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Planning Sustainable Urban Growth in Kurdistan

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Abstract: In Kurdistan region, urban areas and populations are growing rapidly in the recent years. Before 60s or 70s, the process of urbanization was not so complicated because the agricultures solely have shaped the spatial development. Now urban growth and land use change is taking place in a dynamic ways. At the same time environmental infrastructure of services are insufficient to serve the resulting increases in population. The inevitable congestion causes environmental hazards and degradation until strategies for reversing environmental worsening can be implemented. The purpose of this paper is to explain the urban growth process in Kurdistan region, then it tries to illustrate some strategies to make existing and new urban areas in Kurdistan more self-sufficient, sustainable, and enjoyable places to live.

Keywords: Urban growth, Environment, Sustainability, Kurdistan Region-Iraq

1. Introduction

Urbanization and urban spatial growth are the result of combination of natural increase of the urban population and net immigration to urban areas (Firoz, 2004). Urbanization can be regarded from demographic point of view, in terms of the proportion of country's population living in towns and cities. It is observed that urbanization is very closely linked with industrialization, commercialization or the overall economic growth and development. The process of urbanization exhibits a pattern in which the rate rises sharply as the early stages of industrialization are reached, and decrease gradually when the proportion urban beings reach a saturation point. As most of the populations become urbanized, urbanization falls to keep peace with economic development, which is a continuous process.

Urban ecological problems are severe threat to the full realization of the socioeconomic contribution that cities can make (see Figure 1). They also compound inequities, and threaten the sustainability of development achievements (Habitat, 1998). Congestion, pollution, poor housing, inadequate infrastructure and poverty are visible problems of the cities. Apart from the resource problems within the cities, cities due to their link with the hinterland do cause environmental stress for areas far from the city. The concept of sustainable development has the goal of developing the resources of the city in a way that will minimize externalities.

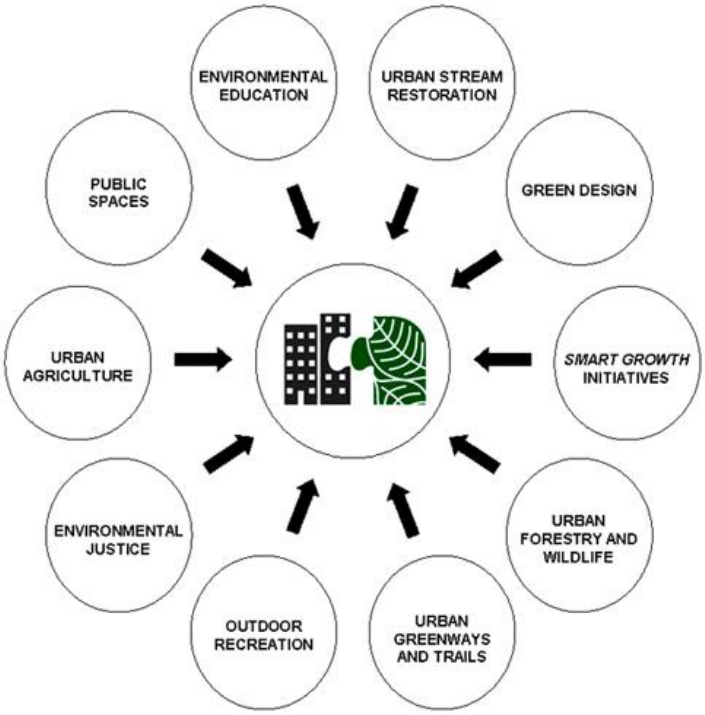


Figure 1: Urban ecological diagram

The urbanization processes in Kurdistan region started in 1970s (Stansfield, 2003). Since then, the process is going on. Following the release of Kurdistan region from Baghdad control in 1991 the urbanization rate was 75%, but in 2007 the urban population growth rate reached its higher level 77.6% which was very high than the last three decades. The main cause of this circumstance is the political conflicts from 1961 to 1992 and some other factors like lack of job opportunities, water scarcity and unavailability that are among the major factors hindering the return to villages.

2. Sustainable Development

Sustainable development refers to use of natural resources that aims at satisfying human needs, while safeguarding the environment, in order to create a developmental plan that aims at meeting not only the requirements of the present generation but also that of the future generations. The term sustainable development was first coined by the Brundtland Commission, who defined the word as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). Figure below shows the path of sustainable development that creates a link between the past, present, and future generations.

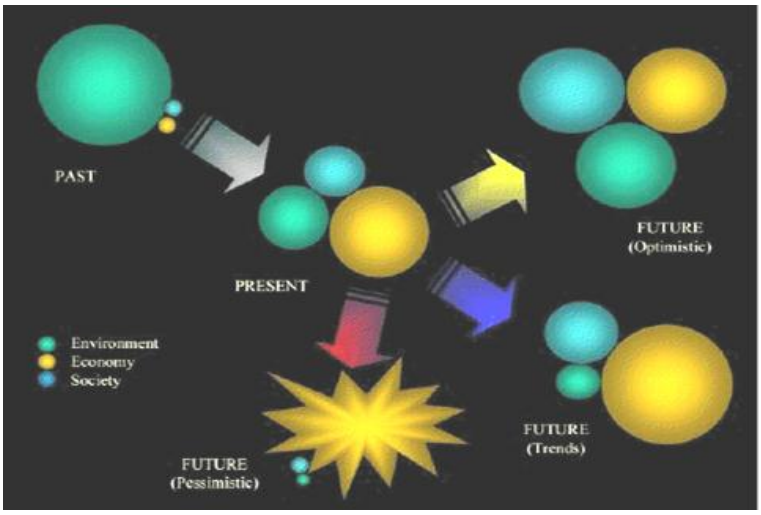


Figure 2: Sustainable development scenarios and consequences (source: Winograd & Farrow, 2002)

Sustainability and sustainable development are multidimensional in nature, and aim at serving various purposes with different scopes (Hardi & Zdan, 1997). Sustainable development could be achieved by using various processes of environmental conservation, and expanding the creation of different social and technological innovative techniques that aim at environmental protection (Winograd, 1995). Sustainable development links the concerns that arise out of bearing the total capacity of the natural resources along with social pressures. In 1970, we see that the term "sustainability" was used to characterize an economy that was "in equilibrium with basic ecological support systems" (Stivers, 1976). Sustainable development is a quantitative variable and can be measured through observations on how well a community is adhering to the needs and conjectures of the present and future citizens. There are various indicators to measure the sustainable development within a community.

3. The Arrangement of Kurdistan Region Territories

Kurdistan is administratively arranged under governorates, which are prescribed by the Iraq's Governorate Law of 1969 (GOI, 1969). Erbil, Suleimaniah and Dohuk Governorates forms the Kurdistan Region (KR), which is located in the northern Iraq and covers more than 80,000 square kilometers of Iraq total area (KRP, 2011). It shares its borders with Syria in the west, Turkey in the north and Iran in the east (Figure 3).

Around 70% of the four million people are residents of urban areas (KRSO, 2007). The three governorates share similar physiographic, geology, hydrogeology and climate conditions and are divided mainly into three physiographic zones, namely:

1. The northern range of the Zagros Mountains
2. The central range of the Border Folds
3. The northern plains of the Tigris River

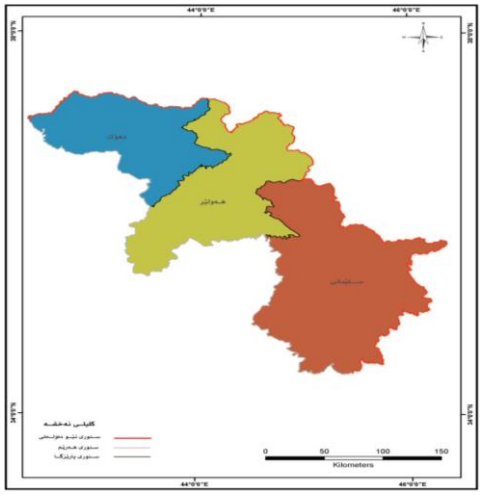
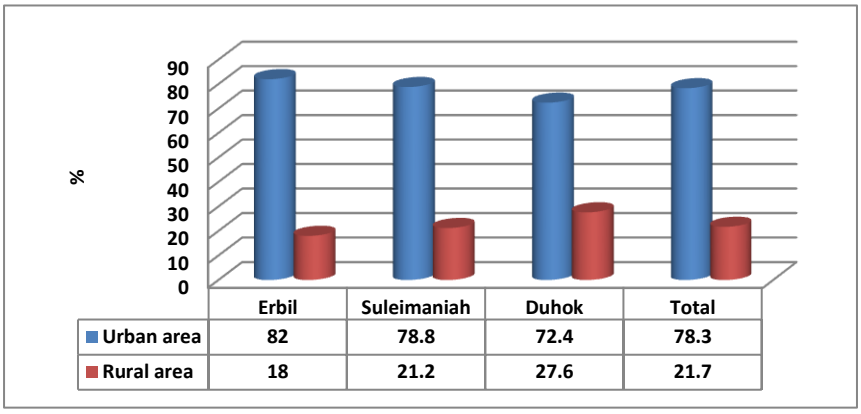


Figure 3: Kurdistan Region

4. Urbanization Process in Kurdistan

Population statistics for Kurdistan proper are notoriously variable. The governing states of Iraq tempted to minimize the figure in an attempt to play down the importance of the Kurdish minority within their country, whereas Kurdish nationalists and political parties are prone to exaggerate the number (Stansfield, 2003). Within Kurdistan Region, population estimates are further compounded because there has been much population movement within the territory, as well as away from it.

With a population of over 4 million and rapidly increasing, the urbanization level increased from 65% in 1990 to 78% in 2007 and is expected to attain much more in the near future. According to the Ministry of Planning, there is an intensive internal migration towards the cities (Erbil, Suleimaniah and Dohuk) and their suburbs (KRSO, 2007). This exerts a big pressure, which in the absence of proper land use planning and adequate infrastructure, results in major environmental problems.



	Erbil	Suleimaniah	Duhok	Total
Urban area	82	78.8	72.4	78.3
Rural area	18	21.2	27.6	21.7

Figure 4: Percentage of population distribution among urban and rural area (KRSO, 2007)

According to the Ministry of Planning about 80% of the resident populations, were displaced during the conflicts from 1961 to 1992. Economic and social considerations have played a role in determining the pace of return to the villages. Displacement was associated with large-scale destruction of villages, towns and housing units rendering immediate return impossible. More than 5,000 villages and towns were affected. Despite all the efforts undertaken at the different levels, a high proportion of the displaced populations are not willing to return to the native villages. Lack of job opportunities, water scarcity and unavailability are among the major factors hindering the return to the villages. Several families who had returned were forced to leave again because of water unavailability and lack of sustainable livelihood systems. Population density at the governorates level reveals that highest pressure is put on large cities (Figure 5) which highlights the rural migration towards urban centers.

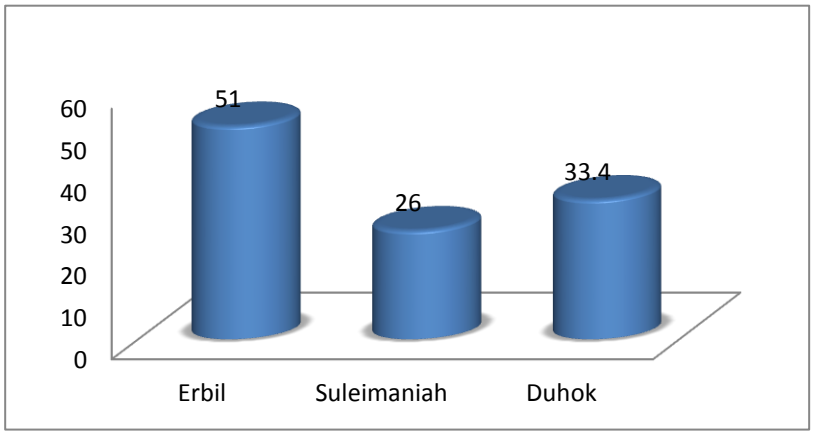


Figure 5: Percent of total urban population inhabit in the center of governorates

The increase in the urbanization level and the fact that a high proportion of the displaced population is not willing to return to the native villages, is directly affecting the agriculture and forestry sector and the sustainability of the rural areas. On one hand, the increase in the urbanization level will mean an increase in the urban extension, which will be at the expense of the pre-urban lands and of some orchards and agricultural fields. It also implies a higher demand on water in urban settings. On the other hand, the migration towards the cities and the abandonment of the villages and agricultural fields in rural areas, will lead to the destruction of the traditional livelihood systems. However the level of urbanization will also have a serious effect on the manpower and less people will be willing to work in agriculture and forestry related fields as they will be looking for better paid jobs, more adapted to the urban life and its requirements.

The above conditions certainly pose great sustainable development challenges for Kurdistan urban centers. The explosive rates of growth have not only progressively complicated and exacerbated inter-related problems of human settlements and the environment but have also greatly accelerated poverty.

5. Planning Sustainable Urban Growth and Development

Rapid urbanization, the concentration of the urban population in large cities, the sprawl of cities

into wider geographical areas are among the most significant transformations of human settlements in Kurdistan region. Taking into account this situation, the KR government should improve the livelihood of the people and ensure sustainable development of the region for present and future generations. This can be done by formulation of strategic policies and implementation of sustainable growth programmes. The Habitat Agenda, Agenda 21 and the MDGs remain the basic framework for action. The key strategies of urban development, provision of adequate shelter; poverty eradication; environmental management; economic development; governance and international cooperation for development, are examined in the following sections.

5.1 Policies for Balanced Development

Strategic planning and regional planning are very important institutional supports to an integrated approach to the sustainability of cities. Figure 6 shows the main structure of the strategic plan. The balanced development of human settlements in the country can be achieved through increased states and local governments' creation. There is a need too for distributing economic development and industrial activities all over governorates, achieving spatial development balance, reducing social and economic disparities, distributing people in a balanced manner and reducing people concentration in large urban centers. To meet this need, industrial location policy must be adopt, whether as individual projects or large industrial clusters.

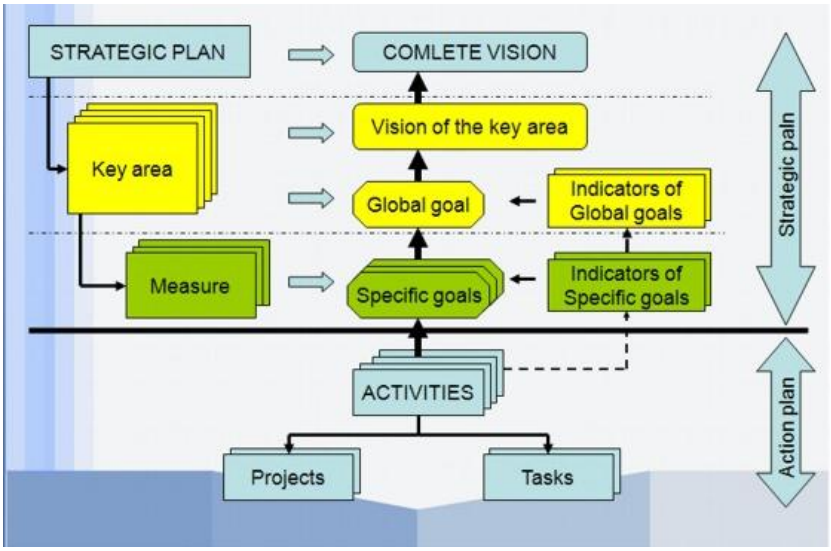


Figure 6: The main structure of the strategic plan

This policy should aim limiting population concentration in certain areas and addressing the accelerated growth of population in central cities and larger urban areas due to concentrated economic development. New cities should be established around central cities to absorb population excess and create the proper environment for new industrial investments. The demographic situation indicates that 80% of population inhibits governorate's centers, while only 20% inhibit districts, sub-districts and rural areas. That city centers attract most industrial and investment activities, and consequently people, at the expense of other places is clearly manifested by this distribution which is enough to explain the reasons behind the increasing migration from governorate outskirts to the centers. This necessitates serious consideration for distributing the

investments and developing the infrastructures in marginal cities in order to mitigate pressure on central cities.

5.2 Urban Development Reforms

A national urban development policy is required towards ensuring sustainable human settlements in Kurdistan. The Urban Development Policy has the goal of developing a system for urban settlements that will promote sustainable economic growth, provide efficient urban and regional development and ensure improved standard of living for all citizens.

A necessary institutional framework must be set up to ensure effective implementation of the policy to implement the provisions of the policy. Future priorities for sustainable urban planning should include:

- Pursuing programmes of urban renewal and slum upgrading in decaying urban centres;
- Preparation of cadastral maps for all urban centres as a basis for efficient urban planning and development;
- Development of comprehensive master plans to ensure coordinated development;
- Establishment of a national urban information database for planning and raising citizens awareness and access to information;
- Preparation of strategic regional development plans for the three governorate zones to reduce regional imbalances;
- Implementation of programmes directed at bridging the rural-urban divide;
- Development of satellite towns to redirect growth to the hinterlands.

5.3 Ensuring Environmental Sustainability

The key challenges in the environment sector include land degradation, pollution, flood and erosion, desertification, inefficient use of energy resources and environmental disasters. Actions aimed at ensuring environmental sustainability increased after the Earth Summit in 1992 and environmental concerns are gradually being integrated into resource management, policy and planning processes as a way of promoting sustainable development. A National Policy on Environment must be launched in Kurdistan. Similarly, a holistic approach to sound environmental management must be located in place with the adoption of a National Environmental sustainability policy and plan of implementation with the goal of ensuring a clean and healthy environment by adopting efficient and cost effective strategies, to safeguard public health and well-being in line with national development objectives.

The Sustainable Cities Programme that implemented in some areas of the world with collaboration with UN-Habitat is another practical response to the search for sustainable development. The programme focuses primarily on capacity building in urban environmental planning and management, on broad-based partnership and participation as well as on leveraging of technical and financial resources at every level, to resolve urban environmental problems. Additionally, the creation of Kurdistan Environmental Bureau, are among other actions of government directed at ensuring effective conservation of the natural resources and ecosystems and thereby setting the region on the path of sustainable development.

6. Conclusion

The urbanization process is irreversible in Kurdistan and must therefore be turned into opportunities for growth. By the year 2015 and beyond, there will be more people in urban than rural Kurdistan. To guarantee that the magnitude and pace of urbanization does not drag on the country's overall development, Kurdistan should continue to implement integrated sustainable development strategies in order that our cities become generators of development, not only for themselves but also for the rural hinterlands. Future priorities should emphasize the following imperatives of sustainable development:

1- Develop efficient and effective governance systems in Kurdistan cities and other human settlements.
2- Strengthen national and local institutional capacities in the areas of sustainable urbanization;
3- Promote city-to-city cooperation to encourage exchange of best practices of sustainable urban development at all levels; and
4- Mobilize external resources and more coordinated and concerted support for sustainable development.

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Teaching Science Vocabulary to ESL Learners

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Abstract: Without gaining knowledge of science vocabulary, understanding of scientific concepts can be difficult. Though, learning science vocabulary is a field of discomfort, and a difficult task for ESL learners, a student's understanding of vocabulary is essential in science classes. Through giving effective instructions that facilitate learning science vocabulary, learners can improve their vocabulary knowledge for a better comprehension of scientific texts. This article suggests some useful strategies to enhance learners' science vocabulary.

Keywords: Science Texts, Science Concepts, Science Vocabulary, ESL Learners

1. Introduction

Science texts contain many unfamiliar words to students. Not knowing these words can hinder students' understanding of a science text. Students who have scientific literacy can "read with understanding articles about science" (Burkhardt et al. 2003, p. 18). For ESL learners developing literacy in science is challenging because they are still in the process of acquiring English as a second language. For a better comprehension of science texts students need a general of knowledge of English and scientific terminology. To accomplish in the science classroom, scientific literacy cannot be neglected. Carrier (2005) states that once ESL learners become familiar with basic sentence structures in science, they are more likely to (a) comprehend them when listening to teachers or to other students, (b) recognize and comprehend them in their science readings, and (c) use them orally in group or class discussions

2. Science Related Teaching Approaches

"Talking science means observing, describing, comparing, classifying, analyzing, discussing, hypothesizing, theorizing, questioning, challenging, arguing, designing experiments, following procedures, judging, evaluating, deciding, concluding, generalizing, reporting... in and through the language of science" (Lemke, 1990, p.1).

Lemke (1990) suggests four strategies to extend the knowledge of scientific concepts:

(a) adopting a whole language approach; it is always useful to integrate the language skills rather than fragmenting them. Language is most effectively learned when it is the vehicle of instruction; when students use it as a tool to create and share meaning in authentic and interesting learning situations (Cantoni-Harvey, 1987; Curtain & Pesola, 1988; Enright & McCloskey, 1988; Laplante, 1997). A text that is related to the topic helps students better comprehension of new words and concepts. Science texts are vocabulary heavy but are useful to enrich terminology.

(b) promoting a language environment favorable to second language development; to provide a great opportunity to construct meaning, the language environment during science activities should be established favorably.

(c) introducing and formally teaching new vocabulary words; it is always useful to explain meanings of words clearly and effectively to the students. In order to promote their comprehension of the meanings of new words, the teacher should provide their meanings before the start of the unit. Teachers should avoid giving long and complex definitions. Seeing the same word many times in a context facilitates their learning. It is useful if students are provided brief explanations of new words to promote their learning them in context. The level of teacher instruction highly contributes to comprehension and learning of new scientific terms. Fathmann, Quinn and Kessler, (1992) are of the opinion that it is only through concrete objects, pictures and visuals, and followed by discussions that scientific words can be acquired. Sarah Carrier defines support materials as:

- drawings, diagrams, and pictures to support the spoken word
- written instructions on word cards or SmartBoard along with verbal instructions
- set-up examples to supplement written lab instructions
- audiotaped instructions alongside written directions
- pictures with words in stages of lab procedures that students can sequence

(d) teaching the minor and major genres of science; students need to spend much time talking science, without practice talking science students cannot discover how to combine new words into correct sentences (Laplante, 1997). Students best learn new words if they are exposed to science texts. As long as they have opportunities to read, write, and discuss these texts, their understanding ability will develop.

Similarly; Laplante suggests four different strategies to teach science vocabulary:

(a) adopting a constructivist orientation in teaching, which is prior knowledge in the learning processes (Treagust,Duit & Fraser, 1996). Teachers should see learning as Hewson (1996, p.131) states "capturing new conceptions, restructuring existing conceptions or exchanging existing conceptions for new conceptions". Children already have knowledge about animals or plants before they study science at school for that reason science vocabulary acquisition is not a difficult process for young learners as "children have views about a variety of topics in science from a young age, and prior to learning science at school" (Osborne, 1985, p.76). If teachers take the students' prior knowledge into consideration, teaching science vocabulary will be easier. Teachers should connect the usage of a new term to students' prior knowledge.

(b) focusing on major conceptually based themes; in selecting themes, consideration should be given to children's interests and background knowledge (Hart, 1987), and learning activities should aim to develop important scientific concepts at their level of understanding (Laplante, 1997). In order to promote students' conceptual development, students need to be asked to present their own ideas. Through conceptually based activities, students will get more involved in new scientific ideas and have more opportunities to develop their comprehension of scientific knowledge.

(c) reflecting the nature of science in the learning activities; Laplante (1997) is of the opinion that students should be doing science as scientists do, working in small groups, exchanging information and discussing ideas. This kind of strategy will as (Hart, 1987, p.16) states "preserve a child's sense

of wonder, joy, excitement, and curiosity". This approach will provide children a great many new words and will enable them to understand scientific concepts. Through a group discussion students will be able to use new words they have learnt in speech.

(d) adopting an approach sensitive to the cultures of the students; Barba (1995) states that teachers should be aware how cultural variables such as instructional language, cultural objects, mode of interaction, role models can affect students' learning. In order to advance students' attitude towards science learning, these notions should be cared for by teachers.

Fathman, Quinn and Kessler (1992) propose five learning principles

1. Prior knowledge influences learning; students need to relate new concepts to their prior knowledge. Cook stresses that learning a second language also requires restructuring within the brain, making new connections between words and concepts and discarding old ones, and changing or resetting parameters already in place (Fathman, Quinn & Kessler, 1992).

2. Learning moves from the concrete to the abstract; to make connections between words and meanings teachers should use visual materials.

3. Learning requires practice in new situations; communicating ideas will enable students to use new words and concepts in authentic settings.

4. Effective learning requires feedback; "Feedback means guiding students in analytical thinking processes and providing suggestions for alternative ways of thinking" (Fathman, Quinn & Kessler, 1992). And ESL learners need feedback in accuracy of knowledge.

5. Learning is not necessarily an outcome of teaching because "good instruction does not necessarily lead to student understanding. Emphasis on the quality of understanding, rather than the quantity of information presented, is important for successful science and language learning" (Fathman, Quinn & Kessler, 1992). If the lesson is not understood the teacher should use different learning styles.

3. Conclusion

Vocabulary knowledge is essential in the science classroom because better vocabulary comprehension will lead to higher performance in the science classroom. Although considered as a difficult process for learners through an effective instruction, students can progress their understanding of science concepts. Learners with a good command of lexical knowledge can understand their subject matter materials with ease.

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Stock Market Movement Direction Prediction Using Three Algorithms

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Abstract: One of the highly challenging businesses today is the task of forecasting the market movements by examining the financial time series data as correctly as possible in order to hedge against the almost incalculable risk involved and to yield better profits for investors. If there was a highly credible estimation technique available giving better results than the traditional statistical tools for financial markets, it would be a great asset for trading decision makers of all kinds such as speculators, arbitrageurs, portfolio fund managers and even individual investors. In this study CART, C4.5 and Random Forest algorithms were used to predict the movement direction of a 10 year Istanbul Stock Exchange index (XU-100). Ten technical market indicators such as momentum, MACD and RSI were used in this study as the feature set.

Keywords: Price Movement Direction, CART, C4.5, Random Forest, Forecasting, Stock Market

1. Introduction

The complex dynamism of the markets is characterized by the nonlinearity and nonparametric nature of the variables influencing the index movement directions including human psychology and political events. The unpredictable volatility of the market index makes it a highly challenging task to accurately forecast its path of movement. On the other hand, it is crucial for investors to estimate the trend of the markets as precisely as possible in order to reach the best trading decisions for their investments, so in this context it is in the investor's best interest to use the most accurate time series forecasting model to maximize the profit or to minimize the risk. By means of this study, it is aimed at contributing to the demonstration and verification of the XU-100 index movement path predictability through some tree algorithms. The stochastic performance parameter is accuracy and it is defined as the ratio of the correctly classified instances divided by the number of all instances. The remaining part of this study is organized into four sections. The next section presents an overview of the theoretical literature while in section 3 the research data and the structures of tree algorithms CART, C4.5, Random Forest is described. In section 4, the reports and results of empirical findings from the comparative WEKA analysis are given. Finally, the last section contains the concluding remarks.

2. Literature Review

2.1 CART Review

The classification tree analysis CART (classification and regression trees) is suggested first by Breiman, Frydman, Olshen and Stone (1984) and uses the predictor variables splitting rule to build

a binary decision tree (Denison, Mallick & Smith, 1998). The CART method is experimented in the credit scoring area, retail lending and evaluation of insurance risks in workers' compensation showing better results than logistic regression and discriminant analysis (Friedman 1991; Devaney 1994; Lee et al., 2006; Kolyshkina & Brookes, 2002).

2.2 C4.5 Review

The C4.5 method is high in efficiency when used for inductive inference. Recent research has shown that this algorithm produces high accuracy in image segmentation (Polat & Gunes, 2009; Mazid et al., 2010). In another work a hybrid approach including C4.5 is suggested with potentially high outcomes (Jiang & Yu, 2009; Mazid et al., 2010). It is also used for classification of remote sensing data (Yu & Ai, 2009; Mazid et al., 2010). Another variant of C4.5 successfully trimmed down the leaf node number and improved accuracy (Yang, 2009; Mazid et al., 2010).

2.3 Random Forest Review

High-dimensional classification and regression problems can be approached by using random forest algorithm that is extensively researched by Breiman (2001). Among the machine learning techniques used to predict markets random forest is quite successful (Dietterich, 2000). Though the practicality of random forest is excellent it is hard to interpret and clarify mathematically (Breiman, 2002; Lin & Jeon, 2006; Biau et al., 2008a, Biau et al., 2008b).

3. Materials and Methods

3.1 CART Method

CART constructs a tree where the data is separated into two parts by binary variable splits. The best divider variable and the best point to split is determined by variance minimization.

The CART algorithm can be viewed as a classification procedure consisting of four distinct parts:
Part 1: a variance criterion,
Part 2: the criterion how good it is split,
Part 3: the terminal node class assignments and estimates of resubstitution,
Part 4: determining the right tree complexity (Buyukbebeci, 2009).

The root node, internal nodes and leaf (terminal) nodes constitute the CART tree. Two child nodes follow each root and internal node. Each node contains and is defined by the subset of the original learning sample. The splitting of each node into child nodes is characterized by a certain rule depending on the chosen feature. The child nodes inherit subsamples with minimum variance that measures their heterogeneity from parent nodes (Iscanoglu, 2005).

The goodness of the splitting procedure is defined by an impurity function that is derived from a variance function which is applied to each split point indicating the best point for splitting (Iscanoglu, 2005). Gini, Entropy and Twoing are the main rules for binary recursive splitting that

are derived from the impurity function (Breiman et al., 1984).

3.2 C4.5 Method

In doing classification with C4.5, the concepts of entropy and correlation coefficient need to be explained in brief. Entropy is a measure of uncertainty among random variables in a collection of data or in other words entropy provides information about the behavior of random processes used in data analysis. Correlation coefficient has its uses as a chief statistical tool in data analysis finding the relationship between variable sets. Different ways of calculations have been introduced to boost the efficiency of the correlation coefficient among which are Kendall, Pearson's and Spearman's correlation coefficients. There are several test options with WEKA providing data classification such as training set, supplied test set, percentage split and cross validation. In this paper, cross validation is chosen as the test option (Mazid et al., 2010).

3.3 Random Forest Method

Random forests are based on conjoining lots of binary regression trees. In the process of growing these large number of regression trees independent subsets of variables are used. Random forests randomly choose variables to split and a bootstrapped sample of the dataset builds the decision trees (Efron & Tibshirani, 1993). When K trees are aggregated the predicted decision is gained as the average value over these K trees. Marking each single tree predictors by h_v h_K, the final outcome is:

$$h(X) = \frac{1}{K} \sum_{k=1}^{K} h_k(x)$$

4. Research Data

In this study, all experiments were conducted on WEKA software using its tree classifiers built-in tool to make comparisons of prediction performances based on the chosen dataset. The dataset is comprised of 10 input variables with 2733 instances in total. These 10 input attributes are technical market indicators as used by Kara, Boyacioglu and Baykan (2010) which are 10-day moving average, 10-day weighted moving average, momentum, stochastic %K, stochastic %D, RSI (Relative Strength Index), MACD (moving average convergence divergence), Larry William's %R, A/D (Accumulation/Distribution) Oscillator and CCI (Commodity Channel Index). The total number of cases or 2733 trading days have 1440 days with increasing direction (advances), while 1293 days show decreasing direction (declines). In the analysis, 10-fold cross-validation was used as the test option in WEKA.

5. Results and Discussion

The relevance and quality of the data, usually, has a big impact on the performance of the model used. Thus, the choice of data becomes the most important part in forecasting the markets. In this study, all series are real-valued and the input data spans from 02/01/1997 to 31/12/2007. For WEKA testing, the accuracy or correctly classified instances metric is utilized, showing the ability of the model to capture the data. The dataset with 10 features is tested using CART, C4.5 and Random Forest classifiers in order to see which tree algorithm has better predictive power over the

others. The results of the tests can be seen in the Table 1 where CART and Random Forest classifiers have almost identical prediction power, whereas C4.5 has a little less prediction power compared to the other two tree algorithms.

Table 1: Tree Classifiers Test Results

	% Accuracy (correctly classified instances)
CART	78.05
C4.5	77.29
Random Forest	78.23

3. Conclusion

The issue of accurately predicting the stock market price movement direction is highly important for formulating the best market trading solutions. It is fundamentally affecting buy and sell decisions of an instrument that can be lucrative for investors. This study focuses on predicting the ISE National 100 closing price movement directions using tree algorithms based on the daily data from 1997 to 2007. Even though the prediction performance of tree classifiers such as CART, random forest and C4.5 do not really outperform studies alike in literature, it is still likely that the forecasting performance of the models can still be improved by doing the followings: Either the model parameters should be adjusted by thorough experimentation or the input variable sets need to be modified by selecting those input attributes that are more realistic in reflecting the market workings. (Kara, Boyacioglu and Baykan (2010) had already proved the significance of using ten particular technical market indicators which gave also about %78 accuracy in this study, as well. More appropriate variables has to be found that may improve the forecasting performance of the models employed that can be a further subject of study for interested readers.

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Comparison of Linear Regression and Neural Network Models Forecasting Tourist Arrivals to Turkey

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Abstract: This paper develops statistical and machine learning methods for estimating tourist arrivals which is one of the donnée for planning the sustainable tourism development. Tourism is arguably one of the world's largest and fastest growing industries. Sustainable tourism development is one of the most promising generators of the sustainable economic development. Realistic tourism projections based on accurate tourism forecasting contribute much for the sustainable tourism development. The challenge of the planning and developing sustainable tourism is to see as the complex paradigm but one of the starting points is the accurate forecasting tourist arrivals. In this study, linear regression and neural network multilayer perceptron (MLP) implementations are considered to make multivariate tourism forecasting for Turkey. Comparison of forecasting performances in terms of correlation coefficient (R), relative absolute error (RAE) and root relative squared error (RRSE) measurements shows that MLP model for regression gives a better performance.

Keywords: Tourism Forecasting, Tourism Demand Modeling, Time Series, Linear Regression, Neural Networks, Multilayer Perceptron, Multivariate Tourism Forecasting

1. Introduction

Tourism demand forecasts are of great economic value both for the public and private sector. Tourism products, such as unfilled airline seats, unoccupied hotel rooms, and unused facilities, cannot be stocked because of their perishable nature (Archer, 1987). Therefore, accurately forecasting tourism demand has great importance to the sectors concerned with tourism, in order to accurate and efficient planning (Petropoulos et al., 2005; Pai & Hong, 2005).

According to the World Travel & Tourism Council (WTTC), travel and tourism is the biggest industry in the world. Since 1992 tourism sector is the largest industry and has the largest employer in the world (Aslan et al., 2008). Turkey's economy grew an average of 6.0% per year in last decade. Currently Turkey is in 16th place on the list of the largest economies of the world and the fastest growing economy among members of the Organization for Economic Cooperation and Development (OECD).

The new goals of Turkish tourism were to establish an efficient tourism sector with high international competitiveness while preserving and enhancing of the country’s natural and historical environment and cultural heritage in a sustainable manner (Ministry of Culture, 2007).

The statistical methods such as linear regression are suitable for data having seasonal or trend patterns, while artificial neural techniques are also efficient for data which are influenced by the

special case, like promotion or extreme crisis (Efendigil et al., 2009).

One major application area of ANNs is forecasting (Gooijer & Hyndman, 2006); (see Zhang et al., 1998; Hippert et., 2001). Generally the ANNs are increasingly used to forecast demands for tourism (Law & Au, 1999; Law, 2000). Pattie and Snyder (1996) used a back-propagation neural network model with two hidden layers to forecast monthly overnight stays in US national park systems. Law and Au (1999) presented a feed-forward neural network with six input and one output nodes to forecast arrivals in Hong Kong. For more application area of ANN, (see Al-Saba & El-Amin, 1999; Beccali et al., 2004; Hobbs et al., 1998; Sozen et al., 2005; Sabuncuoglu, 1998; Vellido et al., 1999; Wong et al., 2000; Ayata et al., 2007; Efendigil et al., 2009).

According to the brief review of literature especially related to tourism demands approaches, this study attempts to develop a multivariate linear regression model and a general regression neural network model for forecasting the number of the tourists coming to Turkey.

2. Theoretical Background

2.1 Linear Regression

Multiple linear regression (MLR) attempts to model the linear relationship called the regression function between a dependent variable and more than one independent variables as different from simple linear models with one independent variable. The dependent variable is sometimes also called the predictand, and the independent variables is called the predictors.
The model for multiple linear regression, given n observations, is

$$y_i = \beta_o + \beta_1 x_{i,1} + \beta_2 x_{i,2} + \cdots + \beta_p x_{i,p} + \varepsilon_i$$

for i = 1,2, ... n.

$x_{i,p}$value of p^{th} predictor, β_o the intercept, also known as the bias in machine learning, β_p coefficient on the p^{th} predictor, p total number of predictors, y_i predictand, ε_i error.

2.2 MLP Approach

Artificial neural networks (ANNs) (also usually preferred Neural Networks NNs) are computing structures inspired from the biological neural networks. A neural network is made of the interconnected processing units (usually called neurons). They have the ability of learning by adjusting the strength of the interconnections which can be achieved by altering the values called weights through the input data (Haykin, 1999). Neuron sums the weighted inputs and conveys the net input through an activation function in order to normalize and produce a result (Jones, 2008).

The multilayer network architecture consists of an input layer, two or more hidden layers, and one output layer. Activation function is used for both the hidden and output nodes. While the sigmoid function can be used to squash the output of the neuron to 0.0 to 1.0 in the hidden layer in order to introduce the non-linearity to NN, linear activation function must use in output layer to predict the numerical values in the regression problems. MLP is trained with supervised learning include the Perceptron learning algorithm, Least-Mean-Squares learning, and Backpropagation.

Backpropagation is one of the most popular approximation approaches for training the multilayer feedforward neural networks based on the Widrow–Hoff training rule (Bishop, 1995; Haykin, 1999; Aslanargun et al., 2007).

3. Materials and Methods

A total of 31 models were obtained on the basis of two regression models and their corresponding parameter selection which are three of them belong to linear regression models and remaining 28 ones belong to MLP models. Those models were evaluated with the validation data through three forecasting accuracy measures: correlation coefficient (R), relative absolute error (RAE), root relative squared error (RRSE).

Three linear regression models were examined on the basis of attribute selection parameter: none, M5 and greedy methods. It has been shown that the linear regression model with greedy attribute selection parameter has the best accuracy when you compare with the other linear regression models but also the worst when you compare with MLP regression models.

3.1 Experimental Results

According to result of our linear regression model: 25 attributes don't affect the results — WEKA builds the regression function by considering the attributes which only statistically contribute to the accuracy of the model (measured in R^2). It will not consider the attributes that don't contribute the regression equation. So this regression model is telling us that whole sale price of Turkey, consumer prize index of Canada, Denmark, Spain, Russia, number of German, France, Syrian, Poland, Romanian, Norwegian, Switzerlandian visitors, Exchange rate of Russia, Canada, Switzerland don't affect the arrivals to Turkey. Estimated positive values (coefficients) tell us as value of those attributes increase number of the total visitors. Estimated negative values (coefficients) reduce the result — linear regression model is telling us that the bigger negative value is, the lower the total coming tourist. This can be seen by the negative coefficient in front of the variables.

Table 1: Overall performance of linear regression and MLP methods

Model	Correlation coefficient	Relative absolute error	Root relative squared error
Linear Regression	0.978	18.73%	20.70%
MLP Regression	0.9874	14.17%	15.86%

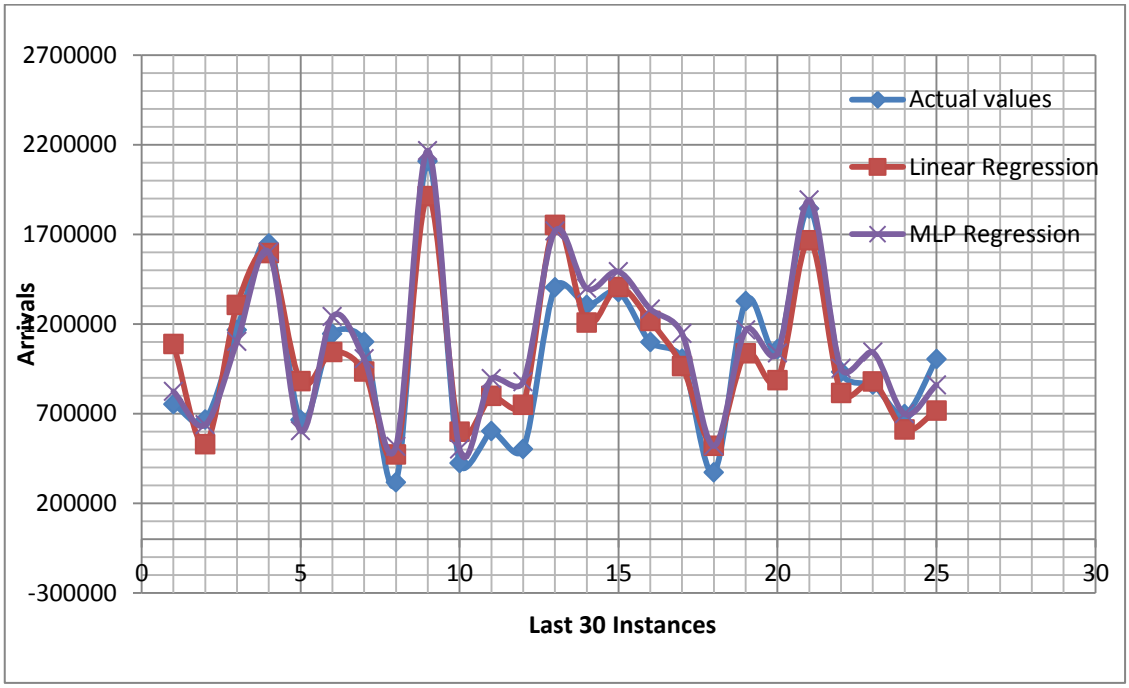

Figure 1 Comparison of MLP and linear regression methods

Among the MLP regression models presented, the best forecasting accuracy was the MLP model composed of three hidden layers with the neuron numbers of 30, 15 and 10 (abbreviated as 30-15-10). In this model the learning rate 0.03, momentum 0.8, epoch 500 values are used and backpropagation training algorithm, sigmoid activation function for hidden nodes and unthresholded linear activation function for output node are employed. It showed R 0.9874, RAE 14.17% and RRSE 15.86% accuracy results.

Results obtained from the experiments in this study, support the discussions in the literature reviews topic of this paper. As seen in the table (1) apparently, machine learning MLP regression model have better performance than statistical linear regression model.

4. Discussion and Conclusion

This study presents a multivariate time-series forecasting to predict the tourism demand to Turkey by employing linear regression and multilayer perceptron methods. The real data sets respect to Turkey and its top ranked 24 tourism clients of the countries are used to compare the performance of the those methods and to find out the achievement of them on forecasting tourism demand to Turkey. Comparison of the experimental results among linear regression and MLP demonstrated that the MLP method had better forecasting accuracy. Experimental results showed that the MLP model can produce lower prediction error and higher prediction accuracy and outperformed the linear regression model. According to the experiments, it can be concluded that the tuned MLP method with the multivariate time series has enough satisfactory to forecast the tourism demand to Turkey.

In this study, linear regression model with greedy attributes selection method and MLP (30:15:10) models have shown better performance when compared with other corresponding models in forecasting the number of monthly tourist arrivals to Turkey owing to the RAE and the RRSE measures.

Unfortunately, there is no certain or systematic method to select the appropriate model. Our studies showed that among the methods mentioned above MLP regression has better performance but still we need numerous experiments to evaluate and find out the most suitable MLP regression model which can be employed on the multivariate time series forecasting.

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Indirect Quotation with Author as Part of the Narrative

LaRue (2007) identified intellectual freedom and patron confidentiality as two key values held historically by libraries.

Direct Quotation with Parenthetical Citation

Darwin used the metaphor of the tree of life "to express the other form of interconnectedness–genealogical rather than ecological" (Gould & Brown, 1991, p. 14).

Direct Quotation with Author as Part of the Narrative

Gould and Brown (1991) explained that Darwin used the metaphor of the tree of life "to express the other form of interconnectedness–genealogical rather than ecological" (p. 14).