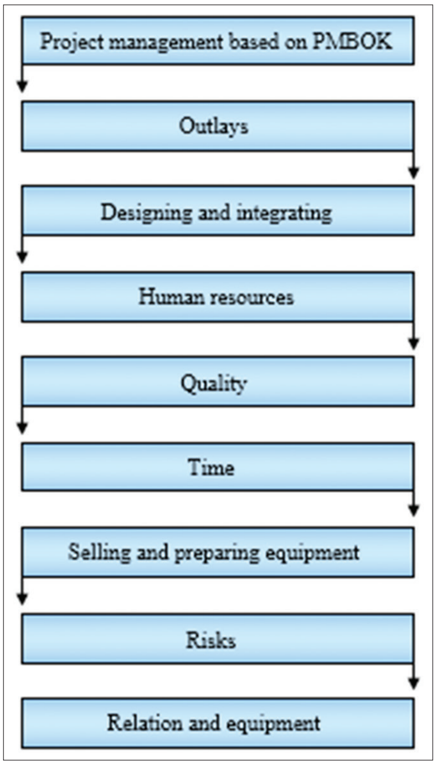

Figure 1. Project management based on project management body of knowledge[3]

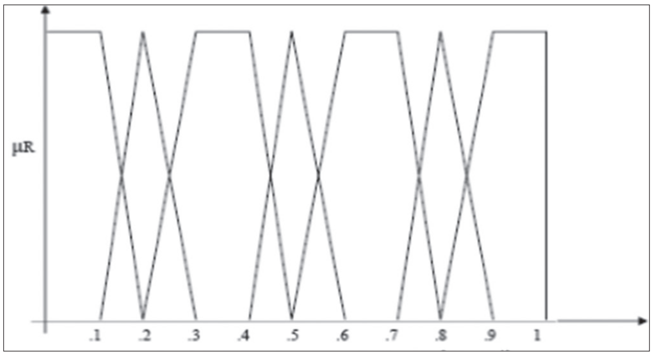

Figure 2. A triangular fuzzy numbers[9]

$$W=0.75(\sum_e)\times A \quad (5)$$
$$C=0.005\times P \quad (6)$$
$$V=p-((\sum)_e+A'+F+C_f) \quad (7)$$
$$\%\ V=V\times 100/p \quad (8)$$
$$Q_p=V-((\sum)I+L+D+S) \quad (9)$$
$$C_v=C_{vd}/C_p \quad (10)$$
$$P_h=T_f/C_v-C_s \quad (11)$$
$$C_{pi}=C_{vp}+C_{fp} \quad (12)$$
$$A_i=T_s-C_{pi} \quad (13)$$
$$V_t=I_F/A_i \quad (14)$$

In equations 5-14, the symbols are W (electrical energy demand), e (total electrical energy employed in lines), A (area, m^2), C (selling outlays), P (selling rate), V (value-added), A′ (initial materials applied), F (maintenance), C_f (unforeseen outlays), Q_p (revenue), I (insurance), L (expenditures of interest and fees), D (depreciation), S (salary), C_v (variable outlays of commodity unit), C_{vd} (variable project outlays), C_p (production capacity), P_h (breakeven point), T_f (fixed manufacturing outlays), C_s (total fixed outlays), C_{pi} (selling outlay of commodity unit), C_{vp} (manufacturing outlays), C_{fp} (variable manufacturing outlays), A_i (annual revenue), T_s (total selling expenses), V_t (time of return on investment), and I_f (fixed capital)[10].

2 Results and discussions

2.1 Project management in Iran

2.1.1 Road construction

According to the new government's regulations, the implementation of road construction projects has been delegated to two groups of private and affiliated with military agencies. Military-affiliated companies are collaborating with the government on national and major projects, while medium and small projects are being privatized through a tender. In this case study, there were 30 employees in each workplace as a team and around 70 projects established by Hamta Rah Tasbit Aria, Zamen Rah Gharb, and Imen Rah Kavosh Fars companies. The reliable project implementation was pertaining on the management and supervision of the executives of team and internal organizations agents. It has a worth to mention that aforementioned companies have received many letters of appreciation for the appropriate execution of the projects. By the way, it was perceived a wane trend in cooperation among variety of government and private organizations in the projects implementation process. Thus, it makes a negative impact in the performance of the companies[2]. Table 1 includes the list of projects implemented by three Iranian companies. Figure 3 displays the locations of complemented projects by three companies.

Landscaping operation usually includes some activities such as destruction, manually and mechanically activities, architecture, metal foundation, stitching, concrete and prefabricated concrete procurement, heavy metals holding, canopy establishment, lining and cufflinks operation, ceramic tiles, floor mosaic and stone layouts, asphalt coverage and transportation operations, sewer construction, excavation, embankment, and pavement operations. Above named projects can be categorized according to their contract rates; (1) small (U$1 million) encompassing sewer, pavement, asphalt coverage, and landscaping operations. It was found the average profit about 20.56% for all above named

Table 1. List of completed projects by three companies (this study)

Project	Location	Year	Project time	Workshop No.	Profit %	Companies
Building	Shiraz	2015	36 months	Subcontract	Running	Hamta Rah Tasbit Aria
Landscaping	Shiraz	2014	2 months	4650002530	30	Hamta Rah Tasbit Aria
Landscaping	Shiraz	2013	3 months	4650002382	30	Imen Rah Kavosh Fars
Landscaping	Shiraz	2013	2 months	4690008619	33	Hamta Rah Tasbit Aria
Pavement and asphalt	Shiraz	2013	2 months	4650002530	25	Hamta Rah Tasbit Aria
Pavement and asphalt	Shiraz	2012	1 month	4650002382	20	Imen Rah Kavosh Fars
Pavement and asphalt	West Azarbaijan	2012	5 months	2880007188	18	Imen Rah Kavosh Fars
Landscaping	West Azarbaijan	2012	6 months	2860005299	22	Imen Rah Kavosh Fars
Landscaping	Shiraz	2012	1 month	4690008619	28	Imen Rah Kavosh Fars
Pavement and asphalt	West Azarbaijan	2011	2 months	2880007188	35	Imen Rah Kavosh Fars
Pavement and asphalt	West Azarbaijan	2011	2 months	2900000335	15	Imen Rah Kavosh Fars
Landscaping	West Azarbaijan	2011	3 months	2980004320	29	Imen Rah Kavosh Fars
Pavement and asphalt	West Azarbaijan	2011	7 months	2860005299	24	Imen Rah Kavosh Fars
Pavement and asphalt	West Azarbaijan	2010	8 months	2880007188	14	Imen Rah Kavosh Fars
Pavement and asphalt	West Azarbaijan	2013	2 months	2940005793	10	Zamen Rah Gharb
Landscaping	West Azarbaijan	2013	6 months	2810025970	23	Zamen Rah Gharb
Pavement and asphalt	West Azarbaijan	2012	1 month	2948005793	11	Zamen Rah Gharb
Pavement and asphalt	West Azarbaijan	2011	2 months	2848005792	8	Zamen Rah Gharb
Landscaping	West Azarbaijan	2010	3 months	2850005783	17	Zamen Rah Gharb
Landscaping	West Azarbaijan	2009	2 months	2744005763	21	Zamen Rah Gharb
Pavement and asphalt	West Azarbaijan	2008	4 months	2740005793	16	Zamen Rah Gharb
Pavement and asphalt	West Azarbaijan	2006	2 months	2744005793	13	Zamen Rah Gharb

Rest of Table 1

Performed project	Assumed profit %	Rework	Risk assessment	Dispute	Cost overrun	Time Overrun	QFD
Building	-		*	***	Yes	No	****
Landscaping	25		*	***	Yes	No	****
Landscaping	25		*	***	Yes	No	****
Landscaping	25		*	***	Yes	No	****
Pavement and asphalt	25		*	***	Yes	No	****
Pavement and asphalt	25		*	***	Yes	No	****
Pavement and asphalt	25	**	*	***	Yes	No	****
Landscaping	25		*	***	Yes	No	****
Landscaping	25		*	***	Yes	No	****
Pavement and asphalt	25		*	***	Yes	No	****
Pavement and asphalt	25		*	***	Yes	No	****
Landscaping	25		*	***	Yes	No	****
Pavement and asphalt	25		*	***	Yes	No	****
Pavement and asphalt	25		*	***	Yes	No	****
Pavement and asphalt	25		*	***	Yes	No	****
Landscaping	25		*	***	Yes	No	****
Pavement and asphalt	25		*	***	Yes	No	****
Pavement and asphalt	25		*	***	Yes	No	****
Landscaping	25	**	*	***	Yes	No	****
Landscaping	25		*	***	Yes	No	****

(Contd...)

Table 1. *(Continued)*

Rest of Table 1							
Performed project	**Assumed profit %**	**Rework**	**Risk assessment**	**Dispute**	**Cost overrun**	**Time Overrun**	**QFD**
Pavement and asphalt	25		*	***	Yes	No	****
Pavement and asphalt	25		*	***	Yes	No	****

*All employees dressed to safety tools and equipment. However, no risk assessment has done to evaluate the hazardous and chemical emissions exposures during implementation of projects. However, risk assessment can be comprised some other aspects such as social, environmental, and political options. **Labor errors in full conformance with Figure 4. ***There are lots of reasons that have been explained below. ****QFD is pertaining on parameters, additives, products, and materials that it is under developing day by day. QFD: Quality function deployment

Figure 3. Areas of completed projects by three companies (this study)

projects. There are a variety of reasons for errors and reworks occurred in road and building construction projects. Figure 4 represents a systemic causal model of pathogens and omission errors[11].

Arditi *et al*.[12] asserted that main reasons of delay in projects in Iran can be the problems related to subcontractors, laboratory delivery of materials, and unforeseen geological conditions. Project delay causes in Jordan comprise (1) investment challenges of contractors, (2) interventions and change orders in project area by employers, (3) weakness in planning and scheduling of the project by the contractor, (4) deficiency of manpower, and (5) unskilled experts. Main reasons of delays in Ghana mentioned to (1) monthly payment delays from employers, (2) weakness in contractor management and technical performances, (3) material provision, and (4) escalation of material outlays. In this country, employers have identified as the major cases of delays. Moreover, the inflation factor is regarded as a separate factor, while in other reviews, this factor is omitted. Delay reasons in Egypt encompass (1) investment difficulties of contractors, (2) alterations by employers or their inspectors, and (3) investment difficulties by employers. Delay in Malaysia projects resulted by (1) contractor's inappropriate planning, (2) contractor's poor site leadership, (3) insufficient contractor experience, (4) insufficient client's investment and investments for implemented work, (5) challenges with subcontractors, (6) deficiency in materials provision, (7) labor recruit, (8) equipment access and failure, (9) bereavement of communication between parties, and (10) errors during the construction steps[13]. The main reason of cost overrun in our projects was delay in payment.

Root causes that give rise to construction claims and disrupts include unfair and unclear risk allocations, unrealistic time/outlays/quality targets by clients, insuppressible external events, adversarial industry culture, unrealistic tender pricing, unfit contract type; professionalism deficiency among project participants, client lack of information or decisiveness and unrealistic information demands by contractors. The proximate causes encompass improper brief, poor communications, personality conflicts, vested interests, changes by client, slow client responses, exaggerated claims, estimating errors, other work errors, internal disputes, unfit contract administration, improper contract documentation, inaccurate design data, incomplete tender documentation, unfit design documentation, unsuitable contractor selection, unfit payment modalities, and unreliable contract form generated by themselves or through interactions[14].

By our connections with >60 company managers and getting and having enough information about project construction procedures in Iran, we can notice to business excellence score by our study and, as a result, sustainability of road construction projects in Iran. Jonidi and Hassanpour[2] distinguished the business excellence score among three above named companies using Kanji's Business Excellence Model (KBEM) and European Federation for Quality Management (EFQM) models with total score of 900 such as 840.66 and 753.15, 844.53 and 738.44, and 849.53 and 748.44 for Hamta Rah Tasbit Aria, Imen Rah Kavosh Fars, and Zamen Rah Gharb, respectively. By the way, both factors of customer and community results and resources and partnership were realized the strength and weakness points, respectively. To investigate the construction material quality, inspectors or their agents need to collect some samples by step to step progress in project development. Table 2 contains the main important tests required to evaluate the construction material quality.

To ensure the project implementation virtue and investigate the material quality failure, employers pay 5% of approved budget of project after passing a year as well as tests verified by laboratory.

2.1.2 Building construction

In developed countries, a maximum of about 5% of building materials are wasted, while this rate exceeded from around 20% in Iran. Energy consumption in the building construction sector has been estimated to be several times higher (around 2.6) in comparison with other nations, in which these rates are a huge quantity of wastages for both energy demand and construction aggregates in Iran. According to statistics reported in 2007, the construction sector accounted for 41.1% of the country's total energy consumption.

Quality function deployment (QFD) is an overwhelming parameter in building quality management that can be

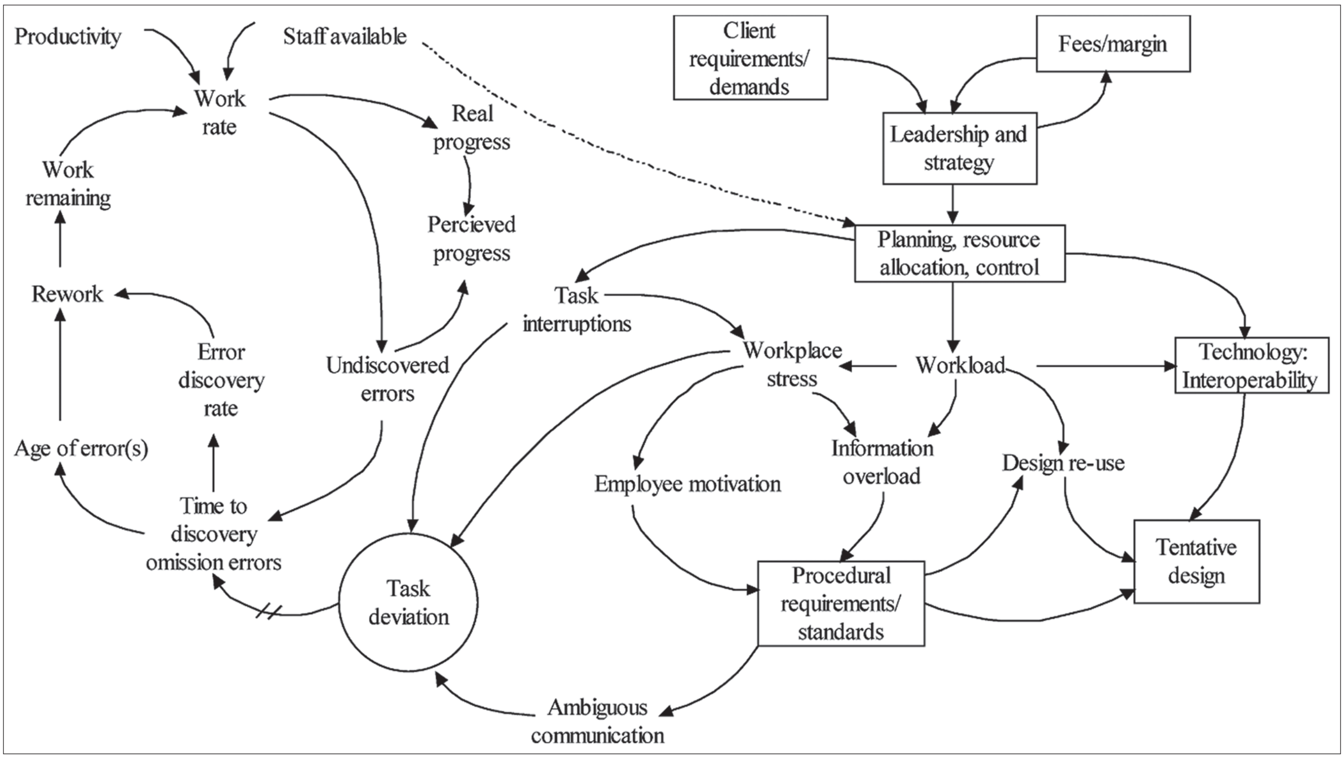

Figure 4. Systemic causal model of pathogens and omission errors[11]

Table 2. Main important tests performed (this study)

Base layer						
Thickness	**Compaction**	**Moisture**	**Density**	**Moisture at location (%)**		
Sand equivalent and deflection	**LL**	**PL**	**PI**	**D_{10}**	**D_{30}**	**D_{60}**
Hot asphalt and Marshall samples						
Thickness of asphalt (Medium)	Empty space between aggregates	Empty space aggregate filled by bitumen	Aggregates rates	Bitumen/asphalt without bitumen	Empty space of mix asphalt	Sand Equivalent
Bitumen/mix asphalt (%)	Resistance	Softness	Density and temperature	Breakage	Specific gravity	Bitumen %
Concrete quality tests						
Slump	Temperature	Resistance	Specific gravity	Air in concrete	Moisture	

employed to assess by considering some options such as (1) Architecture: Application of passive solar, use of a relevant and efficient resources of energy especially paying attention to renewable energy alternatives, use of wooden pieces to insulation purposes at whole building belongings, proper navigation of building considering to natural ventilation, pollutants remediation, and temperature handling options as well as their optimization methods, utilize green roof technology, and optimization of building envelope against thermal islands; (2) Mechanical: Employing environmental friendly products even recycled aggregates so that cooling and heating networks, application of solar energy for supplying energy required for pumps and water heaters etc. (3) Electrical: Exploiting clean electricity, integrating natural lighting and sophisticated lighting practices to impede losing energy and considering to energy saving lamps. The current survey procured a strong coherence among scales of sustainability in building construction practices addressed to both government and construction companies[15]. It has a worth to mention that QFD items are under developing daily according to the rise in human lifestyle.

2.1.3 Petroleum and oil generation and regeneration

Iran is a country enrich in energy embosoming 11% of universal oil storages and 15.3% of universal natural gas storages. Thus, it placed 2nd among Organization Petroleum Exporting Countries possessing a huge potential for natural gas exports to Europe and Asia. Due to a rise in energy or overconsumption recently around 6%/year for the 30 years ago, it has escalated brain surging about the country's formidability to cope self-consumption and exports derived from economic development (5% for the past 40 years) and population growth (about 2%), and immense demand for subsidized energy markets (12%) parallel with poor management, bereavement of investment power paved the way for an inefficient exploitation of energy. The energy intensity index in Iran is culminating twice as top as the world average and has been rising on average by around 3.4%/year over the past 40 years. The alternative subsidizing of energy outlays procured low productivity in the energy-intensive industries, disruption of environment in urban levels, and a countless withstand on the government investment steering to macroeconomic disturbances[16,17].

Due to the scarcity of fossil fuel storages, damaging impacts on environment, outlays for fossil fuels generation, political sanctions, and challenges, their effects on affording sustainable energy paved the way toward the development of a modern frameworks to ensure afford of energy, environment protection, and efficiency promotion of energy systems. Iran is experiencing weakness points on the criteria for CO_2 dissipations and energy consumption. CO_2 dissipation pattern is considerable in Iran because placed the country among the 10 massive dissipating nations due to existing huge storages of oil and gas in Iran[16]. Iranian's private sectors have recently got some contracts to implement plants pertaining on biomass resources and conducting some projects on the wind energy, two geothermal projects, and wind farm equipped to turbines. Pay attention to this important point that the eastern areas of Iran encountered to average wind speed of about 8–10 m/s at 40 m heights. Iran has got non-commercialized projects by average solar insulation approximately 2000 kWh/m^2 year pertaining on sunny hours with sunshine exploitation around 2800 h/year. Iran also has a high geothermal energy potential to utilize almost 60 billion Giga joules. Thus, for geothermal projects, some studies have been running to outline a prototype geothermal power plant. Energy technology demands continuously are maturing and developing to depart us to the new and emerging phenomena and progresses. It is a right opportunity to think about main frameworks of Iranian government regarding all the progresses during last decades; the renewable sources have not comprised even 1% of energy market in Iran[18]. The main energy supplying storages of Iranian government accommodated in both oil and petroleum storages, and they are exploited for so many purposes. Figures 5 and 6 display all petroleum and oil generation and regeneration practices in Iran in comparison to the world.

Each of functional treatment processes outlined in Figure 6 can be assigned to treat of used lubricant oil pertains on number of options such as concentration of available pollutants in the used lubricant oil, quality of expected products and accessibility to purification equipment and facilities. Therefore, with regard to availability, the best and most economical technology is selected, and then the individual units are planted. The distillation process is considered as an integral part of the used lubricant oil purification technologies used. Depending on the unit of distillation and the height of the fractionation column, the price of this unit varies. On the other hand, the type of used lubricant oil and the concentration of pollutants in the beginning of treatment operation determine the amount of temperature required for the purification process. The acid/clay technique assigned to treat the used lubricant oil of reprocessing industries demands low temperatures for conducting reactions, and chemicals are added to the process as additional treatment or as

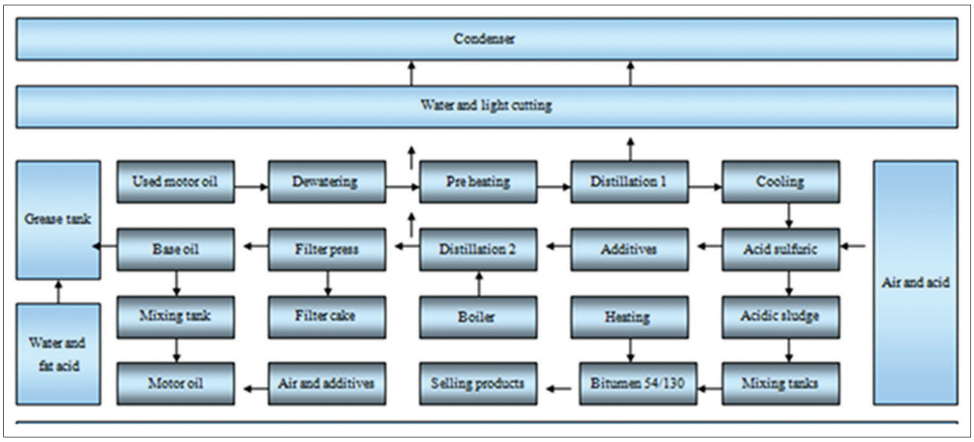

Figure 5. Diagram of layout acidic sludge recycling units and reprocessing industry of used oil in Iran[19]

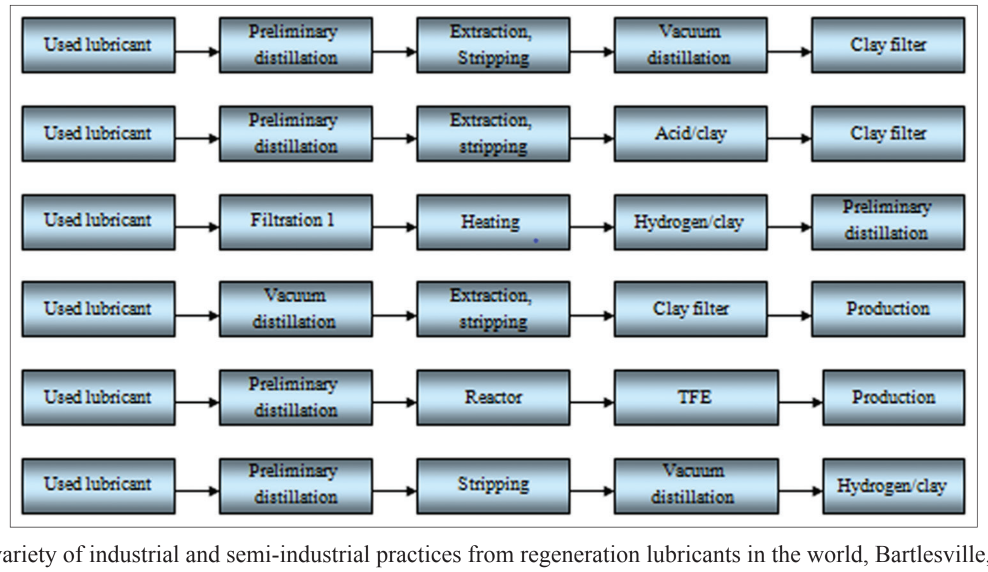

Figure 6. Layout variety of industrial and semi-industrial practices from regeneration lubricants in the world, Bartlesville, solvent extraction in Europe, Phillips process, RTI in Norway, Recyclon process, KTI in America, respectively. No 1 presents filtration unit; and extraction and stripping are joined to solvent[19]

a finishing step. In these industries, the distillation unit is used as heating or preliminary distillation units according to Figure 5. Taking into consideration of huge cost spent on purchasing the distillation unit, developing countries are willing to use either preliminary distillation unit or conventional heating to carry out the refining or reprocessing operations, while developed nations employ thin film evaporation (TFE) technology. Therefore, the distillation unit can be employed as vacuum distillation, heating, preliminary distillation, and TFE in the processes and technologies used to purify the used lubricants. There is a prominent difference between the use of TFE and vacuum distillation with preliminary distillation such as quantities of by-products released and outlays. Thus, the process of clay using ordinary heating unit instead of the preliminary distillation unit requires the lowest outlays, while it has the highest environmental pollution or by-products generation[19]. Our findings have shown that there are over 250 small industries of used motor oil reprocessing industries in Iran to the worth of $500000 individually. In the Europe, about 25 industries in Germany (7 units), Italy (5 units), many units in France, Spain, Denmark, Poland, Slovakia, and Greece and about 400 industries in the USA, Canada, Tunisia, and Saudi Arabia are running with the same procedure (acid clay techniques), in which, in the most cases, they are included as medium and large industries. Table 3 denotes the regenerative technologies comparison.

Hassanpour *et al.*[20] applied a new method for producing bitumen 54/130, in which acidic sludge was mixed with various percentages of bentonite and styrene butadiene styrene polymer, and consequently, the new type of bitumen was generated in Iran. This study has been patented by 75360 No (2012) in Iran. In other study conducted by Hassanpour[21] also reported that using KBEM and EFQM models resulted to appearance of sustainable development trend in used motor oil reprocessing industries in Iran.

Petroleum generation practices are analogous to above named technologies using crude oil to generate which scaled up by refining industries. With regard to immense quantities of sludges released by conventional reprocessing, re-refining, refining, and regeneration techniques and wasting the asset of Iranian people, we can consider to some options to remove all challenges and difficulties in this field. (1) All sludges released by reprocessing, refining, re-refining, and regeneration techniques can be mixed into the 60/70 bitumen and variety of bituminous products to modify bitumen properties as a kind of additives. Any change in the quality of product is pertain on its application. Those ratios are very important in mixing, for instance in a mixture of 5000 tons of residual sludge with 60,000 tons of bitumen 60/70, how much the generated bitumen would be awful? It will be much better in terms of quality because some of the bitumen properties will change. In this case, Hassanpour[22] mixed about 5400 tons of acidic sludge with 61,400 tons of bitumen 60/70 and it resulted to produce blown bitumen 110/15. Thus, all the released bituminous materials can be consumed after either initial modifications or physicochemical processing and curing stages. (2) Another solution is using new technologies such as thermal deasphalting, TFE, or plasma based processes to complete conversion of feed to product without releasing any by-products such as residual sludges. Furthermore, it can be employed to generate gaseous products and reforming operation via Plasmatron. (3) Major disadvantages posed in the case of conventional plasma reformer can be mentioned to high dependence on electrical energy, needs to scale up in industrial

Table 3. Regenerative technology comparison[19]

Regenerative technologies	Energy requirement	Demand for equipment	Economic costs	Acidic sludge	Residual oil sludge	Quality
Distillation	High	Medium	Low	Little	Much	Good
Solvent deasphalting	High	High	High	Little	Much	API (I)
TFE with hydrofinishing	High	High	High	None	Little	API (II)
TFE with clay finishing	High	High	High	None	Little	API (II)
TFE with solvent finishing	High	High	High	None	Little	API (II)
Solvent extraction Hydrofinishing	High	High	High	None	Little	API (II)
TDA	High	High	High	None	Little	API (II)
Acid/clay	Low	Low	Low	Much	Much	Good

TFE: Thin film evaporation, TDA: Thermal deasphalting dimensions, the costs spent on the deterioration of catalyst, its size, and weight, limitations in the field of rapid response, conversion, and reformation of heavy chain hydrocarbons. Recently, many of these limitations have been overcomed, and the new generation of reformer (possessing 50–300 W power, 15–120 mA) has been designed as a low current non-thermal plasmatron, which is pertain on nickel, aluminum, and united catalyst C-11 replacements and is being used for the desired purposes economically even by receding the catalyst applications. The main applications for reformer encompass low pollution electricity generation from fuel cells; H_2-refueling gas stations for fuel cell and powered vehicles, decentralized H_2 generation for industrial aims and internal combustion at engine auto-motives and lots of other applications. Studies have manifested that the electrical energy demand for plasmatron is approximately 5% of the heating value of the H_2 derived, which is very cost effective to request. By the way, plasmatron structure composed a combination of both partial oxidation along with water conversion operation to escalate gaseous outputs as an incorporation of around H_2 - 35%; N_2 - 47%; CO - 3%; and CO_2 - 13%. These gases are the primary feedstock for diamond deposition reactors. Oily sludge and discharges of used motor oil reprocessing, refining, and regeneration processes have massive quantities of heavy hydrocarbons which are, in some cases, a primary feedstock for introducing into plasmatron reactor to process. The plasmatron gasification process can provide the gases required for diamond deposition operations. (4) Pay attention to this point that attitude has changed toward using new techniques instead of conventional, there is a question here, which gasifies can be employed properly for gasification process of residual sludges to conduct diamond deposition operation? High frequency plasma (HFP), direct current (DC), alternating current (AC), microwave (MW), flame, laser, glow and Plasmatron? Figure 7 offers the circumstances of diamond deposition process using plasma forces[23].

To figure out a response for the question was used the fuzzy decision making approach that the following has been explained. Tables 4 and 5 denote the fuzzy decision-making approach to prioritize the surpass technologies. The weighing system was set based on cardinal method (), (j=0-1) and indicators priority follows current trend. Quality (1), (0.1089) > H_2 selectivity (2), (0.1041) = CH_4 conversion rate (3), (0.1041) > growth rate (4), (0.0898) > temperature (5), (0.0836) = pressure (6), (0.0836) > power (7), (0.0659) > technology resource (8), (0.0616) > equipment provision possibility (9), (0.0573) > technical standards (10), (0.0532) > implementation limitations (11), (0.0515) > safety (12), (0.0510) > renewable energy utilization (13), (0.0445) > operational cost (14), (0.0409).

Obtained results represented the values of around 0.7092 (HFP) = 0.7092 (MW) > 0.7052 (Glow) > 0.7032 (laser) > 0.692 (AC) > 0.655 (Plasmatron) > 0.5832 (DC) > 0.555 (Flame) for available technologies, respectively. Gul *et al*.[5] selected a fuzzy PROMETHEE method based on trapezoidal fuzzy interval numbers that can be employed to sort out the difficulties of materials selection. Yekta *et al*.[6] used hierarchical distance-based fuzzy multicriteria group decision-making to assess the drinking water supply networks of Qom, using 6 criteria and 35 sub-criteria. Zolfani *et al*.[7] tried to investigate construction projects of hotels in terms of sustainability, so a hybrid multiple criteria decision-making model posed pertaining on implementation of a five-star hotel by assigning lots of criteria weights and decision alternatives in Tehran, Iran. Cavallaro *et al*.[8] investigated the combined heat and power systems through applying fuzzy Shannon entropy and Fuzzy TOPSIS to prioritize the factors, so it resulted to current classification as gas turbine (first choice), steam turbine (second choice), fuel cell (third choice), reciprocating engine (fourth choice), and final choice for micro-turbine.

2.1.4 Waste management projects

Taking into consideration that the disposal of waste materials into the environment or the accommodation in landfill has exposed to serious impacts on human sanitation and potentially hazardous effects on the environment, etc., so the risk caused can be an insurmountable trouble; therefore, to avoid increasing the disposal outlays and impede rising greenhouse gases, the rigorous rules on landfill and waste disposal have been laid down. On the other hand, the biodegradability of lots of the waste materials is in a situation of ambiguity. Therefore, attention and attitude have been paid to the development and deployment of new technologies for waste management. Nowadays, plasma-based waste management technologies are developing and majority of nations are welcoming them. However, no plan reported for this kind of projects in Iran.

Table 4. Fuzzy decision-making approach to prioritize the surpass technologies (this study)

Indicator/technology	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
HFP	7	7	7	7	7	1	2	6	7	7	1	6	6	7
DC	2	6	6	2	7	1	3	5	7	7	6	4	6	7
AC	6	6	6	6	7	1	3	5	7	7	6	4	6	7
MW	7	7	7	7	7	1	2	6	7	7	1	6	6	7
Flame	3	5	5	7	7	1	1	4	7	7	1	4	6	4
Laser	7	7	7	7	7	1	1	6	7	7	1	6	6	7
Glow	6	7	7	6	7	1	3	6	7	7	4	4	6	7
Plasmatron	6	7	7	6	7	1	2	7	1	7	1	6	6	7

HFP: High-frequency plasma, DC: Direct current, AC: Alternating current, MW: Microwave

Table 5. Decision matrix set in fuzzy system (this study)

Indicator/technology	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
HFP	0.8636	0.8636	0.8636	0.8636	0.8636	0.1362	0.2272	0.7727	0.8636	0.8636	0.1362	0.7727	0.7727	0.8636
DC	0.2272	0.7727	0.7727	0.2272	0.8636	0.1362	0.3695	0.6304	0.8636	0.8636	0.7727	0.5	0.7727	0.8636
AC	0.7727	0.7727	0.7727	0.7727	0.8636	0.1362	0.3695	0.6304	0.8636	0.8636	0.7727	0.5	0.7727	0.8636
MW	0.8636	0.8636	0.8636	0.8636	0.8636	0.1362	0.2272	0.7727	0.8636	0.8636	0.1362	0.7727	0.7727	0.8636
Flame	0.3695	0.6304	0.6304	0.8636	0.8636	0.1362	0.1362	0.5	0.8636	0.8636	0.1362	0.5	0.7727	0.5
Laser	0.8636	0.8636	0.8636	0.8636	0.8636	0.1362	0.1362	0.7727	0.8636	0.8636	0.1362	0.7727	0.7727	0.8636
Glow	0.7727	0.8636	0.8636	0.7727	0.8636	0.1362	0.3695	0.7727	0.8636	0.8636	0.5	0.5	0.7727	0.8636
Plasmatron	0.7727	0.8636	0.8636	0.7727	0.8636	0.1362	0.2272	0.8636	0.1362	0.8636	0.1362	0.7727	0.7727	0.8636

HFP: High-frequency plasma, DC: Direct current, AC: Alternating current, MW: Microwave

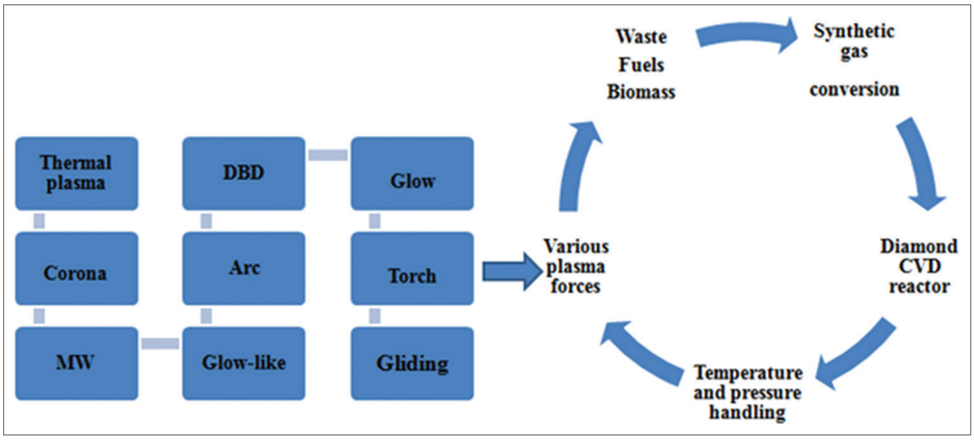

Figure 7. Plasma sources and chemical vapor deposition reactor operation (this study)

Table 6 shows main plant projects for waste gasification technologies by plasma reactors over the world.

Paving the way to implement the redesign and reproduction processes to renovate and regenerate new products using plasma techniques is a promising process.

2.1.5 Nano and plasma technology projects

Many plasma-based industries have been implemented to process the asbestos ashes, destruction of hazardous and toxic wastes, processing scrap cars and used tires, wastes removal, energy generation, and exploitation in France, Madison, Japan, Jackson, and United States, respectively. In the 1960s, semiconductor industry came into view and emerged a new generation of products using low-pressure plasmas for materials manufacturing. The use of this technology in plastics, machinery, aerospace industries, packaging materials, pharmaceuticals, etc., is no longer posed and paved the way for lots of progresses and developments. The use

Table 6. Main plants for waste gasification by plasma currently in operation around the world and plant projects for the next years[24]

Location	Raw material	Capacity (TPD)	Start data	Production (MWe)	Plasma technology	Company
Mihama-Mikata, Japan	MSW/WW sludge	25	2002	-	DC, Westinghouse	Hitachi Metals Ltd.
Utashini, Japan	MSW/ASR	300	2002	-	DC, Westinghouse	Hitachi Metals Ltd.
Yoshi, Japan	MSW	151	1999	-	DC, Westinghouse	Hitachi Metals Ltd.
Pune, India	Hazardous waste	68	2009	1.6	DC, Westinghouse	Maharashtra Environment Power
Nagpur, India	Hazardous waste	68	2010	1.6	DC, Westinghouse	Maharashtra Environment Power
Shanghai, China	-	-	Project	-	DC, Westinghouse	-
Tallahassee, USA	MSW	910	Project	35	DC, Westinghouse	Green Power Systems
Marcenx, France	Industrial/biomass	137	2012	12	DC, Europlasma	CHO-power
Hull, Sunderian, UK	Industrial/biomass	107	Project	37.5	DC, Europlasma	CHO-power
Port Hope, Canada	MSW/TDF	400	Project	26	DC, Europlasma	Sunbay Energy Corp.
Hirwaun, UK	MSW/industrial	750	Project	20	DC, Europlasma	EnviroParks Ltd.
Ottawa, Canada	MSW	85	+	1*	DC, PSC	Plasco Energy Inc.
Trail Road, USA	MSW	-	+	0.88*	DC, PSC	Plasco Energy Inc.
Los Angeles, USA	MSW	-	Project	-	DC, PSC	Plasco Energy Inc.
Beijing, China	MSW	200	Project	-	DC, PSC	Plasco Energy Inc.
Tainan city, Taiwan	Hazardous waste	3-5	2005	-	DC, Homemade	PETA International
Lizuka, Japan	Hazardous waste	10	2004	-	DC, Homemade	InEnTec
U.S.Navy	Shipboard wastes	7	2004	-	DC, PyroGenesis	PyroGenesis
Hurlburt Field, USA	MSW/Hazardous	10.5	2011	-	DC, PyroGenesis	PyroGenesis
Faringdon, UK	-	-	+	-	DC, Tectonics	Advanced Plasma Power
Swindon	MSW	91000 t/year	2008	16.3	DC, Tectonics	Advanced Plasma Power
South Wales	MSW	-	Project	-	DC, Tectonics	Advanced Plasma Power
North of England	MSW	-	Project	-	DC, Tectonics	Advanced Plasma Power
South West England	MSW	-	Project	17	DC, Tectonics	Advanced Plasma Power
Scotland-East Coast	MSW	91000 t/year	Project	-	DC, Tectonics	Advanced Plasma Power
Brazil	MSW	-	Project	-	DC, Tectonics	Advanced Plasma Power
Brazil	ASR	-	Project	-	DC, Tectonics	Advanced Plasma Power
Belgium	Landfill	246% 5 plants	Project	100	DC, Tectonics	Advanced Plasma Power
Swindon	Residual wastes	-	+	BSNG	DC, Tectonics	Advanced Plasma Power

ASR: Auto shredder residue, WW: Waste water, TDF: Tire derived fuel, BSNG: Bio substitute national gas, TPD: Ton per day, +: Demonstration facility, *: MWe/ton, MSW: Municipal solid waste

of plasma centrifugal furnaces for the stabilization and destruction of toxic materials and radioactive wastes has played a prominent role in the promotion of green chemistry. Sakaia and Hiraoka[25] reported to exist four

Table 7. Economic indices of many industrial projects (this study)

Industries	Data value $	Output value $	Value-added %	Profit	Commodity outlay	Breakeven point	Production cost	Time of return on investment
Used motor oil + acidic sludge	5245781.3	2289986	56.34	2795396.8	535	6%=260.83	2470258.36	0.26 (3.2 months)
Acidic sludge	417656.25	132521	68.2	249552.5	141.8	14.7%=131.4	169285.7	1.05
Used motor oil	-	108843.75	36.3	-	-	14.7%	-	0.9
Plastic wastes	678787	255335.75	62	366558	389.65	15.93%	314494.4	1.12
Blown bitumen	12150000	6748064.5	44	5308605.14	140.93	2.4%=1183.67	6897748.4	0.07

Table 8. Depreciation rate, energy consumptions, and number of staff in small Iranian industries as a cluster study (this study)

Industrial group	Number of types	Power (kW/d)	Fuel (GJ/day)	Employees	Depreciation rate* (%)
Food material, beverage, and tobacco	72	13476	63969	2175	4.7
Textile, apparel, and leather industries	41	7666	11885	2001	6.9
Cellulose materials	19	3824	439	563	6.3–7.1
Chemical industries and miscellaneous materials	119	25313	3526	3986	4.6
Mining and construction aggregates	37	14681	3848	1896	5.1–6.5
Appliance, basic metal industries	59	8888	354	2090	5.6
Machinery, tools, equipment, and metal products industries	67	10421	802	2403	4.5
Total	414	84269	84823	15114	5.4

*Depreciation rate of fixed capital[27]

large plasma industries in in Handa, Matsuyama, Mima, and Kamo and 11 separate units in Tokyo Ota, Omiya, Eastern Saitama, and Tamagawa which are dealing with energy exploitation, hazardous waste materials decomposition, and volume reduction from radioactive wastes in Japan. The study by Wang *et al*.[26] has proved that the average degradation efficiency of samples tested in thermal plasma furnaces is approximately 100%. On the other hand, lots of nanomaterial and products are synthesized using plasma forces and reactors over the world nowadays. Figure 8 presents many applications of plasma technology in above named projects.

2.1.6 Nuclear power energy project

Before the revolution, efforts were made to implement and deploy a nuclear power unit in Iran. The first phase of the Bushehr nuclear power plant was set up to generate electricity at nominal capacity of around 1000 megawatts in 1974. However, political sanctions and subsequent disapproval were prevented developing of this unit. Then, project was resumed in 1999 and the end of the project was postponed until the end of 2004. Initially, the project was secretly operated and strictly regulated, but the international rules and existing conflicts led to be launched, obviously, and this project has now been restored under the supervision of international agencies. Considering to the existing energy reserves in Iran, proved that there is no possibility of using wave energies and ocean thermal and tidal energies[18]. Hence, nuclear energy by nuclear fission can be the best alternative for energy exploitation purposes and other uses in Iran.

2.1.7 Industrial projects

Large industries only include around 2% of Iranian industries proportion, but they beset main role in the economic cycle in Iran. Tables 7 and 8 display the economic indices of many industries and depreciation rate of fixed capital among small Iranian industries. It has a worth to mention that small industries have got

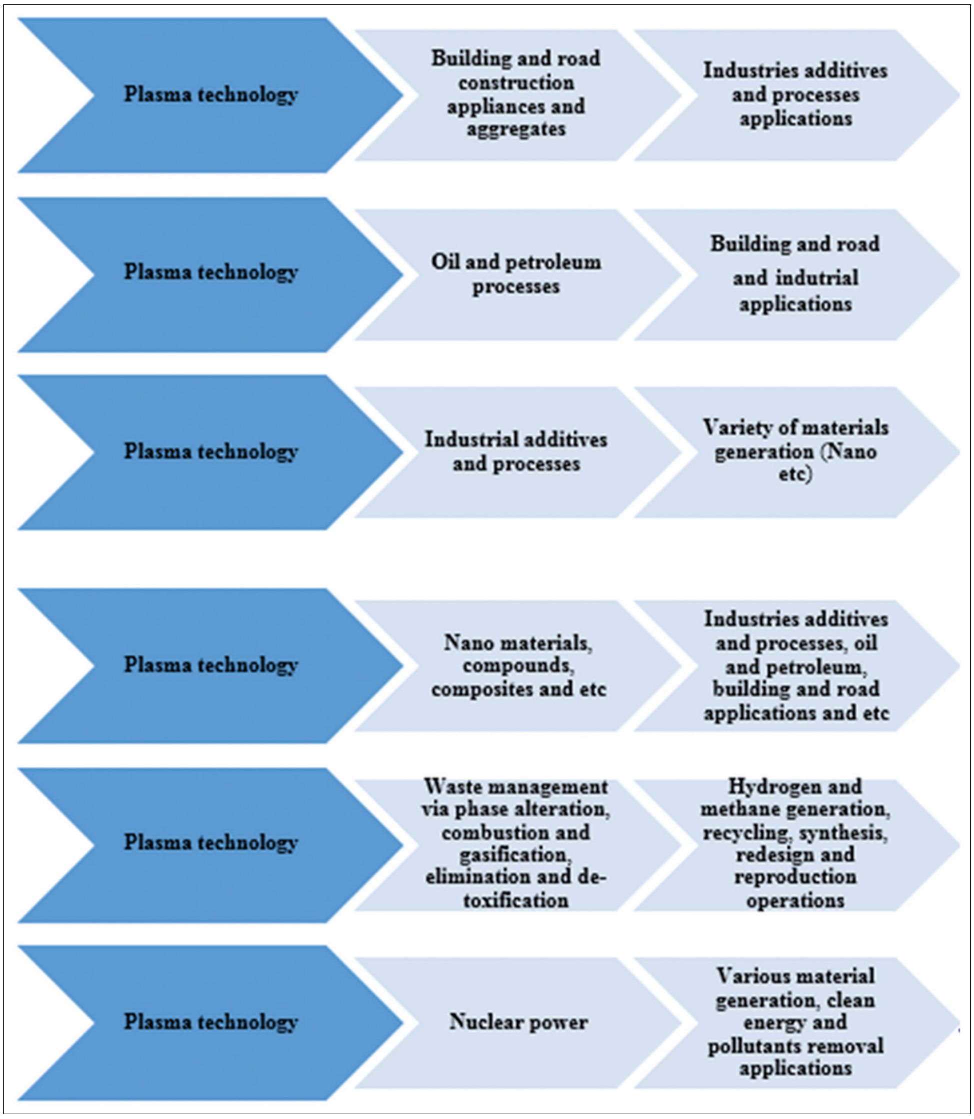

Figure 8. Many applications of plasma technology in projects (this study)

under 50 employees individually and vice versa in Iran. The results of the study by Moosavi and Rajabi[28] indicated that the value added from the Iranian industries will culminate by an average of 18% annual growth rate from 2009 to 2025.

3 Conclusion

According to the obtained results, the petroleum and oil sectors created both of challenges and developments for Iranian government and it can be a booster lever to more progress, especially through attracting attentions toward diamond deposition alternatives. Furthermore, Iranian Government can find the sustainability of all projects by focusing and planning on implementation of new technologies as a general conclusion, and employers have tried to proceed toward integrated and systematic management of projects particularly in road and construction sectors in Iran.

4 Acknowledgment

This research was conducted as a working paper in incorporation with author PHD project. I would like to extend my thanks to the managers of the three companies for their help in offering and collecting the data and resources in running the program.

References

[1] Atkinson R. Project management: Cost, time and quality, two best guesses and a phenomenon, it's time to accept other success criteria. Int J Proj Manag 1999;17:337-42.

[2] Jonidi AJ, Hassanpour M. Performance assessment of three companies (road construction) using business excellence models. Int J Bus Manag 2014;2:6-15.

[3] Hassanpour M. Cost management of projects using a standard PMBOK in engineering projects. Int J Eng Sci Res Technol 2015;4:137-47.
[4] Shirazia F, Kazemipoor H, Tavakkoli-Moghaddam R. Fuzzy decision analysis for project scope change management. Decis Sci Lett 2017;6:395-406.
[5] Gul M, Celik E, Gumusb AT, Guneri AF, Ozgurler S. A fuzzy logic based PROMETHEE method for material selection problems. Beni Suef Univ J Basic Appl Sci 2018;7:68-79.
[6] Yekta TS, Khazaei M, Nabizadeh R, Mahvi AH, Nasseri S, Yari AR, *et al.* Hierarchical distance-based fuzzy approach to evaluate urban water supply systems in a semi-arid region. J Environ Health Sci Eng 2015;13:53.
[7] Zolfani SH, Pourhossein M, Yazdani M, Zavadskas EK. Evaluating construction projects of hotels based on environmental sustainability with MCDM framework. Alexandria Eng J 2018;57:1357-65.
[8] Cavallaro F, Zavadskas EK, Raslanas S. Evaluation of combined heat and power (CHP) systems using fuzzy Shannon entropy and fuzzy TOPSIS. Sustainability 2016;8:556-64.
[9] Zad HS. Multi-criteria decision. Summation of researches. 1st ed: Islamic Azad University Publication; 2013. p. 1-310.
[10] Jonidi JA, Hassanpour M. Survey of economic indices of the used motor oil industry equipped to acidic sludge recycling unit. A case study. Merit Res J Eng Pure Appl Sci 2014;2:22-9.
[11] Love PE, Edwards DJ, Irani Z, Davis PR, Cheung SO, Lopez R. Project pathogens: The anatomy of omission errors in construction and resource engineering project. IEEE Trans Eng Manag 2009;56:425-35.
[12] Arditi D, Nayak S, Damci A. Effect of organizational culture on delay in construction. Int J Proj Manag 2017;35:136-47.
[13] Moghaddam AG. Change management and change process model for the Iranian construction industry. Int J Manag Bus Res 2012;2:85-94.
[14] Love EP, Davis P, Jefferies M, Ward P, Chesworth B, London K, *et al*. Dispute Avoidance and Resolution a Literature Review. Vol. 6. Brisbane, Australia: CRC for Construction Innovation; 2007. p. 4-62.
[15] Roufechaei KM, Bakar AH, Tabassi AA. Energy-efficient design for sustainable housing development. J Clean Prod 2014;65:380-8.
[16] Moshiri S. Energy price reform and energy efficiency in Iran. Int Assoc Energy Econ 2013;2:33-8.
[17] Alizadeh R, Lund PD, Beynaghi A, Abolghasemi M. An integrated scenario-based robust planning approach for foresight and strategic man. Agement with application to energy industry. Technol Forecast Soc Change 2016;104:162-71.
[18] Rezaei M, Chaharsooghi SK, Abbaszadeh P. The role of renewable energies in sustainable development: Case study Iran. Iran J Energy Environ 2013;4:320-9.
[19] Jonidi JA, Hassanpour M. Analysis and comparison of used lubricants, regenerative technologies in the world. Resour Conserv Recycl 2015;103:179-91.
[20] Hassanpour M, Jonidi JA, Farzadkia M, Gholami M. Processing of produced acidic sludge from used motor oil recycling industries with additives to polymer bitumen. Iran Tool Behdasht 2014;42:15-28.
[21] Hassanpour M. Evaluation of sustainable development using business excellence model in used motor oil industries. Iran J Health Saf Environ 2014;1:177-85.
[22] Hassanpour M. A management and economic survey in implementation of blown bitumen production using acidic sludge recycling. A case study. Iran J Health Saf Environ 2016;3:604-17.
[23] Unnisa SA, Hassanpour M. Editorial: Plasma technology and waste management. Resour Recycl Waste Manag 2017;1:1-3.
[24] Fabry F, Rehmet C, Rohani VJ, Fulcheri L. Waste gasification by thermal plasma: A review. Waste Biomass Valorization 2013;4:421-39.
[25] Sakaia SI, Hiraoka M. Municipal solid waste incinerator residue recycling by thermal processes. Waste Manag 2000;20:249-58.
[26] Wang Q, Yan JH, Chi Y, Li XD, Lu SY. Application of thermal plasma to vitrify fly ash from municipal solid waste incinerators. Chemosphere 2010;78:626-30.
[27] Molaei M. Investigating and Comparing the Productivity of Various Small and Large Industrial Groups in Iran. Iran: Second National Conference on Industrial Engineering, Yazd University; 2000.
[28] Moosavi HM, Rajabi A. Modeling the effect of energy intensity changes in industrial sector on the economic and environmental indices: A system dynamics approach. J Civ Eng 2013;3:103-34.