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Message from the Editor-in-Chief

Hello from TOJSAT

TOJSAT welcomes you.

We are very pleased to publish volume 5 issue 3 in 2015. As an editor-in-chief of The Online Journal of Science and Technology (TOJSAT), this issue is the success of the reviewers, editorial board and the researchers. In this respect, I would like to thank to all reviewers, researchers and the editorial board.

This issue covers different research scopes, approaches which subjects about science and technology by valuable researchers. I and The Online Journal of Science and Technology (TOJSAT) editorial team will be pleased to share various researches with this issue as it is the miracle of our journal. All authors can submit their manuscripts to tojsateditor@gmail.com for the next issues.

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July, 01, 2015

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Activity Based Costing Application in Turkish Hardcoal Authority[1]

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Abstract: As result of the growing competition and changing production structure, traditional cost systems are not adequate any more. In this study, it is aimed to review the feasibility of activity based costing (ABC) system - one of the modern costing systems - for a coal enterprise. In this context, case study was conducted via the selected enterprise. Results obtained from the research are as follows: First of all, due to not including the cost proportion of sales /marketing and general administrative expenses to inventoriable costs calculated in the enterprise of application, inventoriable costs were lower in traditional costing system compared to ABC system. The most important reason for that is, in the accounting system of Turkey, even if operating expenses belong to that production period, it is considered as a non-production expense and added to operating accounts instead of stock accounts.

Key Words: Activity Based Costing System, Cost Management, Hardcoal Enterprises

Introduction

Rapid developments that took place in technology in recent years appear also in production technologies, and create new production systems. These new production systems specifically depend on automation. It is considered that traditional costing systems are not suitable for such new production environments. Main reasons for that are rapid increase in product range and therefore considerable increase in design expenses and after sales service expenses, increase in ratio of general production expenses in total costs but decrease in proportion of direct workmanship costs instead.

Two basic factors which are significant to reach the profit - purpose of the enterprises - are cost and sales price.

Sales prices are determined by companies offering goods or services in a competitive environment.

Besides that, costs are partially under the control of the related enterprise. It is regarded that traditional cost systems are not very succesfull in fulfilling this control in a healthy way. For this case, Activity Based Costing (ABC) system is recommended, which is regarded as one of the modern cost systems and usage of which becomes more common day by day.

ABC method was developed which yields more accurate results compared to traditional cost methods in product costing as well as produces broader and more rational information which executives can use during their decision processes. Purpose of this study is to review the feasibility of ABC system in a coal enterprise, with a case study approach. In this sense, case study was performed in a mine enterprise operating in Turkey.

Activity Based Cost (ABC) System

As result of the changes taken place for years in the environment which the enterprises were active; the competition has increased, new demands of customers such as quality, efficiency, elasticity, innovation and continous development came to the fore and thus, the basic assumption that a product can be manufactured for a long term phenomenon, which traditional costing systems have based on, have dissappeared (Durer etc., 2009). ABC system calculates the cost of resources, which the enterprise uses during production process (Cooper & Kaplan, 1992). ABC is a total quality instrument used for measuring the costs and performances of activities, resources and cost objects (Ashford, 2011). ABC System is the measurement method for measuring costs and performances of activities, resources and cost drivers. ABC is a system that charges resource costs to activities by grounding on sourcing of activities, and that charges activity costs to cost objects by grounding on use of activities of cost drivers (Bengü, 2005).

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ABC System can be defined as a sense of cost and management which the products consume the enterprise resources on the basis of activity, thus acts in a sense that indirect expenses should be classified on the basis of activity and builds a linear relationship at various levels between the product and indirect expenses regardless of only being based on the production volume (Dumanoğlu, 2005).

Basic purposes of ABC system are as follows (Alkan, 2005):
- To eliminate or minimize the costs of activities which do not create added value,
- To provide active information flow in simplifying the activities with high added value,
- To provide identification of main reasons for the problems and remedy those factors,
- To eliminate the mistakes arising from the cost distribution,
- To provide correct cost information in decisions to be taken by executives.

Basic concepts used in ABC system can be listed as resource, activity, center of activities, cost pool and cost factor (Unutkan, 2010). Explaining the said concepts can be useful. The resource concept is the expenditures required to perform the activities. The activity concept refers to some procedures which are performed in order to manufacture and sell the products or services. Center of activities concept refers to centres where activities having similar processes or sense of the same cost distribution in resource consumption come together. Cost pool concept is used in order to follow the total amount of resources consumed by activities on the basis of activities (Unutkan, 2010). Since cost pools contain the costs of similar activities, those cost pools are have homogeneous characteristics. Thus, one single cost factor becomes sufficient in transferring the costs accumulated in the cost pool for each activity to products or services (Bekçi & Negiz, 2011). The cost factor concept refers to distribution keys in charging the resource costs to activities and charging the costs accumulated in the cost pools to products or services.

2.1. Properties Which Distinguish ABC System From Traditional Costing System

The most important difference between ABC system and traditional costing systems does not only appear at production costs, but also in dealing with other activity costs (Karacan & Aslanoğlu, 2005). In traitional costing system, only costs associated with production are classified as direct and indirect. While direct costs can be charged to manufactured products or services directly, indirect expenses are charged to products or services through some distributive criteria. In this respect, the costs which arise generally in production environment in traditional costing system are first distributed to production centers, then the costs accumulated in production centers are charged to productions or services through volume based criteria.

Another property of traditional costing system is that it only takes into consideration the costs resulted in production environment in calculating the manufactured product or service costs. In other words, while general administrative expenses and activity expenses such as marketing, sales and distributive expenses are calculated in traditional costing system as production costs, they are not considered as a cost element and are regarded directly as period cost instead.

The most important deficits of traditional costing system are that it falls behind to meet the needs of management with the information it produces, can not accurately and correctly reflect the production process, does not allow to make an effective performance evaluation, that the information it provides are very general, can not measure the resource consumption correctly, is late in providing information, that the information it provides are not reliable, encourages overstock, makes unrealistic cost distributions and is unable to provide necessary information for the future production (Edward & Heard, 1984, cited by:Çabuk, 2003).

ABC system is the one that is underlying for removing the deficits or mistakes arising from traditional costing system in terms of resource consumption of activities. Basic contribution of ABC system in calculating the costs related to production outputs is to provide the connection between the activity or series of activities causing the formation of production costs, and production outputs which causes the appearance of such activity or series of activities (Karacan & Aslanoğlu, 2005).

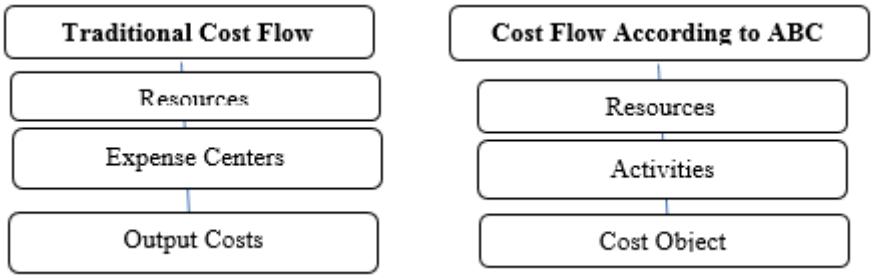

Figure 1: Cost Flow Chart

Source: Öker, F. (2003). Faaliyet Tabanlı Maliyetleme Üretim ve Hizmet İşletmelerinde Uygulamalar. İstanbul: Literatür Yayınları, p.33.

Unlike traditional costing system, the ABC system focuses on activities in calculating the costs of products or services. In this advanced costing system, in identifying the costs of production and service; not only the costs arising during the production process are considered, but also non-operational expenses are taken into consideration. In this respect, operational expenses are taken into operating accounts as a cost element relating to production. Since the costs can be followed up according to activity or series of activities in ABC system, it is possible to analyse how much cost an activity has created. It is possible to present the cost flow process of traditional costing and ABC system in Figure 1.

As can be seen in Figure 1, cost flow in traditional costing system is first transferred from resources to essential and auxiliary production centers, and costs accumulated in such centers transform to output costs. However in ABC system, resource costs are first charged to activities that consume those resources, and expenses accumulated in activities are transferred to cost objects through various cost factors.

2.2. Structure of ABC System

In an enterprise, ABC system shoud be established expediently, with minimum cost, simple and in a perceptible manner. In this sense, there should be harmony between the determined activities. Rather than the specific activities, choosing more macro size activities should be considered. By gathering the activities that seem unimportant, unnecessary works should be prevented. In addition, it is very important to provide correct data flow in order to get successful results from the system (Bengü & Arslan, 2009).

It is possible to list the stages of ABC system as follows (Bekçi & Negiz, 2011).

A1. Determination of activities: Activities occur throughout the process ranging from the beginning of manufacture of a product or service to presentation of the said product or service to customers in a producion environment. It is quite important to determine, define and categorize all the activities involved in that process. In the process of determination of the activities, some important points should be taken into consideration. It is possible to summarize the said points as follows (Doğan, 1996, cited by: Alkan, 2005).

1. The determined activities should be detailed relevant to the system's purpose,
2. Macro activities should be chosen,
3. Less important activities should be collected in an activitiy group,
4. Activities should be defined explicitly.

A2. Determination of the activity centers: After the activities are determined, second stage of the system design is determination of activity centers. It is possible to explain activity centers in four basic category as follows (Erdoğan & Saban, 2014):

1. Activities at product unit level: These kind of activities are the ones which always appear when manufacturing of products or services are performed. When those activities are performed, resource costs are directly associated with the number of produced units.

2. Lot level activities: These kind of activities appear according to the number of produced lots. The costs related to such activities vary for each lot, but constant for products or services provided in the lots.

3. Product level activities: These kind of activities appear as the activities required for manufacturing of multi-feature products or services.

4. Factory level activities: These are the activities performed in order to make the production at desired level. The costs related to such activities are asscociated with products or services according to various distribution criteria.

A3. Determination of Cost Factors: Cost factors are validation instruments in terms of amount of resources consumed by activities and its monetary amount. In other words, cost factors build causality relationship in charging resource costs to activities and costs accumulated in activities to products and services (Alkan, 2005).

A4. Transfering the costs to activity centers: In charging resource costs to activities, it is required to determine several cost factors. In choosing such cost factors, cause and effect relationship between resource and activity should be considered. In result of transfering resource costs to each activity, the cost of each activity center is calculated correctly.

A5. Charging the costs to products: After determining the suitable cost fctors for activity centers, it is required to determine several cost factors for each manufactured product or service group and transfer such costs to product or service groups (Öker, 2003).

An application On a Coal Enterprise

The application is on only one establishment of TTK *(Turkish Hardcoal Authority)* that continues its activities in field of hardcoal mining. Hardcoal production is considerably performed in a labour-intense manner that depends on manpower. Under these circumstances, number of saleable coals carried out by the Coal Enterprise in 2014 is 325 953 tons. The produced coking coals are washed in washery, and the A, B and C type coals obtained after the coal is washed are supplied to the market and sold. In the said enterprise, 316 258 tons of coals out of 325 953 tons produced in the year of 2014 were sold. The enterprise carried out such activities with its 2159 employees consisting of workers and officials. Operating expenses of the coal enterprise for 2014 operating cycle can be shown in Table 1.

Table 1: Operating Expenses of the Coal Enterprise For 31.12.2014 Operating Cycle

Indirect Expenses	Total (Turkish Lira - ₺)
Indirect raw materials and consumables	10 579 544.50
Indirect labour expenses	95 241 972.23
Civil servants wages and expenses	2 730 167.52
Electricity costs	8 283 665.10
Depreciation	12 939 254.15
Outsourced benefits and services	6 773 255.79
Marketing and sales expenses	3 601 849.02
Administrative expenses	23 242 952.58
TOTAL	163 392 660.89

3.1. The First Stage: Determination of Activities

In this stage, activities shall be determined for the enterprise under application. In the enterprise under application, many activities are being fulfilled and adequate number of activities has been determined in terms of study frame. In determining the said activities, a negotiation was made with the enterprise management and activities were classified in line with the obtained information. The said activities can be seen in Table 2.

As seen in Table 2, eight activities were determined in the coal product enterprise. Pit 1-6 activities include production activities related with reaching the coal mine, shattering and extracting the coal. Sales and marketing activity includes the activities related with sales and distribution of the coal mine which was made usable. And lastly, the enterprise management activity includes all the activities which are administratively necessary for the enterprise in order to continue its activities in line with its mission.

Table 2: Determined Activities in the Coal Enterprise

Activitiy No	Activitiy Name
1	Quarry Area 1 Activitiy
2	Quarry Area 2 Activitiy
3	Quarry Area 3 Activitiy
4	Quarry Area 4 Activitiy

Activitiy No	Activitiy Name
5	Quarry Area 5 Activitiy
6	Quarry Area 6 Activitiy
7	Marketing and Sales Activity
8	Business Management Activity

4.2. Second Stage: Determination of Cost Factors

At this stage, it is required to determine various cost factors in order to charge all activity expenses of 2014 production period to the activities determined for the enterprise in the previous stage. With that purpose, in order to charge the activity expenses to activities about which we gave information before, it is possible to present the information in Table 3 concerning the optimum cost factors determined in enterprise environment.

Table 3: Determination of Cost Factors:

Indirect Expenses	Cost Driver
Indirect raw materials and consumables	Number of mine timber(number)
Indirect labour expenses	Number of employee (worker)
Civil servants wages and expenses	Number of employee (officer)
Electricity costs	Use of elektricity (kWh)
Depreciation	Rate of machine utilisation (%)
Outsourced benefits and services	Usage rate (%)
Marketing and sales expenses	Usage rate (%)
Administrative expenses	Usage rate (%)

Table 4: Data For Cost Facors On the Basis Of Activities

Activities	Use of mine timber (Number)	Number of employee (Person)	Number of officer (Person)	Use of elektricity (kWh)	Rate of machine utilisation (%)	Equal rating (%)
Quarry Area 1	34 495	345	2	8 694 338.62	16.50	16.66
Quarry Area 2	30 020	317	2	7 579 854.72	16.50	16.66
Quarry Area 3	21 813	322	0	7 977 192.58	16.50	16.66
Quarry Area 4	28 287	290	0	8 839 706.42	16.50	16.66
Quarry Area 5	33 462	307	1	7 638 001.83	16.50	16.66
Quarry Area 6	41 382	327	3	6 533 208.66	16.50	16.70
Marketing and Sales	0	0	0	0.00	0.00	0.00
Business Management	0	32	213	1 593 429.17	1.00	0.00
Total	189 909	1 939	220	45 855 732.00	100.00	100.00

In Table 3; Number of mine timbers were considered as the cost factor in charging the indirect raw materials and consumables' expenses to the activities while number of employees in charging workmen and officials' wage expenses, electricity utilization in charging electricity expenses, machine using rates in charging depreciation expenses, using rate in charging sales and marketing expenses, using rate in charging outsources and using rate in charging general administrative expenses. After the necessary definition was made for the cost factors, it will be useful to present numerical information for such factors in details. Using of cost factors with respect to activities are shown in Table 4.

3.3. Third Stage: Determination of Activity Costs

In this stage of the application, indirect costs shall be provided to be added to activities through the cost factors determined in the previous stage.

In Table 5, number of mine timbers were considered as the cost factor in charging of indirect raw materials and consumables' expenses to the activities. Total cost in activity centers is 10 579 544.50 ₺. Total number of mine timbers used for ongoing activities is 189 909. Relevant expenses were distributed by considering the number of mine timbers used in activity centers.

Table 5: Distribution of Indirect Equipment and Material Expenses to Actvities

Activities	Use of Mine Timber	Unit Expense Criterion	Total(₺)
Quarry Area 1	34 495	55.71	1 921 664.52
Quarry Area 2	30 020	55.71	1 672 369.01
Quarry Area 3	21 813	55.71	1 215 169.39
Quarry Area 4	28 287	55.71	1 575 826.19
Quarry Area 5	33 462	55.71	1 864 117.65
Quarry Area 6	41 832	55.71	2 330 397.75
Marketing and Sales	0	55.71	0.00
Business Management	0	55.71	0.00
Total	189 909		10 579 544.50

Not: Unit Expense Criterion = 10 579 544,50 / 189 909,00 = 55,71

In Table 6, number of workmen were considered as the cost factor in charging the indirect labour expenses to activities. Total cost in activity centers is 95 241 972.23 ₺. Total number of workmen for the ongoing activities is 1939. Relevant expenses were distributed by considering the number of workmen in activity centers.

Table 6: Distribution of Indirect Labour Costs to Activities

Activities	Number of Employee	Unit Expense Criterion	Total (₺)
Quarry Area 1	345	49 119.12	16 957 618.79
Quarry Area 2	317	49 119.12	15 553 903.35
Quarry Area 3	322	49 119.12	15 798 467.53
Quarry Area 4	290	49 119.12	14 253 577.56
Quarry Area 5	307	49 119.12	15 070 700.55
Quarry Area 6	327	49 119.12	16 051 543.70
Marketing and Sales	0	49 119.12	0.00
Business Management	32	49 119.12	1 556 160.75
Total	1 939		95 241 972.23

Not: Unit Expense Criterion = 95 241 972,23 / 1 939,00 = 49 119,12

In Table 7, number of officials was considered as the cost factor in charging the officials' wage bills to activities. Total cost in activity centers is 2 730 167.52 ₺. Total number of officials for the ongoing activities is 220. Relevant expenses were distributed by considering the number of officials in activity centers.

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Table 7: Distribution of Officials' Wage Bills to Activities

Activities	Number of Officer	Unit Expense Criterion	Total (₺)
Quarry Area 1	2	12 409.83	19 257.17
Quarry Area 2	2	12 409.83	19 034.78
Quarry Area 3	0	12 409.83	0.00
Quarry Area 4	0	12 409.83	0.00
Quarry Area 5	1	12 409.83	12 409.83
Quarry Area 6	3	12 409.83	35 798.87
Marketing and Sales	0	12 409.83	0.00
Business Management	213	12 409.83	2 643 666.86
Total	220		2 730 167.52

Not: Unit Expense Criterion = 2 730 167.52 / 220.00 = 12 409.83

When Table 8 is observed, the electricity consumed (kWh) was considered as the cost factor in charging the electricity expenses to activities. Total cost in activity centers is 8 283 665.10 ₺. Amount of consumed electricity for ongoing activities is 45 855 732.00 kWh. Relevant expenses were distributed by considering the amount of electricity consumed in activity centers.

Table 8: Distribution of Electricity Expenses to Activities

Activities	Use of Elektricity (kWh)	Unit Expense Criterion	Total (₺)
Quarry Area 1	8 694 338.62	0.17	1 474 156.39
Quarry Area 2	7 579 854.72	0.17	1 285 191.63
Quarry Area 3	7 977 192.58	0.17	1 352 561.70
Quarry Area 4	8 839 706.42	0.17	1 498 804.02
Quarry Area 5	7 638 001.83	0.17	1 295 050.68
Quarry Area 6	6 533 208.66	0.17	1 107 729.03
Marketing and Sales	0.00	0.17	0.00
Business Management	1 593 429.17	0.17	270 171.65
Total	45 855 732.00		8 283 665.10

Not: Unit Expense Criterion = 8 283 665.10 / 45 855 732.00 = 0.17

When we look at table 9, we see that using rates (%) were used as the cost effect in charging outsource expenses. Total cost in activity centers is 6 773 255.79 ₺. Relevant expenses were distributed by considering the using rates in activity centers.

When we look at Table 10, we see that machine using rates (%) were considered as the cost factor in charging depreciation expenses to activities. Total cost in activity centers is 12 939 254.15 ₺. Relevant expenses were distributed by considering the machine using rates in activity centers.

Table 9: Distribution of Outsource Expenses to Activities

Activities	Usage Rates (%)	Unit Expense Criterion	Total (₺)
Quarry Area 1	16.66	67 732.56	1 128 424.41
Quarry Area 1	16.66	67 732.56	1 128 424.41
Quarry Area 1	16.66	67 732.56	1 128 424.41
Quarry Area 1	16.66	67 732.56	1 128 424.41
Quarry Area 1	16.66	67 732.56	1 128 424.41
Quarry Area 1	16.70	67 732.56	1 131 133.72
Marketing and Sales	0.00	67 732.56	0.00
Business Management	0.00	67 732.56	0.00
Total	100.00		6 773 255.79

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Not: Unit Expense Criterion = 6 773 255.79 / 100.00 = 67 732.56

Table 10: Distribution of Depreciation Expenses to Activities

Activities	Rate of Machine Utilisation (%)	Unit Expense Criterion	Total (₺)
Quarry Area 1	16.50	129 392.54	2 134 976.93
Quarry Area 2	16.50	129 392.54	2 134 976.93
Quarry Area 3	16.50	129 392.54	2 134 976.93
Quarry Area 4	16.50	129 392.54	2 134 976.93
Quarry Area 5	16.50	129 392.54	2 134 976.93
Quarry Area 6	16.50	129 392.54	2 134 976.93
Marketing and Sales	0.00	129 392.54	0.00
Business Management	0.00	129 392.54	129 392.54
Total	100.00		12 939 254.15

Not: Unit Expense Criterion = 12 939 254.15 / 100.00 = 129 392.54

In Table 11, the first stage cost charging was made at a rate consumed by activities, and total costs of activity centers were presented in the table.

3.4. Fourth Stage: Determination of Cost Factors

After activity costs are determined, several cost factors are needed at this stage of the application in order to charge activity costs to products. In this respect, it is possible to present cost factors as in Table 12 for the ongoing activities in the coal enterprise.

When we look at Table 12, the amount of tons produced will be considered as the cost factor in distribution of total activity costs to products for Pit 1-6 activities, and the amount of tons sold will be considered as the cost factor in distribution of total costs accumulated in sales, marketing and business administration to activities. With this point of view, it is possible to present numerical data as in Table 13 for activity factors on the basis of products.

3.5. Fifth stage: Determination of Product Costs

As the last stage of the application, total activity costs can be distributed to manufactured products in this stage by using the activity factors determined at the fourth stage.

Table 11: Determination of Total Activity Costs (₺)

Activities	Material Costs	Labour Expenses	Officer Wages	Electricity Costs	Outsourced Benefits and Services	Depreciation	Marketing and Sales Expenses	Administrative Expenses	Total
Quarry Area 1	1 921 664.52	16 957 618.79	19 257.17	1 474 156.39	1 128 424.41	2 134 976.93	0.00	0.00	23 636 098.21
Quarry Area 1	1 672 369.01	15 553 903.35	19 034.78	1 285 191.63	1 128 424.41	2 134 976.93	0.00	0.00	21 793 900.12
Quarry Area 1	1 215 169.39	15 798 467.53	0.00	1 352 561.70	1 128 424.41	2 134 976.93	0.00	0.00	21 629 599.97
Quarry Area 1	1 575 826.19	14 253 577.56	0.00	1 498 804.02	1 128 424.41	2 134 976.93	0.00	0.00	20 591 609.12
Quarry Area 1	1 864 117.65	15 070 700.55	12 409.83	1 295 050.68	1 128 424.41	2 134 976.93	0.00	0.00	21 505 680.07
Quarry Area 1	2 330 397.75	16 051 543.70	35 798.87	1 107 729.03	1 131 133.72	2 134 976.93	0.00	0.00	22 791 580.00
Marketing and Sales	0.00	0.00	0.00	0.00	0.00	0.00	3 601 849.02	0.00	3 601 849.02
Business Management	0.00	1 556 160.75	2 643 666.86	270 171.65	0.00	129 392.54	0.00	23 242 952.58	27 842 344.38
Total	10 579 544.50	95 241 972.23	2 730 167.52	8 283 665.10	6 773 255.79	12 939 254.15	3 601 849.02	23 242 952.58	163 392 660.89

Table 12: Factors For Activities of the Coal Enterprise

Activities	Activity Factors
Quarry Area 1	Produced Ton
Quarry Area 1	Produced Ton
Quarry Area 1	Produced Ton
Quarry Area 1	Produced Ton
Quarry Area 1	Produced Ton
Quarry Area 1	Produced Ton
Marketing and Sales	Sold Ton
Business Management	Sold Ton

Table 13: Data For Activity Factors On the Basis Of Products

Activities	Product A	Product B	Product C	Total Productin	Total Sold
Quarry Area 1	92 810	19 742	213 401	325 953	-
Quarry Area 2	92 810	19 742	213 401	325 953	-
Quarry Area 3	92 810	19 742	213 401	325 953	-
Quarry Area 4	92 810	19 742	213 401	325 953	-
Quarry Area 5	92 810	19 742	213 401	325 953	-
Quarry Area 6	92 810	19 742	213 401	325 953	-
Marketing and Sales	92 810	19 742	213 401	-	316 258
Business Management	92 810	19 742	213 401	-	316 258

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When we look at Table 14, total of costs at Pit 1 activity center is 23 636 098.21 ₺, and the cost factor to be used in distribution is the produced ton. Total amount of production for the manufactured A, B and C products is 325 923 tons. Total of costs at Pit 2 activity center is 21 793 900.12 ₺, and the cost factor to be used in distribution is the produced ton. Total amount of production for the manufactured A, B and C products is 325 923 tons. Total of costs at Pit 3 activity center is 21 629 599.97 ₺, and the cost factor to be used in distribution is the produced ton. Total amount of production for the manufactured A, B and C products is 325 923 tons. Total of costs at Pit 4 activity center is 20 591 609.12, and the cost factor to be used in distribution is the produced ton. Total amount of production for the manufactured A, B and C products is 325 923 tons. Total of costs at Pit 5 activity center is 21 505 680.07 ₺, and the cost factor to be used in distribution is the produced ton. Total amount of production for the manufactured A, B and C products is 325 923 tons. Total of costs at Pit 6 activity center is 22 791 580.00 ₺, and the cost factor to be used in distribution is the produced ton. Total amount of production for the manufactured A, B and C products is 325 923 tons. Cost factor calculation for this activity center is as follows.

Table 14: Distribution of Activity Expenses to Products

Unit	Products	Produced Ton	Unit Expense Criterion (UEC)	Total (₺)	Measuring UEC
Quarry Area 1	Product A	92 810.00	72.51	6 730 007.93	23 636 098.21 / 325 953 = 72.51
	Product B	19 742.00	72.51	1 431 567.90	
	Product C	213 401.00	72.51	15 474 522.39	
	Total	325 953.00		23 636 098.21	
Quarry Area 2	Product A	92 810.00	66.86	6 205 470.94	21 793 900.12 / 325 953 = 66.86
	Product B	19 742.00	66.86	1 319 991.46	
	Product C	213 401.00	66.86	14 268 437.72	
	Total	325 953.00		21 793 900.12	
Quarry Area 3	Product A	92 810.00	66.36	6 158 689.05	21 629 599.97 / 325 953 = 66.36
	Product B	19 742.00	66.36	1 310 040.29	
	Product C	213 401.00	66.36	14 160 870.63	
	Total	325 953.00		21 629 599.97	
Quarry Area 4	Product A	92 810.00	63.17	5 863 137.45	20 591 609.12 / 325 953 = 63.17
	Product B	19 742.00	63.17	1 247 172.28	
	Product C	213 401.00	63.17	13 481 299.38	
	Total	325 953.00		20 591 609.12	
Quarry Area 5	Product A	92 810.00	65.98	6 123 404.81	21 505 680.07 / 325 953 = 65.98
	Product B	19 742.00	65.98	1 302 534.83	
	Product C	213 401.00	65.98	14 079 740.43	
	Total	325 953.00		21 505 680.07	
Quarry Area 6	Product A	92 810.00	69.92	6 489 544.63	22 791 580.00 / 325 953 = 69.92
	Product B	19 742.00	69.92	1 380 417.95	
	Product C	213 401.00	69.92	14 921 580.00	
	Total	325 953.00		22 791 580.00	

When we look at Table 15, we see that total costs at Sales and Marketing activity center is 3 601 849.02 ₺, and the cost factor to be used in distribution is the sold ton. Total amount of sales for the manufactured A, B and C products is 316258 tons. Total cost at Business Administration activity center is 27 842 344.38 ₺, and the cost factor to be used in distribution is the sold ton. Total amount of sales for the manufactured A, B and C products is 316 258 tons.

Table 15: Distribution of Activity Expenses in Sales-Marketing and Management Units to Products

Unit	Products	Sold Ton	Unit Expense Criterion (UEC)	Total (₺)	Measuring UEC
Marketing and Sales	Product A	92 810.00	11.39	1 057 009.17	3 601 849.02 / 316 258 = 11.39
	Product B	14 118.00	11.39	160 789.31	
	Product C	209 330.00	11.39	2 384 050.54	
	Total	316 258.00		3 601 849.02	
Business Management	Product A	92 810.00	88.04	8 170 696.02	27 842 344.38 / 316 258 = 88.04
	Product B	14 118.00	88.04	1 242 903.64	
	Product C	209 330.00	88.04	18 428 744.73	
	Total	316 258.00		27 842 344.38	

When we look at Table 16, we see that the second stage cost charging was made and total costs of product costs are presented.

Table 16: Total Presentation of Product Costs (₺)

Collective Display of Product Cost				
Activities	Product A	Product B	Product C	Total
Quarry Area 1	6 730 007.93	1 431 567.90	15 474 522.39	23 636 098.21
Quarry Area 2	6 205 470.94	1 319 991.46	14 268 437.72	21 793 900.12
Quarry Area 3	6 158 689.05	1 310 040.29	14 160 870.63	21 629 599.27
Quarry Area 4	5 863 137.45	1 247 172.28	13 481 299.38	20 591 609.12
Quarry Area 5	6 123 404.81	1 302 534.83	14 079 740.43	21 505 680.07
Quarry Area 6	6 489 544.63	1 380 417.95	14 921 617.42	22 791 580.00
Marketing and Sales	1 057 009.17	160 789.31	2 384 050.54	3 601 849.02
Business Management	8 170 696.02	1 242 903.64	18 428 744.73	27 842 344.38
Total	46 797 960.01	9 395 417.65	107 199 283.23	163 392 660.89

- Presentation of Total Costs For Products Calculated According to ABCS

It is possible to show the total presentation of product costs as in Table 17, which are calculated according to ABCS. As seen in Table 17, it can be observed that product C has the most share of cost among the product costs calculated according to ABC system while product B has the least. Accordingly, it is possible to sort the products as C, A and B from having the most share of cost to the least one. In terms of their share of costs, product A has 29% of the total cost while product B has 6% thereof and product C has 65%.

Table 17: Total costs For Products Calculated According To ABCS (₺)

Costs	Product A	Product B	Product C	Total
Direct	3 365 814.89	715 956.44	7 739 125.78	11 820 897.11
Indirect	46 797 960.01	9 395 417.65	107 199 283.23	163 392 660.89
Total	50 163 774.90	10 111 374.10	114 938 409.01	175 213 558.00

- Presentation of Total Costs For Products Calculated According to Traditional Costing System

Product costs which are calculated according to traditional costing system shall provide convenience in analyzing product costs in both costing systems. In this direction, according to information obtained from the coal enterprise, it is possible to present product costs which the enterprise calculated according to traditional costing system as in Table 18.

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Table 18: Total Costs of the Products Calculated According to Traditional Costing System (₺)

Costs	Product A	Product B	Product C	Total
Direct	3 365 814.89	715 956.44	7 739 125.78	11 820 897.11
Indirect	38 351 544.55	8 157 916.09	88 182 932.43	134 692 393.07
Total	41 717 359.44	8 873 872.53	95 922 058.21	146 513 290.18

As can be seen in Table 18, it can be observed that product C has the most share of cost among the product costs calculated according to traditional costing system while product B has the least. Accordingly, it is possible to sort the products as C, A and B from having the most share of cost to the least one.

Conclusion

Changes experienced in today's business management sense have increased the efforts to calculate the costs more accurately and provide more cost control. Utilization of cost focused production techniques in enterprises and focusing on the quality of process in the context of continuous improvement has lead the costs to be discussed within a system. Since costs can be calculated more accurately with ABC system and it provides an insight to executives in their decisions, this system has come into prominence today. ABC system allows activities and thus activity costs to be made out better in production enterprises. With this purpose, the ABC system was applied in a coal enterprise and within the frame of obtained results, it was determined that there were differences between in two costing systems. Due to not including the cost share of sales, marketing and general administrative expenses into the product costs calculated in the enterprise of application, product costs were lower in traditional costing system compared to ABC system. The most important reason for that is in the accounting system applied in our country, operating expenses are considered as a non-production expense even if included in that production period and transferred to nominal account instead of stock account. In fact, amount of product costs calculated according to ABC cystem should be included in stock account and then the cost expenses of sold products should be transferred to nominal account.

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An Audio Data Encryption with Single and Double Dimension Discrete-Time Chaotic Systems

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Abstract— In this article, a study on increasing security of audio data encryption with single and double dimension discrete-time chaotic systems was carried out and application and security analyses were executed. Audio data samples of both mono and stereo types were encrypted. In the application here, single and double dimension discrete-time chaotic systems were used. In order to enhance security during encryption, a different method was applied by also using a non-linear function. In the chaos based application realized with the method developed, analyses results were achieved with common security analyses such as key space, key sensitivity, chaos effect and histogram. Several examinations on the safety of chaotic systems in the application were carried out with these analyses results.
Key words— Audio Data Encryption, Chaos Based Encryption, Information Security, Security Analyses

Introduction

A safe communication is one of the most significant needs of our era. Many studies on hiding data types like text, audio, image and so on have been carried out in order to meet such need. In this article, a study on increasing the security of audio data has been executed. Many studies on audio data encryption have appeared in the literature so far (Gopalan et al., 2012, Chang et al., 2003, Chen et al., 2007, Dipu & Alam, 2007). Some of these included directly hiding audio files while others included methods of hiding the information by embedding some other data in the audio files. The general objective of all these studies is to prevent the possession of data by undesired people. Today, telephone conversations and conversations in any other place can easily be monitored with the help of some certain technological devices. It has become a necessity to take many security precautions to protect such information. Although people try to protect data by encrypting, it is generally accepted that they can still be decrypted in a certain amount of time with some techniques. Factors like the complexity of the encrypted data and algorithms used during encryption have become important in encryption. Contrary to recently used standard encryption algorithms, number of studies with chaotic systems has starting increasing. Chaotic systems have become more popular in encryption as they can successfully maintain infusion and diffusion, the basic components of encryption, by providing complexity with activities like noise and being sensitive to primary conditions.

There are numerous encryption and signal hiding studies in the literature used with the chaos technique. In some of their studies about signal hiding, Pehlivan and his colleagues employed masking technique that included adding information signals to chaotic signals (Pehlivan & Uyaroglu, 2007, Cicek et al., 2013, Pehlivan & Wei, 2012, Pehlivan & Uyaroglu, 2012). Sakthidasan and Santhosh; carried out encryption with chaos by mixing original data and data from chaotic system (Sakthidasan & Santhosh, 2011). Oğraş and Türk achieved encryption by making use of a non-linear function. (Ogras & Turk, 2012). To decrypt data which has been encrypted this way, one needs to know the non-linear function and all the parameters in it. By combining chaotic system based and non-chaotic encryption algorithms, Fındık performed text encryption (Fındık, 2004). In real environment applications, since image, video, audio and such data are big in size, encryption with such method is disadvantageous in terms of speed. Yardım and Afacan carried out some studies on timing in encryption and decryption by applying delay and switching on chaotic signal data (Yardim & Afacan, 2010). In order to decrypt data encrypted this way, one needs to know which data has been encrypted when and in which order. Any mistake will hinder the decryption of the encrypted data. Sohby and Shehata achieved chaos based encryption by adding the data to be encrypted to the Lorenz system (Sobhy & Shehata, 2001).

There are many few studies on hiding audio data by using chaotic systems. Abdulkareem and Abduljaleel developed a new encryption method by using single dimension chaos generator and non-chaotic encryption method Blowfish algorithm and combining audio data with chaos and non-chaos algorithm (Maysaa & Iman, 2013). Zhang and Min developed a non-symmetrical numerical encryption algorithm for audio communication and also made the security analyses of their system (Zhangx, 2005). Gnanajeyaraman and his colleagues carried

out audio encryption studies by employing multiple dimension chaotic system for safer communication (Gnanajeyaraman et al., 2009). Prabu and his colleagues carried out an audio encryption study with single dimension discrete chaotic Logistic Map system and realized a real time application (Prabu et al., 2012). Ganesan and his colleagues' audio encryption study included a simple double dimension chaotic system (Ganesan et al., 2006).

In this study, chaos based encryption applications were done for the safe transmission of mono and stereo audio data. Single and double dimension discrete chaotic systems, which have a simple structure and are very affective for encryption, were preferred. Key space, key sensitivity, chaos effect and histogram analyses about the success of the encryption procedures were performed with MATLAB programme. Codes written with Matlab is convertible to C/C++ codes and codes can be gathered and run in other environments without Matlab being installed, which are two important advantages of Matlab.

The second part of the article includes information about single and double dimension discrete chaotic systems used in chaos based encryption applications. In part 3, application method was explained and realized. In part 4, security analyses were performed. The last part covers the results and evaluations.

Discrete-Time Chaotic Systems Used In Encryption Applications

Single dimension Logistic Map and double dimension Arnold's Cat Map chaotic systems, which are very common in the literature, were used in this study.

Logistic Map

Logistic Map is a very commonly used single dimension chaotic system. Figure 1 exhibits bifurcation diagram that shows at which intervals Logistic Map enters chaos. r parameter was examined between 0-4 values. Bifurcation diagram in Figure 1 shows that r value must be chosen 3.5699-4 so that the system can enter chaos. Otherwise, the system will not enter chaos and keys necessary for encryption will not be produced and thus chaotic encryption will not be possible.

$$Xn + 1 = r * Xn * (1 - Xn) \quad (1)$$

X value represents the system variable, and r represents the system parameter in Equation 2. n value is changeable according to the data to be encrypted. Value of n depends on how many bits of data will be encrypted.

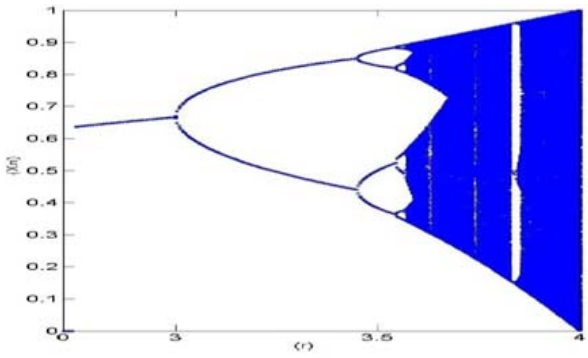

Figure 1: Logistic Map bifurcation diagram

Arnold's Cat Map

Another chaotic system utilized for encryption in this study is Arnold's Cat Map. Arnold's Cat Map is a double dimension chaotic system, therefore it is represented by two different equations in Equation 3 and 4 below.

$$Xn + 1 = Xn + Yn \pmod 1 \quad (2)$$

$$Yn + 1 = Xn + k * Yn \pmod 1 \quad (3)$$

x and y variables in Equation 3 and 4 are the system variables like in Logistic Map and n value is the number of repetition. k value is the system parameter. x(0) and y(0) initial values must be defined so that the encryption with Arnold's Cat Map can be started.

Chaos Based Encryption Application And Security Analyses

Method

A non-linear equation was used in order to increase security in encryption. One needs to know a and b parameters and also know what kind of equation was used in order to decrypt data encrypted with the function in Equation 5. "x" value in the function represents the keys produced with chaos generators and "m" value represents the audio data to be encrypted in bits.

$$f(x,m) = \frac{2x(1 + xm + (1 - m)) + a}{b} \quad (4)$$

In this study, a parameter is 0.9 and b parameter is 4.8. Choosing an appropriate value range for equation and parameters is necessary for achieving a chaos based encryption. When certain limits are exceeded, the system will get out of chaos and thus chaos based encryption will not be achieved.

Figure 2 exhibits the general block diagram of encryption application for safe transmission of any audio data. As can be seen on the block diagram, audio data and keys produced with chaotic systems are encrypted with the help of a function. Data encrypted later in the block diagram can be decrypted with the inverse of the function. In order to decrypt audio data encrypted in the application in this figure, one needs to know keys produced for each bit (46000 keys for 46000 bits of audio data) and the order of these keys, the chaotic system used, parameters in the chaotic system and initial values, and also non-linear equation and all parameters employed in this equation. Otherwise, it will not be possible to decrypt the encrypted data.

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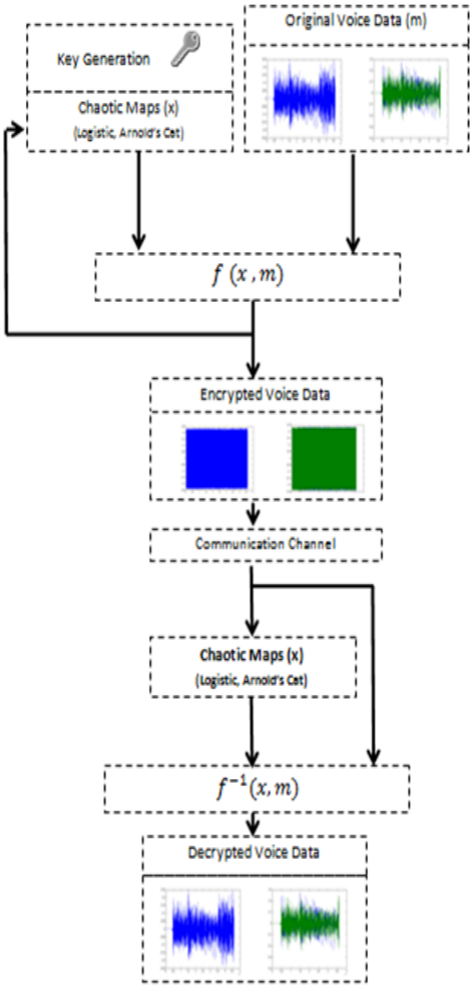

Figure 2: Block Diagram of Encryption and Decryption Audio Data

Encryption Applications on Mono and Stereo Audio Data

Figure 3 and 4 show 46000 bits mono and stereo audio data to be encrypted. Although green signal seems dominant in stereo audio data in Figure 4, in fact there are two separate signals as green and blue.

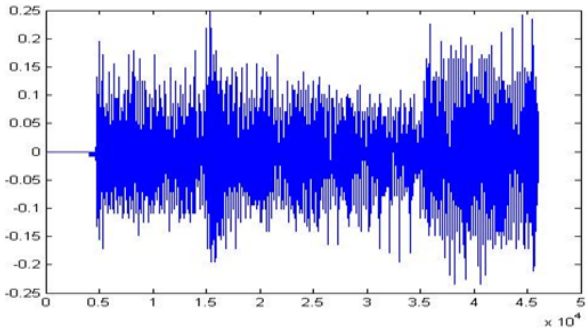

Figure 3: Mono Original Audio Data

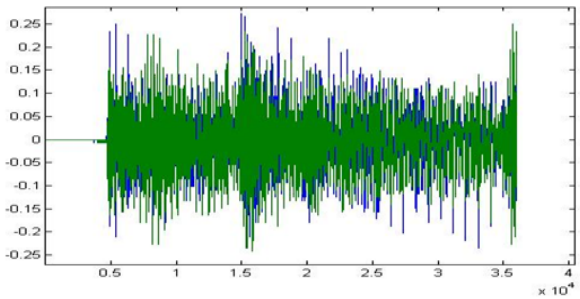

Figure 4: Stereo Original Audio Data

Original mono and stereo audio data in Figure 3 and 4 were encrypted by using two different chaotic systems, as explained in Part 3.1. As for chaotic systems, discrete-time single dimension Logistic Map and discrete-time double dimension Arnold's Cat Map, which are both very common in the literature, were utilized. Encrypted audio data from the encryption done with Logistic Map is as shown in Figure 5 and 6.

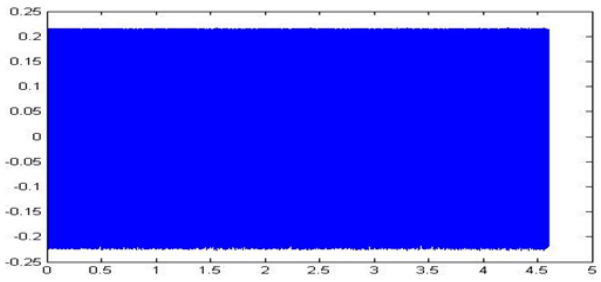

Figure 5: Mono audio data encrypted with Logistic Map

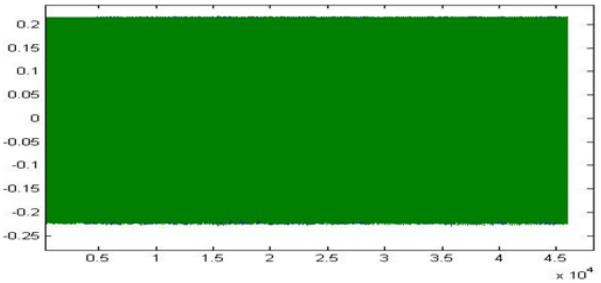

Figure 6: Stereo audio data encrypted with Logistic Map

Figure 7 and 8 exhibit audio data encrypted with Arnold's Cat Map chaotic system. In the encryption of stereo audio data by Logistic Map and Arnold's Cat Map, green audio data is dominant in encrypted data, yet at the background there is also very little blue encrypted audio data in Figure 8.

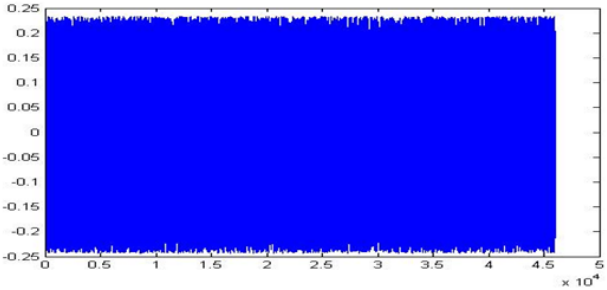

Figure 7: Mono audio data encrypted with Arnold's Cat Map

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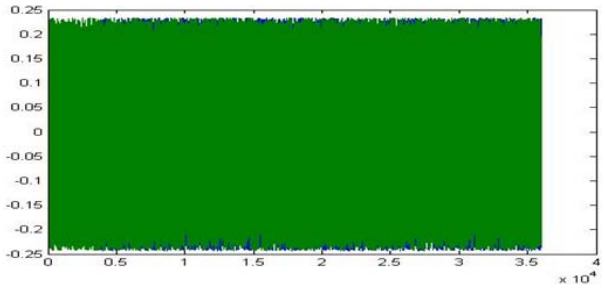

Figure 8: Stereo audio data encrypted with Arnold's Cat Map

Figure 9 and 10 show decrypted audio data obtained from the decryption process which was performed as explained on the block diagram in part 3.1. There was no corruption in the audio data, which proves that both encryption and decryption processes were performed successfully.

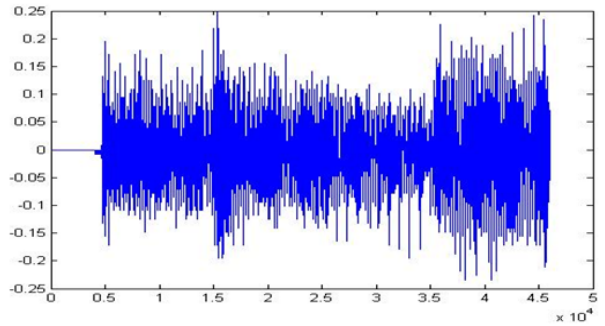

Figure 9: Decrypted mono audio data

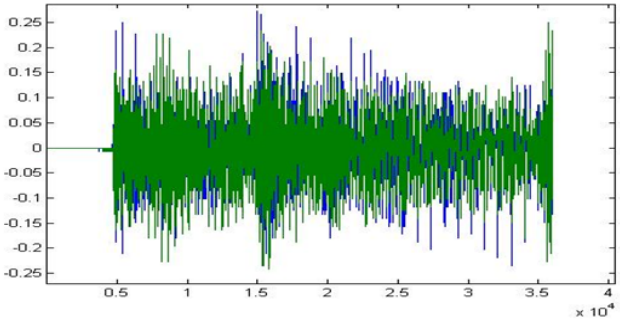

Figure 10: Decrypted stereo audio data

Security Analyses of Encryption Applications

Encryption processes may have been performed successfully. Yet, security analyses must be carried out in order to assess the reliability of encryption processes. Encrypted data with disappointing results in security analyses will not be preferred as they are so vulnerable to be decrypted. Key space analysis, key sensitivity analysis, chaos effect and histogram were performed in order to compare the chaotic systems utilized in this study.

Key Space Analysis

Key space needs to be large enough to prevent strong attacks. As size and other variables increase in chaotic systems, key space increases, too. When there is only one variable, key space can have 10^{14} different values. For instance, in a three dimension chaotic system with just one variable, total key space will be 10^{56} as initial conditions can be 10^{42} because of the size and 10^{14} because of the parameter. In such an application, key spaces

will vary due to size, depending on Logistic Map or Arnold's Cat Map chaotic system. Key space for Logistic Map is 10^{28}, according to r parameter and x(0) initial value. Key space for Arnold's Cat Map is 10^{42} according to k parameter, x(0) and y(0) initial values. Based on these results, it can be concluded that a encryption with Arnold's Cat Map will be more reliable than the one with Logistic Map.

Key Sensitivity Analysis

While encrypted data is being decrypted, a small change in the key leads to different results during the decryption. In a safe encryption, a very small change in keys must prevent attacks. This shows why chaos encryption is so important. Change in one of the keys directly affects the result; in other words, encrypted data can not be decrypted even if only one key has been changed. One needs to know all the keys to decrypt the encrypted data because different keys are produced for each data. It is also necessary to know the order of the keys. Knowing all the keys will not suffice because if the decryption does not happen in the correct order, the data cannot be decrypted. In some studies, more than one audio data or other data are processed for encryption. Therefore, sensitivity may increase as a result of a small change in any data since other data are included in encryption. Decrypted data is what counts as the result in analysis. If any small change prevents obtaining the original data, analysis result is successful. For instance, during the decryption of encrypted mono audio data from Arnold's Cat Map in Figure 7, data on the 10000th bit was changed and as a result of this change, corrupted signal was obtained as in Figure 11.

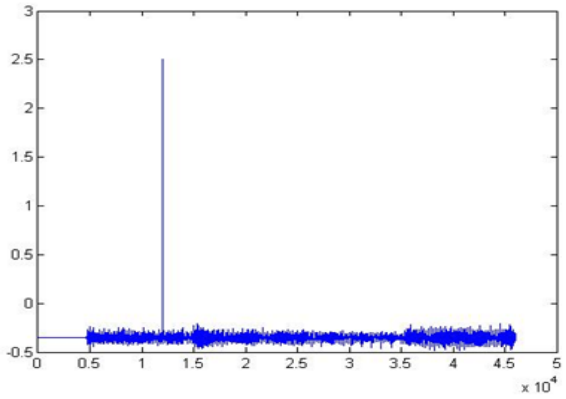

Figure 11: Corrupted audio data as a result of changing a bit while mono audio data was being decrypted.

Chaos Effect (Encryption Effect Analysis)

The effect of chaos during encryption is called chaos effect. Examining encrypted audio data to see chaos effect in application, one can observe that encryption was performed in a very complex way with both systems. Audio data seemed dominant at all intervals and also very dominant sounds were obtained when encrypted audio data was listened to. It will not be easy for cryptanalysts to decrypt data encrypted with chaotic systems because encrypted audio data are very complex.

Histogram Analysis

Distributions of data values in a system comprise the histogram. Histogram analyses can be made by examining data distributions in many different fields. In encryption practices, if the distributions of numbers that represent encrypted data are close, this means encryption has been performed well. The closer the data distributions are, the more difficult it will be to decrypt the encrypted data.

Examining the histogram diagrams of mono audio data in Figure 12. a) and b), one can see that the distribution by Arnold's Cat Map in Figure 12.b) is much better than the one by Logistic Map in Figure 12.a). Therefore, it can be concluded that encryption with Arnold's Cat Map is better than encryption with Logistic Map and that it will be more difficult to decrypt data encrypted with Arnold's Cat Map.

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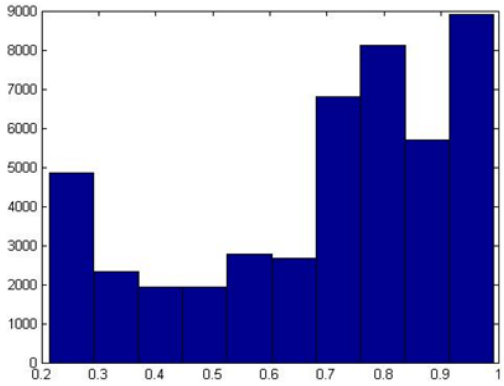
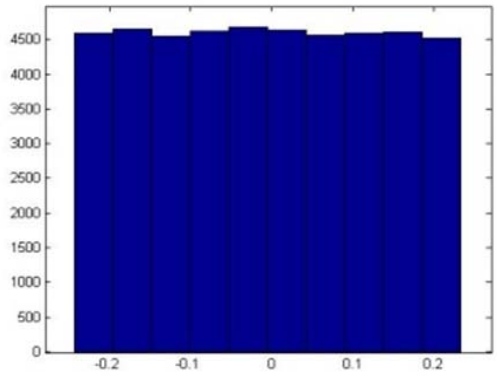


a)



b)

Figure 12: Histogram Diagrams for Mono Audio Data **a)** Logistic Map **b)** Arnold's Cat Map

Figure 13 and 14 show the histogram diagrams of stereo audio data encrypted with Logistic Map and Arnold's Cat Map, respectively. Since stereo audio data have two different signals, two different histogram diagrams were included here. Not only for mono audio data but also for stereo audio data, histogram distributions in encryption with Arnold's Cat chaotic system are much better for both signals (blue and green).

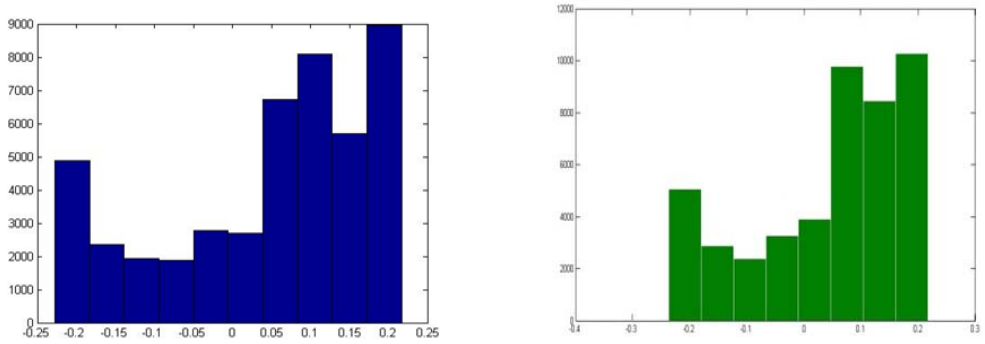


Figure 13: Histogram Diagrams of stereo audio data encrypted with Logistic Map

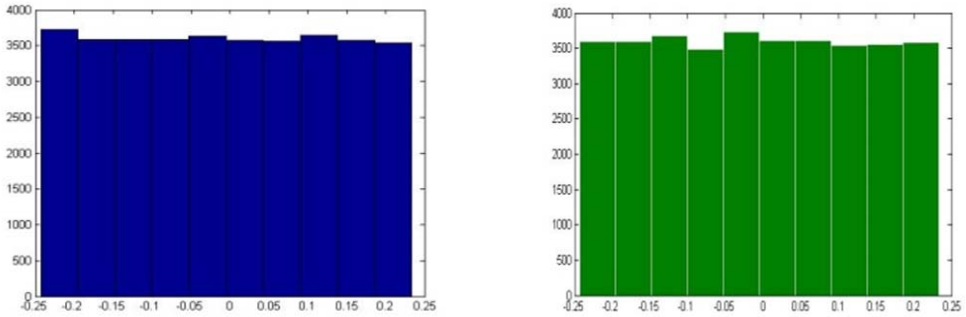


Figure 14:. Histogram Diagrams of stereo audio data encrypted with Arnold's Cat Map

Results and Evaluation

Safe communication is one of the many areas of application of chaotic systems. In this article, two different discrete-time chaotic systems were used to increase security of audio data and security analyses were executed. In order to decrypt the encrypted data in chaos based encryption applied here, one needs to know which chaotic systems were used, keys produced and their order, all parameters and initial values in chaotic systems, the non-linear equation used and all parameters belonging to this equation. Because of any mistake during the decryption of the encrypted data, such as changing even just one key data (as seen in key sensitivity analysis), encrypted data can not be decrypted and the original audio data can not be retained.

Based on the key space and histogram analysis, it is clear that double dimension Arnold's Cat Map can provide safer encryption than single dimension Logistic Map. As Part 4.1 explains, key space of double dimension Arnold's Cat Map chaotic system is larger than that of single dimension Logistic Map. As the histogram analysis in Part 4.4 shows, Arnold's Cat Map has a much better distribution and is better than Logistic Map and thus decryption the data will be more difficult.

When security analysis results for a encryption application on a chaotic system are better than that of another system, other analyses reveal similar results. For example, Arnold's Cat Map chaotic system in this study showed better histogram analysis results, and it also showed better results in all analyses. Since software necessary for the chaos based encryption method used here take up very small ram space, excluding audio data, (1KB for mono, 2KB for stereo), it will be more advantageous to use them in real environment applications. Moreover, this study was encrypted in Matlab, codes can be converted to C/C++ and codes can be gathered and be run in other environments without Matlab being installed, which are other advantages of this application.

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Business in Sustainability – a European Perspective

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Abstract: Modern business consumes most of the world's nonrenewable resources – it is to a considerable extent responsible for environmental pollution and contributes to deepening of some social pathologies. Increasing global ecological and social problems deteriorate the health of the Earth, threatening the existence of future generations. The response to these adverse trends is sustainable business - a new current, developing in the world in the field of sustainable science. In the paper the authors present their own model conception of business in sustainability. A special feature of this conception is moving sustainability from peripheries of business to its centre – replacement of unsustainable resources and activities with their sustainable equivalents. The authors also discuss the necessity for creation of such conceptions and barriers to their implementation in business practice. The ideas presented in the paper have been set in the realities of the European Union, which has significant achievements in sustainable development.

Key words: sustainable development, sustainable business, sustainable enterprise

Introduction

Business should keep up with changes taking place in the world. One of the most important changes of the global nature is the deteriorating health of our planet, which is the consequence of the accelerated pace of the civilization development. The development of mankind is accompanied by growing economic and social problems and in consequence a high degree of unsustainability confirmed by the indicators presented in the Living Planet Report 2012 (Switzerland 2013). For the most part it is business, and in particular manufacturing enterprises, that are responsible for this unsustainability. Concern for future generations changes priorities of business. Ecological and social objectives become as important as economic goals. High degree of unsustainability of the system of human development forces traditional business to transform into sustainable business. To make such a transformation possible, definite sustainable business conceptions and models are indispensable. Meanwhile, in this field mainly fragmentary solutions are to be found in the literature. Some authors deal with sustainable/sustainability management e.g. (Cohen, 2011), (Haugan, 2013), (Bossink, 2012). Other scholars concentrate on sustainable/sustainability marketing, e.g. (Belz, Peattie, 2010), (Leitner, 2010), (Martin, Schouten, 2012), (Kadirov, 2010). Another field of study is s*ustainable logistics and supply chain management*, e.g. (Grant, 2013), (Morana, 2013), (Howard, 2014), (Lindgreen, 2013). The above examples do not exhaust all spheres of business to which sustainability principles are applied. Another shortcoming of the solutions presented in the literature is their focus only on selected business sectors or selected sphere of sustainability.

The paper demonstrates the necessity of search for complex solutions in sustainable business pointing out to some determinants of pursuance of such activity in the European Union. Furthermore, the authors' own model conception of business in sustainability has been presented, taking into account its most important components. An important characteristic of this conception is the transfer of sustainability from the peripheries of business to its centre – replacement of unsustainable resources and activities with their sustainable equivalents.

Background

Sustainable development efforts undertaken for many years have not improved significantly the health of our planet. Growing ecological and social threats are confirmed by the Living Planet Report 2012. An analysis of the data presented in the Report led to the following conclusion: „clearly, the current system of human development, based on increased consumption and a reliance on fossil fuels, combined with a growing human population and poor overall management and governance of natural resources, is unsustainable" (Living Planet Report 2012, p. 10). The degree of this unsustainability is well reflected by Table 1.

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Table 1: State of the Earth's unsustainability

Areas	Indices
Biodiversity has declined globally	The global Living Planet Index declined by almost 30 per cent between 1970 and 2008. The global tropical index declined by 60 per cent during the same period. The global temperate index increased by 31 per cent – however this disguises huge historical losses prior to 1970. The global terrestrial, freshwater and marine indices all declined (freshwater index by 37 per cent) The tropical freshwater index declined by 70 per cent.
Human demands on the planet exceed supply	Humanity's Ecological Footprint exceeded the Earth's biocapacity by more than 50 per cent in 2008. The carbon footprint is a significant component of this ecological overshoot. Biocapacity per person decreased from 3,2 global hectares (gha) in 1961 to 1,8 gha per capita in 2008.
Many river basins experience water scarcity	Examining scarcity on a monthly basis reveals many river basins that seem to have sufficient supplies based on annual averages are actually overexploited, hampering critical ecosystem functions. 2,7 billion people around the world live in catchments that experience severe water scarcity for at least one month a year.

Source: (Living Planet Report 2012, p. 12)

The ever increasing unsustainability leads to surpassing of the tolerance limits of nature and uncontrolled growth of social problems, in consequence of which future generations will to a considerable extent be deprived of chances for development – as the Earth is an isolated system, powered from outside only by solar energy and in future this system will be unable to carry the burdens created by man (Pabian, 2013a, p. 3). Therefore, one of the greatest challenges for the present generation is to transform contemporary consumer societies into sustainable societies, based on sustainable production and consumption (Pabian, Bylok, Rajczyk, Rajczyk, 2012, pp. 299-300).

The European Union took up this challenge going down the road of sustainable development. The current strategy of sustainable development of the European Union is set forth in the document called *Europe 2020.* It was adopted by the European Council on 17th June, 2010. The *Europe 2020* strategy is based on the following three priorities: smart growth, sustainable growth and inclusive growth. The basic instruments of implementation of the *Europe 2020* strategy on the Member States' level are the so-called National Reform Programmes (Ministry of Economy, 2012, p. 53). Table 2 shows figures of the significant indicators related to this strategy and their targets.

Table 2: Indicators of the Europe 2020 strategy for smart, sustainable and inclusive growth

EU-28		**2005**	**2011**	**2012**	**Target**
Employment	Employment rate (percent of population aged 20-64)	67,9	68,5	68,4	75
EU-28		**2005**	**2010**	**2011**	**Target**
R&D	Gross domestic expenditure on R&D (percent of GDB)	1,82	2,00	2,02	3
EU-27		**2005**	**2010**	**2011**	**Target**
Climate change/energy	Greenhouse gas emissions (index 1990 = 100)	93	86	83	80
	Renewables in gross final energy consumption (%)	8,5	12,5	13,0	20
	Primary energy consumption (million tonnes of oil equivalent)	1703	1645	1583	1474
EU-27		**2005**	**2011**	**2012**	**Target**
Education	Early leavers from education and training (percent of population aged 18-24)	15,8	13,4	12,7	less than 10
	Tertiary educational attainment (percent of population aged 30-34)	28,0	34,6	35,8	40 or more than 40
EU-27		**2005**	**2011**	**2012**	**Target**
Poverty or social exclusion	People at risk of poverty or social exclusion (million)	123,9	119,8	124,4	95,7

Source: (Basic figures on the EU, Winter 2013/2014 edition)

As shown in Table 2, the European Union has adopted ambitious targets in respect of sustainable development and has been successful in this sphere. The successes are proved by positive values of most of the indicators in the years 2005 – 2012. The ambitious aims are reflected by the figures in the Target column, which the European Union intends to achieve by 2020.

Entrepreneurship can contribute to sustainable development to a much greater extent than they do now. "Produce better" is one of the most important recommendations given to entrepreneurs: significantly reduce inputs and waste in production systems, manage resources sustainably, scale-up renewable energy production (Living Planet Report 2012, p. 107).

Business in sustainability conception seeks to achieve not only economic but also social and ecological goals. Preferences with regard to these goals can be different. According to Poles, enterprises should support the following most important social and ecological goals (Mirońska, Zaborek, 2014, p. 37):

- fight against hunger and poverty – 61% responses,
- helping the chronically ill – 83%,
- helping animals – 53%,
- fight against social pathologies – 48%.

Results of the surveys show that taking social and ecological goals into consideration in business can be beneficial for an entrepreneur. Many consumers are willing to pay more for a product which supports such goals. The percentage of this type of consumers in the selected countries of the European Union is as follows: Germany – 35%, Italy – 34%, France – 30%, the Netherlands – 30%, Belgium – 29%, Great Britain – 28%, Poland – 13%. In some non-European countries this percentage is much higher e.g. China – 80%, India – 71%, U.S.A. – 39% (Mirońska, Zaborek, 2014, s. 35).

Business in sustainability conception fits into the framework of the European entrepreneurship, whose condition has been presented in Table 3.

Table 3: Condition of entrepreneurship in selected EU countries (%)

Description		Austria	France	Germany	Poland	Romania	Sweden	Hungary
Sectors in which businesses are set up	Mineral extraction	1,6	5,3	0,8	6,7	17,7	9,5	12,2
	Manufacturing	11,4	17,2	14,8	41,3	21,2	14,1	26,2
	B2B services	40,1	33,4	30,5	18,1	17,3	38,2	23,4
	B2C services	46,8	44,1	54,0	33,9	43,9	38,1	38,2
Fear of failure		43,5	46,7	49,0	58,7	45,1	38,9	45,9
Motives for starting a business	To improve standard of life	38,2	58,9	50,7	30,1	37,7	48,6	35,3
	Necessity	10,8	18,1	21,7	40,7	24,2	6,8	31,1
New businesses' growth aspirations	At least 5 new jobs within 5 years	13,0	25,5	25,9	29,8	48,6	16,6	33,5
	At least 10 new jobs and employment growth by at least 50% within 5 years	7,6	21,9	21,7	15,6	35,6	9,7	22,6

Source: (Global Entrepreneurship Monitor – Poland 2012, pp. 13-14, 24, 21-22, 25-26)

The structure of European entrepreneurship is dominated by production, B2B and B2C services, which are the economy sectors where business in sustainability should be implemented in the first place. Mineral extraction should be systematically reduced, and such materials and technological solutions should be sought that will make minerals unnecessary thus leading to cessation of mineral extraction e.g. by substituting traditional energy sources with energy from renewable sources. More than half of entrepreneurs in most of the countries presented in Table 3 are not afraid of failure in business. Such attitudes foster sustainable business projects. High aspirations of entrepreneurs have an influence on the rate of development of this type of projects.

Conception of the European business in sustainability

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According to the authors of this paper, business in sustainability is an ordered set of actions and things, the functioning and output of which in the form of particular products and services are in conformity with the principles of sustainable development. The idea of business in sustainability has been show in Figure 1:

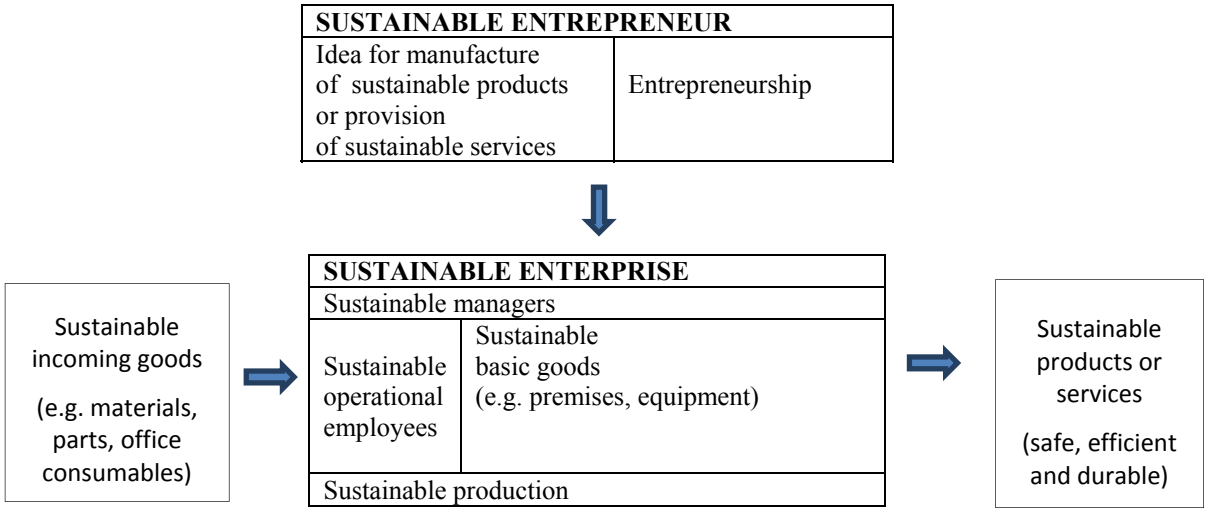

Figure 1: A concept of business in sustainability

In the suggested approach the starting point for business in sustainability is an idea for manufacture of sustainable products or provision of sustainable services. These products and services are people and environment friendly. Sustainable products are not only safe and efficient but also durable. Durability fosters protection of man's natural environment because it reduces demand for products, which results in reduction of their production volume and hence, also in reduction of factors having a negative impact on the environment, and caused by the said production.

People and organizations initiating sustainable business projects should understand and support the ideas of sustainable development. Their ecological and social sensitivity is reflected by the following characteristics (Cohen, 2011, pp. 1-19, pp. 132-158), (Pabian, Bylok, Kucęba, Zawada, 2013, p. 7):

- they want to take responsibility for the health of Earth,
- they act for the benefit of future generations, so that they are able not only to survive, but also to develop,
- they focus on future (also very distant),
- they make efforts to achieve economic, environmental and social goals,
- they value sustainability (also in production, consumption and sales) much more than economic growth,
- they control the environmental and human effects of their organisation,
- they minimise negative impact of their organisation on the planet,
- they develop products, services and technologies in line with the rules of sustainable development.

An idea for sustainable business itself is not enough. In order to execute the planned project it is necessary to create an appropriate action structure, gather the necessary resources and set everything in motion assuming the form of production of material goods or services. Hence, there is a need for entrepreneurship understood in the aspects of action as a high degree of activity, dynamism in action, pursuance of the adopted goals. Thanks to the entrepreneurship understood in this way the idea for sustainable business will be put in practice.

Sustainable business can be carried out within a newly established or already existing enterprise. As shown in Figure 1 a sustainable enterprise is an organization whose resources and operation have a sustainable character (contribute to sustainable development). Sustainable human resources and sustainable basic goods i.e. buildings, machinery, equipment, fittings and other tangible goods owned by the enterprise rank among the most important resources of a sustainable enterprise. Sustainable human resources are ecologically and socially sensitive employees of the organization, observing the principles of sustainable development in their work. Among them there are sustainable managers (top managers, middle level managers, supervisory managers) and sustainable operational employees. A characteristic feature of sustainable employees is their triple orientation – focus on their own needs as well as on social and ecological needs of the present and future generations.

Buildings and other enclosed structures owned by a sustainable enterprise have been designed, located and erected according to the sustainable development principles. They are environment friendly and do not cause any social harm. Use of those buildings and structures requires consumption of small amount of energy coming from renewable sources. For example, solar collectors and solar cells convert solar radiation into heat used to heat water and rooms (solar thermal energy – STE) and into electric current (photovoltaics). Machinery, equipment and other appliances located within this infrastructure, used in the operation of the enterprise, also have pro-

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ecological and pro-social character.

Operation of an enterprise requires incoming goods, including raw materials, materials, components, office supplies and other products. A sustainable enterprise procures and introduces into its system only such basic and incoming goods which have sustainability features.

The essence of sustainable operation and its results will be illustrated with an example of a sustainable manufacturing activity. It is based on production of safe, efficient and durable products, manufactured in the processes of clean production. A characteristic feature of clean production is elimination of harmful gases, liquids, solid substances and radiation from technological processes and limitation of wastage of energy, heat, water, raw materials and other factors of production. It is advisable that clean production should be carried out by all enterprises which form the production chain of the particular product, also by manufacturers of materials, components and sub-assemblies.

An important determinant of success of sustainable business projects is sustainable business management. In the approach proposed by these writers it assumes the form of sustainable/sustainability management. S. Cohen in his book published in 2011 in the U.S.A. states: „sustainability management is in its infancy […]. It today will not be able to predict its pace, shape or trajectory" (Cohen, 2011, p. 146). According to that Author "sustainability management is the practice of economic production and consumption that minimizes environmental impact and maximizes resource conservation and reuse […] At the heart of sustainability management is a concern for the future" (Cohen, 2011, p. 2). B. Bossink defines sustainable management in the aspect of eco-innovations „as the development of new initiatives in an organization to sustain, improve and renew the environmental, social and societal quality of its business processes and the products and services these business processes produce" (Bossink 2012, p. 1). A. Pabian perceives sustainable management with regard to its functions. He defines sustainable management as planning, organizing, leading and controlling resulting in establishment, operation and development of a sustainable organization, that is an entity contributing to the balance of intergenerational needs (Pabian, 2013a, p. 5).

The following question arises: is it necessary to introduce sustainable management in an enterprise if all resources subject to this management are sustainable? It is necessary to do so because sustainable resources can also be managed in unsustainable way e.g. by treating the employees unethically, by managing sustainable equipment inappropriately.

Discussion

Scholars being aware of the global ecological and social threats rather agree that sustainable development should be continued, also through changes in the sphere of business as it is business that consumes most of the world's nonrenewable resources. There is no agreement, however, as to the strategy of sustainable development. Proponents of the ideas of Thomas Malthus advocate restraint and economical resource management. Supporters of Robert Solow believe that a global disaster can be prevented by technology and innovations (Martin, Kemper, 2012, p. 48-56). In the opinion of the authors of this paper, the technical and technological progress is much slower than the rate of environment destruction and natural resource depletion. It is probable that the Earth will be destroyed before man is able to create technical and technological methods to prevent the destruction. The authors of this paper believe that business should use both T. Malthus's and R. Solow's approach. It would involve both economical utilization of available resources and seeking innovative solutions to counteract ecological and social problems.

Another controversial issue is related to the search for and presentation of the sustainable business conceptions, which in the present conditions and with the existing state of social awareness cannot be fully implemented in practice (such is the nature of the conception presented in Figure 1). These writers believe that it is necessary to look for and present such model solutions – they are benchmarks (target statuses) which the contemporary business should aim at. Every step on the way to their implementation in practice means progress in sustainable development and thus contribution to balancing intergenerational needs.

Another debatable problem is the issue of the major barriers to implementation of the presented conception of business in sustainability. This conception requires many sacrifices, including abandonment of the growth of production, consumption, sales and profits. Such sacrifices do not lie in the nature of enterprises or in the nature of entrepreneurs and managers in charge. Motivation to use sustainable management is also weakened by the fact that man does not perceive and does not understand many adverse phenomena occurring on the Earth and cannot control their progress. What is more, enterprises operate in the countries having different attitudes to sustainable development, which is the consequence of economic, political and cultural differences (Pabian, Pabian, 2012, p. 8). A major barrier to involvement in sustainable business are also high costs of its implementation in enterprises. Will, therefore, sustainable business ever become common and universal on a global scale? According to these writers, it is hardly probable.

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Conclusions

We are currently pretty sure that planetary critical thresholds have already been crossed, we only do not know, to what extent (Rogall, 2010, p. 145). In these circumstances, global action towards sustainable development must be accelerated. All organisations operating in the world, including states and their associations, an example of which is the European Union, should contribute to improve the health of our planet by using all endeavours aimed at achieving sustainability objectives with respect both to the Earth, its environment, and all products created by man. The European Union is implementing the strategy for sustainable development, the effect of which is the document Europe 2020 and positive sustainability indicators. The European consumerist community will be gradually transformed into a sustainable society based on pro-environmental and pro-social approach in manufacturing and consumerism (Pabian, Bylok, Kucęba, Zawada, 2013, p.7).

Business in sustainability is still in the initial phase of its development. This development should be continued by moving the principles of sustainability from the peripheries of business to its centre. It is expressed in the gradual replacement of unsustainable resources and actions necessary in business with their sustainable equivalents.

Transformation of traditional business pursuing economic goals into sustainable business geared also towards achievement of ecological and social goals is a very difficult task. It requires primarily a change of attitudes and behaviours both of entrepreneurs and consumers, which can be achieved by raising and educating the present and future generations of manufacturers, sellers and buyers in the spirit of sustainable development (Pabian, 2013b). It is also important to induce pro-ecological and pro-social behaviours through legislation and widespread campaigns promoting the principles of sustainable development in the society. (Pabian, 2013c, s. 12-17).

Business in *sustainability* is a new challenge for contemporary entrepreneurs. Future generations will judge whether this challenge has been taken up by them and to what extent it contributed to balancing of intergenerational needs. Let us remember that "we don't inherit the earth from our ancestors; we borrow it from our children" (Emery, 2012, p. XI).

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Evaluation of Consumer Confidence Index of Central Bank of Turkey Consumer Tendency Survey

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Abstract : Consumer confidence index is an indicator used to measure consumer confidence based on the degree of optimism on economy. Basically. it is a measure that reveals how optimistic or pessimistic consumers are with respect to the economy in the near future. The consumer confidence index calculated from the survey results can take value between 0-200. Consumer confidence index greater than 100 indicates an optimistic outlook for consumer confidence. Consumer confidence index is smaller than 100 represents the worst case. In this paper. consumer confidence index data are collected for the periods 2004-2012 from Central Bank of Turkey and analyzed using repeated measures analysis to investigate whether there is a trend throughout the years..

Key words: Consumer confidence index. Central Bank of Turkey. Repeated measures analysis.

Introduction

The repeated statement was added to the general linear model (GLM) procedure in 1984, since the methodology of univariate analysis of variance does not enough to resolve the covarince structure of repeated measures. The separate analyses at each time point, univariate analysis of variance, univariate and multivariate analyses of time contrast variables, and mixed model methodology are several statistical methods used for analyzing repeated measures data. The designs of repeated measures can be one-way repeated measures (one treatment factor) and two-way repeated measures (two treatment factors: one repeated factor (the trials factor) and one treatment factor (the groups factor)) which is a special type of repeated measures design that is frequently used by researchers is (Montgomery,2001).

The aim of this study is to analyze the Consumer confidence index (CCI) data using one-way repeated measures analysis and to investigate whether there is a trend throughout the years. The CCI data is collected for the periods 2004-2012 from Central Bank of Turkey and is calculated from the survey results. CCI can take value between 0-200. If it is greater than 100. it indicates an optimistic outlook for consumer confidence (CC) and if it is smaller than 100, it represents the worst case. CCI is a measure that reveals how optimistic or pessimistic consumers are with respect to the economy in the near future.

The remainder of our paper is organized as follows. In the next section, the definition of the consumer confidence index is given. In Methodology Section starts with a summary explaining the methodology of the repeated measures analysis experiments and then presents the theory of the repeated measures analysis of variances. Then we represent the analysis of CCI data for Central Bank of Turkey. Finally, the conclusions of this study is given in the last section.

Consumer Confidence Index

CC is one of the many indicators that is designed to measure the changes in economic activity and widely used in macroeconomic assessments and forecasts. CCI is a measure of consumer attitudes. Firstly. consumer attitudes might improve consumption forecast by reporting on consumers' views about their own and the economy's recent, current and expected economic conditions. Thus these data may be more informative about future consumer spending. Secondly, consumer attitudes may incorporate households' estimates of the impacts of rare shocks whose effects cannot be directly estimated from past experience or data (Brand., 2012).

A CCI measures how consumers feel about several economic factors. The measure is based on several questions by an interviewer to the consumer. The result which is represented by a numerical value speaks to consumer's evaluation of their own financial situation, employment chances, expenditure intentions and their opinion of general economic conditions. The index is based on a randomly selected sample of consumers that is representative of the country for which the index is constructed. The computation of a business confidence index essentially follows the same format except that it is the responses of business persons to business-focused

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questions that are captured and measured. These indices may rise or fall from period to period or remain unchanged (Kelvin, 2011).

The analysis of CC derives from the distinct literature of psychological economics. It is widely accepted that the perceptions and expectations of households determine the type of responses given during the survey. Katona (1960 and 1968) studied much in this area. The author argues that as one of the main tendency measures, economic sentiment can be credited with having additional information on the future path of the economy. An increase in confidence should lead to a rise in consumption expenditure with a certain lag. Since income cannot reflect all changes in consumption. CC offers help as an indicator because it allows one to measure both the ability and willingness to buy that individuals possess alongside other significant economic and financial variables. One can separate the literature on CC into three distinct approaches. The first argues that there is a significant and strong relationship between consumer sentiment and consumption expenditures (Carroll et al. 1994). The second fails to find any supportive evidence of empirical significance, rejecting the validity of consumer confidence as a leading indicator (Garner, 1991). Finally. the third uses some form of unconventional methodology to bridge the gap between qualitative survey data and quantitative analysis, resulting in favorable (Jansen and Nahius, 2003) and non-favorable evidence (Dominitz and Manski, 2004). However. the common point of all these studies is to focus on the explanatory power of CC thus restricting it to the role of an exogenous variable. The approach used by each of these studies range from the use of time series models to estimate the predictive ability of consumer confidence on household spending; to the use of consumer expectations and changes in future consumer sales activity; to the use of unconventional methodology like analyzing forecast errors regarding the CCI, the possible relationship between the blue chip economic indicators and consumer sentiment, or micro-level expectations data in a Euler- equation framework (Kelvin. 2011).

Methodology

The Repeated Measures Analysis of Variances (rANOVA) is one of the most widely used experimental designs in the past two decades because of advancements in computing hardware and software. Specifically in educational, psychological, diet and population research, multiple measurements are made on the same experimental units over a period of time, such data are called repeated measures. The repeated measures experiments interest on how treatment means change over time; and how treatment differences change over time. i.e.. is there a treatment by time interaction? The repeated measures data analysis distinctive is the covariance structure of the observed data. The assumptions of using the *F* test to analyze an experimental design are :

- The response variable is continuous,
- The residuals follow the normal distribution,
- The subjects are independent,
- The within-subject covariance matrices are equal for all between-subject groups. This assumption is tested by Box's M test,
- All of the within-subject covariance matrices are circular. This assumption is tested by Mauchly's test and be studying the values of epsilon (defined below). The circularity assumption is not necessary when only two repeated measures are made. When the significance level of Mauchly's test is < 0.05 then sphericity cannot be assumed.

The one-way repeated measures analysis model is given;

$$y_{ij} = \mu + \alpha_j + d_{ij} + \varepsilon_{ij} \; . i = 1 \ldots n. \;\; j = 1 \ldots k$$

where n is the number of observation, k is the number of treatment

y_{ij} : the response variable

μ : is the overall mean effect

α_j : is a fixed effect of treatment j

d_{ij} : is a random effect of observation i in treatment j

ε_{ij} : is a random error observation i in treatment j

- $\varepsilon_{ij} \sim NID(0.\sigma_\varepsilon^2)$, approximately normally independently distributed with mean of 0 and variance of σ_ε^2.
- $d_{ij} \sim NID(0.\sigma_d^2)$, approximately normally independently distributed with mean of 0 and variance of σ_d^2.

Assuming d_{ij} and ε_{ijk} are independent

$$E(y_{ij}) = \mu + \alpha_j + \tau_i$$
$$Var(y_{ij}) = \sigma_d^2 + \sigma_\varepsilon^2$$

and the covariance between any two different observations on the same subject is

$Cov(y_{ij} \,.\, y'_{ij}) = Var(d_{ij}) = \sigma_d^2 \,.\, j \neq j'.$

Analysis of CCI data for Central Bank of Turkey

In this study the CCI data is collected for the periods 2004-2012 from Central Bank of Turkey from the Central Bank of Turkey database. In monthly, consumer tendency survey, consumers' assessments on current situation and their expectations for personal financial standing and general economic situation have been evaluating by the Central Bank of Turkey. Indices are compiled in accordance with the balance method of European Union. The balance is calculated as the difference between the percentages of positive and negative responses and 100 is added to this difference, thus forming a separate diffusion index for each question. Then, the general index is calculated by taking arithmetic means of diffusion indices of the questions included in consumer confidence index. The consumer confidence index calculated from the survey results is evaluated within the range of 0-200. It indicates an optimistic outlook when the index is above 100, but it indicates a pessimistic outlook when it is below 100. CCI data set and was downloaded for the Central Bank of Turkey web page (http://evds.tcmb.gov.tr/fame/webfactory/evdpw/yeni/cbt-uk.html) and is given in Table 1. For this data set the each CCI is observed monthly. This data is analyzed using repeated measures analysis to investigate whether there is a trend throughout the years. The response variable y_{ij} is CCI at month *i* in year *j*, the treatment factor α_j is a fixed effect of year *j* and d_{ij} is a random effect of month i in year *j*. Treatment factor is often referred to as the within-subjects factor. The repeated measures analysis model for this data set is given;

$$y_{ij} = \mu + \alpha_j + d_{ij} + \varepsilon_{ij} \,.i = 1 \ldots 12. \;\; j = 1 \ldots 9$$

Table 1: The CCI data collected for the periods 2004-2012 from Central Bank of Turkey

2004	2005	2006	2007	2008	2009	2010	2011	2012
111.40	105.40	101.70	91.80	92.10	71.60	79.20	91.30	92.20
111.90	105.20	101.10	92.70	87.60	74.00	81.80	93.60	93.20
111.00	102.10	101.70	92.40	82.00	74.80	84.70	93.40	93.90
111.00	100.40	102.30	93.70	76.20	80.80	85.80	93.50	91.10
107.30	100.30	100.10	95.00	75.40	83.30	86.60	92.80	92.10
106.60	99.10	92.20	94.20	75.00	85.30	88.00	96.40	91.80
105.40	99.20	88.60	95.50	77.00	82.40	87.50	94.80	92.80
105.40	97.50	91.40	98.20	79.80	81.30	87.40	91.70	91.10
101.20	95.50	91.40	97.10	80.70	81.90	90.40	93.70	88.80
102.80	98.10	91.60	96.20	74.20	80.50	89.00	89.70	85.70
103.70	99.50	93.30	92.50	68.90	78.40	91.30	91.00	89.20
105.20	99.50	92.00	93.90	69.90	78.80	91.00	92.00	89.00

The descriptive statistics for CCIs are displayed in Table 2. Figure 1 also shows the mean trend by years. As shown in Table 2 and Figure 1, the highest consumer confidence index mean is observed in 2004 due to the some economic precautions on the economy. It can be seen a decline until 2006. The mean index in 2006 is not different from the mean index in 2007. After 2007, there was a serious decline until 2008 which has the lowest CCI mean. Between 2009 and 2008 there was a stagnation. Since the last quarter of 2008, the global economic

crisis around the world was felt in our country. So an increase was observed again from 2009 to 2011. However, after 2011 the mean index again began to decrease.

Table 2: The descriptive statistics of CCI data for the periods 2004-2012

Year	Mean	Variance	Minimum	Maximum
2004	106.91	13.28	101.20	111.90
2005	100.15	8.42	95.50	105.40
2006	95.62	27.26	88.60	102.30
2007	94.433	4.052	91.80	98.20
2008	78.23	45.43	68.90	92.10
2009	79.42	16.78	71.60	85.30
2010	86.89	13.28	79.20	91.30
2011	92.825	3.291	89.70	96.40
2012	90.908	5.443	85.70	93.90

Figure 1 : The graph of the mean of the CCI for the periods 2004-2012

IBM SPSS 20 was used for the data analysis. For the CCI data collected for the periods 2004-2012 from Central Bank of Turkey, the normality assumption holds (P=0.127). The results of the Mauchly's Test of Sphericity is given in Table 3. From the results , we see that, the spherecity assumption does not hold (P=0.00).

Table 3: Mauchly's Test of Sphericity

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
year	0.000	111.211	35	0.000	0.232	0.278	0.125

The null hypothesis for repeated measures analysis is "there is no trend for consumer confidence index" $H_0: \mu_1 = \mu_2 = \cdots = \mu_9$ can be tested against the alternative hypothesis, H_A: *At least one mean is different* . The results are given in Table 4. Since the spherecity assumption does not hold , Greenhouse-Geisser, Huyn-Feldt or Lower-bound test can be used. According to the Huynh-Feldt test, the hypothesis is rejected in the 5% significance level. So the mean of the CCI are different and has a trend for the periods 2004-2012. The multiple comparison test is performed to make the pairwise comparison, and the results of tests for the pairwise comparison are given in Table 5.

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Table 4 : Repeated Measures ANOVA Results

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
year	Sphericity Assumed	8190.546	8	1023.818	67.029	0.000
	Greenhouse-Geisser	8190.546	1.858	4408.251	67.029	0.000
	Huynh-Feldt	8190.546	2.220	3689.288	67.029	0.000
	Lower-bound	8190.546	1.000	8190.546	67.029	0.000
Error(year)	Sphericity Assumed	1344.125	88	15.274		
	Greenhouse-Geisser	1344.125	20.438	65.766		
	Huynh-Feldt	1344.125	24.421	55.040		
	Lower-bound	1344.125	11.000	122.193		

Pairwise comparisons: The null hypothesis for pairwise comparisons is $H_0: \mu_i = \mu_j$, $i \neq j$ and alternative hypothesis is $H_A: \mu_i \neq \mu_j$, $i \neq j$. The results of pairwise comparisons with respect to Bonferroni test are given in Table 5. By considering Central bank of Turkey data, the consumer confidence index's means are not different for the years 2006 – 2007-2010- 2011, 2012, and 2008-2009-2010 and 2010-2012 and 2011-2012 , However the consumer confidence index's means for the others years are different. Especially the mean of the consumer confidence index's in 2004 is different from the other years.

Table 5: Bonferroni Pairwise comparisons

(i) year	**(j) year**	**Mean Dif. (i-j)**	**Std. Error**	Sig.[b]	**95%Con.Interval for Diff.**	
					Lower Bound	**Upper Bound**
2004	2005	6.758*	0.516	0.000*	4.570	8.947
	2006	11.292*	0.799	0.000*	7.905	14.678
	2007	12.475*	1.505	0.000	6.094	18.856
	2008	28.675*	1.560	0.000*	22.059	35.291
	2009	27.483*	1.995	0.000*	19.025	35.941
	2010	20.017*	2.028	0.000*	11.418	28.616
	2011	14.083*	1.075	0.000*	9.525	18.642
	2012	16.000*	0.712	0.000*	12.981	19.019
2005	2006	4.533*	1.025	0.037*	0.188	8.878
	2007	5.717	1.351	0.051*	-0.010	11.444
	2008	21.917*	1.562	0.000*	15.295	28.538
	2009	20.725*	1.914	0.000*	12.610	28.840
	2010	13.258*	1.823	0.001*	5.529	20.987
	2011	7.325*	0.999	0.001*	3.091	11.559
	2012	9.242*	0.699	0.000*	6.278	12.206
2006	2007	1.183	1.934	1.000	-7.019	9.386
	2008	17.383*	1.727	0.000*	10.062	24.705
	2009	16.192*	2.400	0.001*	6.016	26.367
	2010	8.725	2.394	0.139	-1.424	18.874
	2011	2.792	1.607	1.000	-4.022	9.605
	2012	4.708	1.297	0.143	-0.793	10.209
2007	2008	16.200*	2.151	0.000*	7.080	25.320
	2009	15.008*	0.907	0.000*	11.163	18.854
	2010	7.542*	0.925	0.000*	3.619	11.464
	2011	1.608	0.794	1.000	-1.757	4.974
	2012	3.525	1.052	.234	-0.938	7.988
2008	2009	-1.192	2.849	1.000	-13.273	10.889
	2010	-8.658	2.916	0.459	-21.022	3.706
	2011	-14.592*	1.977	0.001*	-22.976	-6.208
	2012	-12.675*	1.697	0.000*	-19.872	-5.478

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2009	2010	-7.467*	0.928	0.000*	-11.403	-3.531
	2011	-13.400*	1.091	0.000*	-18.025	-8.775
	2012	-11.483*	1.509	0.000*	-17.883	-5.084
2010	2011	-5.933*	1.204	0.016*	-11.039	-0.827
	2012	-4.017	1.573	0.964	-10.684	2.651
2011	2012	-1.917	0.558	0.202	-4.284	0.451

* The mean difference is significant at the %1 level.

Conclusions

The CCI data for the periods 2004-2012 from Central Bank of Turkey was taken directly from the Central Bank of Turkey web page. We analyzed the CCI data using rANOVA and investigated that there is a trend through the years.

The evaluation of Turkish Economy's growth, inflation, labor and employment, public finance, foreign trade, balance of payments and tourism revenue figures for the period of 2001-2013 is very important in regards to the development and dynamics of the country's economics in the recent ten years.

In 2002, Turkey's economy took some precautions to overcome the economic crisis. It also started a growth period with the support of global help. These precautions ensure the trust and stability on the economy. During the period of 2002-2007, a high growth rates, substantial increase in exports and production and decrease on the inflation rates occurred. Since the last quarter of 2008, the global economic crisis around the world relatively affected the Turkey's economy. The year 2009 also was a difficult financial based crisis year for Turkey's economy.

Therefore, the dynamics on the CCI depend upon the structural movements in the economy.

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Experimental Investigation Of Heat Transfer In A Rectangular Channel With Perforated Ribs

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Abstract: Ribs are known to enhance the heat transfer between the energy-carrying fluid and the heat transfer surfaces. One effect of surface roughness is to increase momentum transfer and flow resistance. An experimental investigation of forced convection heat transfer in a rectangular channel with perforated ribs is presented. Measurements are carried out for a rectangular channel, rib transverse pitch (S) to transverse rib height (e) ratio of S/e=12.0, and a rib height (e) to channel height (H) ratio of e/H= 0.1. The convective fluid was air, and the Reynolds numbers considered for the channel flow case range from 5375 to 36362. The aim of the work was to study the effect of the thermal performance of the ribbed channel. The heat transfer results were obtained using an infrared thermal imaging technique. The heat transfer results of the perforated ribs are compared with those of a smooth plate. The presence of perforated ribs produces higher heat transfer coefficients than the smooth plate surfaces. Results show a 34.1% increase in heat transfer due to the use of ribs. These perforated ribs show a more significant increase in heat transfer coefficient for channel flows.

Key words: Heat transfer; perforated ribbed channel; thermal imaging technique; Pressure drop

Introduction

Perforated rib arrays inside internal channels are often used in heat exchanger systems to enhance the heat transfer in gas turbine blade cooling channels. A typical application is the internal cooling of gas turbine blade: the ribs break the laminar sublayer and create local wall turbulence due to flow separation and reattachment between the ribs, thus greatly enhancing the cooling effect.

First studies dealt with uniformly heated square or rectangular channels with two opposite rib-roughened walls; continuous, regularly spaced, transverse ribs have been the most common ribbed geometry for years (Han, Glickmann and Rohsenow, 1978 – Han, 1988). The effects of the most important parameters (rib height, rib pitch, channel aspect ratio, hydraulic diameter, and Reynolds number) on heat transfer and pressure drop were investigated. Further studies (Han,Park and Lei, 1985 – Han, Ou, Park and Lei, 1989) showed that the use of parallel angled ribs can have a significant impact on local heat transfer and pressure drop because of the secondary flow induced by the rib angle. To overcome this drawback, modified ribs in the form of "perforated ribs" have been applied instead of solid ones (Liou, Chen, 1998 – Karwa, Maheshwari,Karwa, 2005). Caliskan (Çalışkan, 2013) investigated heat transfer and flow characteristics under impingement of a multiple circular jet array with perforated rib surfaces (PRS) and solid rib surfaces (SRS) with an infrared thermal imaging technique and a Laser-Doppler Anemometry system, respectively.

Perforated ribs have been designed. In order to investigate the convective heat transfer performance of perforated ribs, an experimental set-up was established. The effects of perforated ribs from the channel bottom on the heat transfer and pressure drop characteristics were examined.

Experimental setup

The experimental setup is shown in Fig. 1. The experimental system consisted of a honeycomb, an entrance section, a test section, a centrifugal blower, an infrared thermography system, perforated ribs, and devices for measuring flow velocity, temperature and pressure difference. Air was drawn in by a variable speed fan and passed through the test section of the channel. The channel inner cross section dimensions were 100mm (wide) and 50mm (height). The channel was constructed with 9mm thick plexiglass plates. The dimensions of the heating plate were 100mm (width) and 270mm (length). In the experiments, the heating plate was made of stainless steel foil. It was firmly clamped and stretched between two copper bus bars. The foil was electrically heated by means of a high current DC power supply to provide a constant heat flux surface. The perforated ribs were mounted on the bottom of the channel to enhance the convective heat transfer. The averaged heat transfer coefficient on the plate surface was measured for various rates of airflow through the channel.

Views of perforated ribs are shown in Fig. 2. The perforated ribs were made of high conductivity aluminum material. The perforated ribs were attached to the stainless steel foil plates by a thin layer of super-glue. The thermal contact resistance due to the super-glue introduced a minor conservative preference to the reported results (Rallabandi, Rhee, Gao, Han, 2010). Thermal images were obtained from an IR camera positioned on the bottom of the heater assembly vertical to the z-direction. The air velocity was measured by the Kimo LV107-type anemometer connected to the output of the blower. ALMEMO and a pressure transducer were used to determine the pressure drop between the air inlet and outlet at the test section. The inlet and outlet temperatures of the channel air were measured in different locations of the channel by using a K-type thermocouple. All of these thermocouples were connected to a PC-based data acquisition system. The infrared thermography system, which included a ThermaCAM SC500 camera from FLIR systems and a PC with AGEMA Researcher software, could measure temperatures from -20 ºC to 1200 ºC with an accuracy of ±2%. The infrared camera used an uncooled focal plane array detector with 320x240 pixels, which operated over a wavelength range of 7.5-13 μm. The field of view was 25ºx18.8º/0.4m; the instantaneous field of view was 1.3 m-rad, and the thermal sensitivity was 0.07ºC at 30ºC. The images captured by the infrared camera were displayed and recorded using a computer for further analysis.

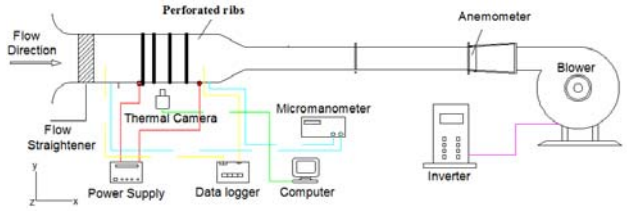


Figure 1: Experimental set-up

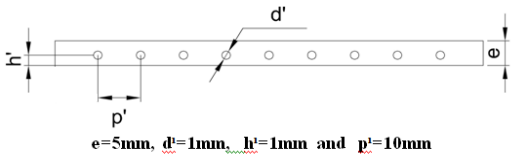


Figure 2: Schematic view of present perforated ribs

The bottom side of the stainless steel foil was covered with a layer of black backing paint. The emissivity of each side of the plate was measured with an AE anemometer and was found to be 0.82 and 0.13 for the painted and unpainted surfaces, respectively.

The local heat transfer coefficient and Nusselt number were defined as:

$$h_x = \frac{q_{conv}}{(T - T_{b,x})} \tag{1}$$

where T and T_{bx} were the local temperature of the heating surface and the bulk fluid, respectively.

$$Nu_x = \frac{h_x D_h}{k} \tag{2}$$

The convective heat flux was evaluated as follows:

$$q_{conv} = \frac{Q_{el} - Q_{loss}}{A} \tag{3}$$

where Q_{el} was the measured input power to the heater. Radiation, free convection from the bottom side, and conduction were considered as heat losses.
The radiation heat flux from both sides of the sheet was given by

$$q_r^{front} = \varepsilon_t \sigma \left(T^4 - T_b^4 \right) \quad (4)$$

$$q_r^{back} = \varepsilon_b \sigma \left(T^4 - T_\infty^4 \right) \quad (5)$$

where ε_t and ε_b are the emissivities of the unpainted and painted surfaces, respectively. σ is the Stefan-Boltzmann constant.

The free convection heat flux from the bottom side of the sheet was calculated using

$$q_f = h_f \left(T - T_\infty \right) \quad (6)$$

where the free convection coefficient h_f was defined as 1.1 W/m^{2}K, for an air velocity of 0.1 m/s (Janssen, Warmoeskerken, 1991)
The conduction was given by:

$$q_c = k \frac{\Delta T}{t} \quad (7)$$

where k was the thermal conductivity of the sheet, ΔT was the temperature difference across the sheet, and t was the thickness of the sheet. As a result of the thinness of the sheet, the lateral conduction was negligible as reported by Lytle and Webb (Lytle, Webb, 1994). The sum of Q_{loss} was typically in the range of 7.3 to 10.4% of Q_{el} at the highest Reynolds number.

The averaged Nusselt number Nu_{avg} was calculated by integrating the local Nusselt number over the heating surface, i.e.,

$$Nu_{avg} = \frac{1}{L} \int Nu(x) \partial x \quad (8)$$

The Reynolds number based on the channel hydraulic diameter was given by

$$\mathrm{Re} = \frac{\rho u D_h}{\mu} \quad (9)$$

where D_h=2WH/(W+H) was the channel hydraulic diameter.

Friction factor, f, can be written as

$$f = \frac{\Delta P}{\left(\frac{L}{D_h} \right) \rho U^2 / 2} \quad (10)$$

where Δp was pressure drop across the length of the channel, L.

The experimental uncertainties had been determined by a standard error analysis. Both the inlet and outlet temperatures of the air were measured by using calibrated K-type thermocouples with an accuracy of 0.3 °C. The inlet velocities at the centers were measured by an anemometer with an uncertainty of 0.03 m/s. The uncertainty in the experimental data was determined according to the procedure proposed by Kline and McClintock (Kline, McClintock, 1953). In our experiment, the fluid properties were assumed constant. The uncertainty in the calculation of the Nusselt number and Reynolds number was found to be less than 6.2% and 5.8%, respectively. The uncertainty in the friction factor f was estimated to be 4.2% at the highest Reynolds number and 6.7% at the lowest Reynolds numbers. The maximum uncertainty of the infrared thermography measurements was less than $\pm 1.5\%$.

Results and Discussion

The experimental data for the heat transfer and friction factor in a rectangular duct with perforated ribs was examined under a turbulent flow regime. The present experimental results in a smooth wall channel were first validated in terms of the Nusselt number and the friction factor. The Nusselt number and the friction factor obtained from the present smooth channel were, respectively, compared with the correlations of Dittus-Boelter and Blasius found in the open literature (Incropera, 1996) for turbulent flow in ducts.

Correlation of Dittus-Boelter,

$$Nu = 0.023\,\mathrm{Re}^{0.8}\,\mathrm{Pr}^{0.4} \quad \text{for heating} \tag{11}$$

Correlation of Blasius,

$$f = 0.316\,\mathrm{Re}^{-0.25} \quad \text{for } 3000 \le \mathrm{Re} \le 20{,}000 \tag{12}$$

Fig. 3 and 4 shows, respectively, a comparison of the Nusselt number and the friction factor obtained from the present work with those from correlations of Eqs. (11) and (12). In the figures, the present results reasonably agree well within the ±11.8% deviation for both the friction factor and Nusselt number correlations.

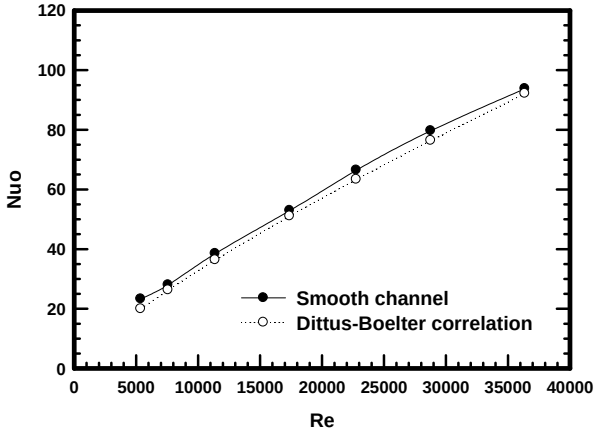


Figure 3: Verification of Nusselt number for smooth channel

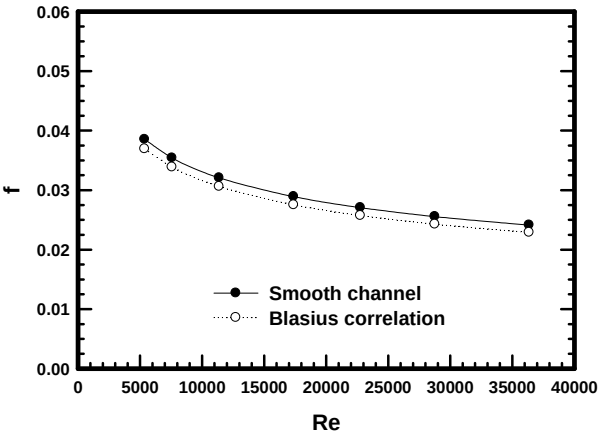


Figure 4: Verification of friction factor for smooth channel

Effects of perforated ribs

The present experimental results on heat transfer characteristics, in a channel equipped with perforated ribs are presented in the form of Nusselt number. The Nusselt numbers obtained under turbulent flow conditions for perforated ribs with different Reynolds number are presented in Fig. 5. As shown in Fig. 5, the use of perforated ribs lead to considerable heat transfer enhancements in a similar trend in comparison with the smooth channel and the Nusselt number values, increase with the rise of the Reynolds number. The maximum difference of the averaged Nusselt number the between smooth and perforated rib is found to occur at Re=36362 with a value equal to 34.1%.

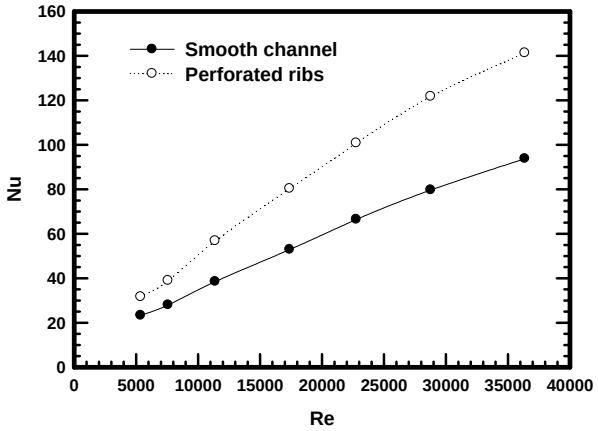
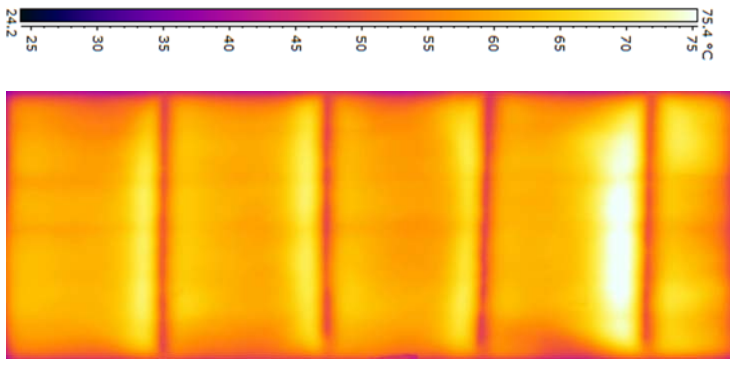
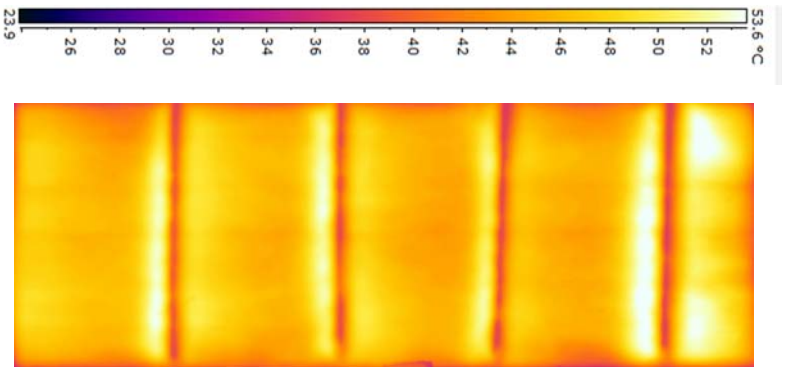


Figure 5: Variation of avareged Nusselt number with Reynolds number

Fig. 6a, b and c present the temperature contours for the perforated ribs in both the streamwise and the spanwise directions for the different Reynold number. As shown in Fig. 6a, b and c, the temperature is decreases with increasing of the Reynolds number. The wall temperatures for the perforated rib surface were lower than the smooth surface, which disrupted the boundary layer more, resulting in a better heat transfer.



(a) Re=5375



(b) Re=17390

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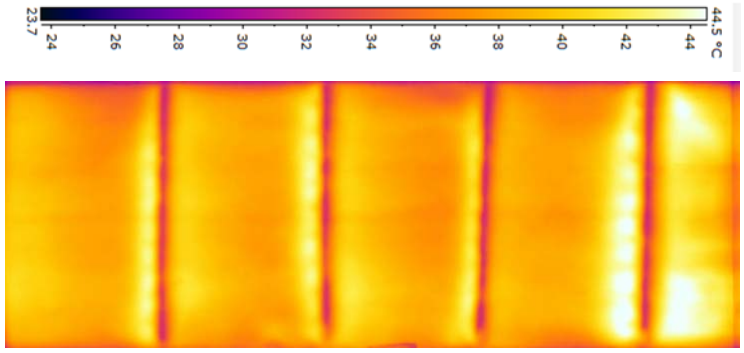
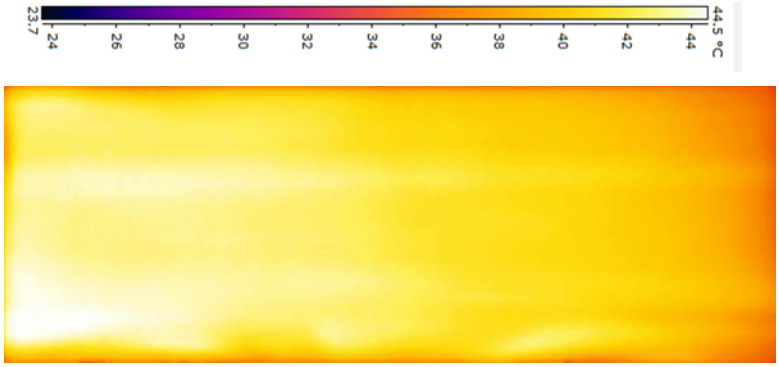


(c) Re=36362



(d) Re=36362

Figure 6: Temperature contours in the x-y plane for the perforated ribs and smooth surface **(a)** Re=5375-perforated ribs, **(b**) Re=17390-perforated ribs **(c)** Re=36362-perforated ribs and **(d)** Re=36362 smooth surface.

Variations of the ratio friction factor, f, versus the Reynolds number for the perforated ribs are shown in Fig. 7. The friction factor found from using the perforated ribs was observed to be higher than that from the smooth duct. This can be attributed to flow blockage and the act caused by the reverse flow due to the presence of the perforated ribs.

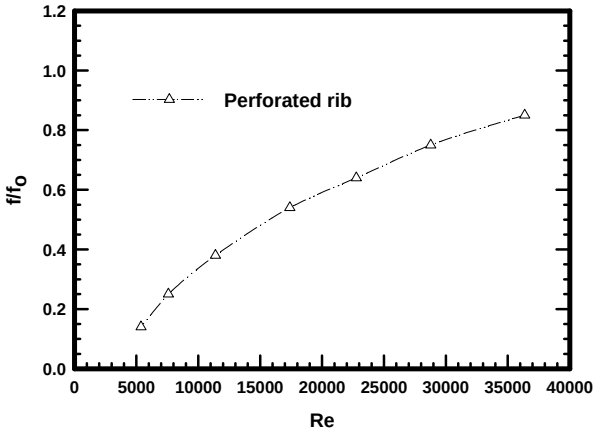


Figure 7: Friction factor ratio with Reynolds number

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Conclusions

An experimental investigation in a rectangular duct with perforated ribs under uniform heat flux conditions has been performed.

The following conclusions have been drawn:

- Perforated ribs had significantly enhanced the heat transfer rate, in comparison to a smooth duct. The averaged heat transferred from surfaces with perforated ribs was higher than that of the smooth surface. The disturbance in the boundary layer was formed due to holes, which created higher turbulence due to the separated and reattached flows.
- The present results reasonably agree well within the ±12% deviation for both the friction factor and Nusselt number correlations.
- The maximum difference of the averaged Nusselt number the between smooth and perforated rib is found to occur at Re=36362 with a value equal to 34.1%.

Acknowledgements

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Nomenclature

A	convection heat transfer area of channel (m^2)
D_h	hydraulic diameter (m)
f	friction factor (-)
H	channel height (m)
h	averaged heat transfer coefficient (W/m^2 K)
k	thermal conductivity of air (W/m K)
Nu	Nusselt number (-)
Nu_{avg}	averaged Nusselt number (-)
ΔP	pressure drop (Pa)
Pr	Prandtl number (-)
Re	Reynolds number (-)
Q	heat transfer (W)
T	temperature (K)
U	mean velocity (m/s)

Greek symbols

ρ	density of the fluid (kg/m^3)
ν	kinematic viscosity (m^2/s)

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Internationalization of New Ventures and the Central Role of The Nascent Entrepreneur

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Abstract: This paper contributes to the understanding of the background conditions of the internationalization of new ventures in the context of entrepreneurial intentions of Polish students' focused on entering foreign markets. The aim of the study is to examine undergraduates' entrepreneurial intentions concerning international activity on the example of students of Faculty of Management of Czestochowa University of Technology (FoMCUT). The name - international entrepreneurial intentions (IEI) is used for this kind of EI. Various aspects of IEI and additional determinants are discussed in the context of demographic characteristics of the sample. The study aims at the analysis of the symptoms of early internationalization of new ventures created in the future by the students of the Faculty. The conducted research leads to the conclusions concerning the level of IEI of the students of the faculty, which is strictly connected with the science and practice of management and entrepreneurship.

Key words: new venture, nascent entrepreneur, internationalization, students

Introduction

The focus of entrepreneurship scholars' attention emerging recently is the domain of international entrepreneurship (IE). According to B.M. Oviatt and P.P. McDougall (2005), IE "is the discovery, enactment, evaluation, and exploitation of opportunities - across national borders - to create future goods and services" (p.540). The research on IE can be divided into two streams: the one focusing on international new ventures (INVs) or 'born globals', and the other one focusing on the IE activities of the established companies (Covin, Miller, 2014, pp. 11-44). The paper is devoted to the first stream, describing the future entrepreneurs' intentions aiming at internationalization of their future new ventures.

Several previous studies have investigated the aspects related to the firm's start-up process, its stages, moments and subsequent performance. The relevance of understanding this process lays in the predominant role of entrepreneurs in the capitalist system development, given their skills to innovate and create employment and economic growth (Baltar, Coulon, 2014, pp. 69-81). As J.S. McMullen and D.A. Shepherd (2006, pp. 132-152) underline, entrepreneurship requires action. Whether conceptualized as the creation of new products or processes (Schumpeter, 1934), the entry into new markets (Lumpkin, Dess, 1996, pp. 135-172), or the creation of new ventures (Gartner, 1985, 696-706), entrepreneurship typically involves a phenomenon in which personal initiative influences the system-wide activity and outcomes (Kilby, 1971; Stevenson, Jarillo, 1990, pp. 17-27). In this context the personal initiative of an entrepreneur is the basis for any kind of entrepreneurial actions, including the ones leading to the activity on foreign markets and the rapidity of the internationalization process.

A number of small enterprises enter the international marketplace at a much younger age than others. Simultaneously, they pursue strategies that involve international activities at an earlier stage of their lifecycle. Those ventures also tend to grow faster in comparison to the ones operating mainly on domestic markets. This condition implicates the need for consideration and research on the determinants of early internationalization at as early stage as possible. However, much of the research concerns further stages of life cycle of early internationalized enterprises as the *ex post* analysis. Nonetheless, as entrepreneurial intentions and their predictors are often analyzed as the background of new venture creation, they also may be examined in the context of both early and incremental internationalization of the future enterprise. The assumption applied in this study is that the main actor of the internationalization process and also the new venture creation process is the entrepreneur, performing the activities leading to a new entry both on the domestic, international, and even global market. Accordingly, the entrepreneur or the future entrepreneur (e.g. a person with strong entrepreneurial intentions but not in business yet) and the manager of a small business may be considered as the strategic actor affecting international performance of the enterprise. This leads to the conclusion that studying international entrepreneurial intentions and the symptoms of the prospective business activity on foreign markets may be advisable and may create the background for the prediction of the possibility of future internationalization of the new ventures to be created by future entrepreneurs.

Entrepreneurial intentions (EI) that direct attention, experience and activities towards business concepts, create the form and direction of organizations at their inception stage. Future organizational outcome such as

survival, development and growth are based on these intentions. The ideas of entrepreneurs and their intentions formulate the initial strategic template of new organizations and are the underpinnings of new venture development of a relevant and crucial value.

While the number of studies dealing with early and rapid internationalization of small and medium-sized enterprises has grown substantially over the past twenty years, most of them focus on businesses originated in highly developed countries, such as the US, Scandinavian countries, Switzerland, Canada, UK, Spain, Australia or New Zealand. Studies covering the emerging economies have started to appear only recently and, in great part, they relate to the BRICs. Studies concerning early internationalization of SMEs from transition economies and particularly from Central and Eastern European (CEE) countries are still relatively rare (Nowiński, Rialp, 2013, pp. 191-231), which leads to the conclusion that studying international entrepreneurial intentions (including early internationalization) may constitute the contribution of a great significance both to IE and entrepreneurship domains.

In the light of the above, the aim of the study is to examine undergraduates' entrepreneurial intentions concerning international activity on the example of students of Faculty of Management of Czestochowa University of Technology (FoMCUT). The name - international entrepreneurial intentions (IEI) is used for this kind of EI.

New Venture Internationalization as the Research Direction

The distinctiveness of IE within the broader domain of entrepreneurship theory and research was first acknowledged in the late eighties of the 21st century (McDougall, 1989, pp. 387-399). The seminal article of Oviatt and McDougall of 1994 (pp.45-64) is often credited (E.g.: Keupp, Gassmann, 2009, pp. 40-65) with spurring research interest in this subject (Covin, Miller, 2014, pp. 11-44). The phenomena of the greatest interest to be explored are the factors enabling entrepreneurs not only to internationalize their operations but also to build entrepreneurial organizations capable of maintaining sustainable competitive advantage (Al-Aali, Teece, 2014, pp. 95-116).

While the number of studies dealing with early and rapid internationalization of small and medium-sized firms has grown substantially over the past twenty years (Szyliowicz, Galvin, 2010: pp. 317-332; Jones et al., 2011, pp. 632-659; De Clercq et al., 2012, pp. 143-165; Cesinger et al., 2012, pp. 171-190; Sipa, Smolarek, 2004, pp. 221-233), most of them focus on enterprises of highly developed countries, such as the United States, Scandinavia, Switzerland, Canada, UK, Spain, Australia or New Zealand (Rennie, 1993, pp. 45-52; Jones, 1999, pp. 15-41; McAuley, 1999, pp. 67-82; Andersson, Wictor, 2003, pp. 249-276; McDougall et al., 2003, pp. 59-82; Rialp et al., 2005, pp. 133-171; Coviello, 2006, pp. 713-731; Gassmann, Keup, 2007, pp. 350–366; Crick, 2009, pp. 453-476). Studies referring to the emerging economies do exist but mostly they relate to the BRICs (Zhou, 2007, pp. 281-293; Zhang et al., 2009, pp. 292-322; Majumdar et al., 2010, pp. 109-136; Naudé, Rossouw, 2010, pp. 87-111; Wood et al., 2011, pp. 252-282). As W. Nowiński and A. Rialp (2013) state, studies concerning early internationalization of SMEs from transition economies and particularly from Central and Eastern European (CEE) countries are still relatively few (pp. 191-231).

As S. Andersson and H. Floren (2011, pp. 233-258) pinpoint, Coviello and McAuley (1999, pp. 223-256) identified three different strands of research on the internationalization of small firms. The first focuses on foreign direct investment (FDI) and has its basis in Hymer's (1960) seminal work from 1960 and its later elaboration by Dunning (1988, pp. 1-31) who developed the eclectic paradigm that explains FDI in terms of ownership advantages, location advantages, and internalization. This stream of research is mainly focused on the problem why firms invest in foreign markets but small firms, due to the liability of smallness, often do not have the resources to engage in foreign direct investment, but instead use export and middlemen. The second strand of research includes the establishment chain models of internationalization. Probably the best-known model in this area is the so-called Uppsala Internationalization Model (Johanson, Vahlne, 1977, pp. 23–32). It drew on both the behavioral theory of the firm (Cyert, March, 1963) and the theory of the growth of the firm (Penrose, 1959; Kuraś et al., 2014). This model is focused on the process of enterprise internationalization and explains the commitment on international markets by means of increased organizational empirical learning. This stream of research discusses how small firms grow internationally in a step-by-step way starting with direct export, followed by middlemen, sales subsidiaries, and production subsidiaries. The third strand of research is the development of this model which included network perspective (Axelsson, Johansson, 1992, pp. 218–234).

Traditional stage models such as the Uppsala Internationalization Model (Johanson, Vahlne, 1977, pp. 23-32) and Innovation-related Export Models (Bilkey, Tesar, 1977, pp. 93-98; Cavusgil, 1980, pp. 273-281; Reid, 1981, pp. 101-112; Czinkota, 1982) assume that most companies would follow a gradual internationalization path of increasing involvement in international operations. These models explained gradual internationalization through lack of knowledge concerning foreign markets/operations and perceived uncertainty of such operations (Andersen, 1993, pp. 209-231; Nowiński, Rialp, 2013, pp. 191-231).

An important strand of research in the area of internationalization of a new venture is focused on studying the rapidity of the venture internationalization process connected with the characteristics of the entrepreneur. As A. Rialp et al. (2005, pp. 133-171) underline, some small and medium enterprises (SMEs) become international soon after their foundation, while many other SMEs still appear to follow a slow, gradual, and evolutionary path of development abroad, some newly established and highly entrepreneurial ventures are becoming international almost at founding. Very likely, the revolutionary technological, social, and economic changes currently taking place in many markets and industries worldwide, together with more sophisticated and skilful managers and entrepreneurs, propel these firms into international markets from the outset (Oviatt et. al., 1995, pp. 30–43; Oviatt et al., 1997, pp. 85–99; McDougall et al., 2000, pp. 902–908).

According to some authors (e.g. Knight et al., 1996, pp. 11–26; Madsen, et al., 1997, pp. 561–583), born globals are becoming more and more widespread, and the growing relevance of such early internationalizing enterprises is critically challenging traditional internationalization theory. There has been identified an increasing number of SMEs choosing to be extensively present on international markets immediately – or very soon after – their birth. Such enterprises have been labeled in a different way (Rialp et al., 2005, pp. 133-171): Born-Globals , International New Ventures, High Technology Start-ups, Global Start-ups, Instant Exporters, Instant Internationals, Born-Internationals Micromultinationals and Early Internationalizing Firms.

Even though labeled very differently, the definitions have a common denominator: born globals (BG) or international new ventures (INV) are "small, (usually) technology oriented companies that operate on international markets from the earliest days of their establishment" (Knight, Cavusgil 1996, pp. 11-26). They have been described across different countries and industries. As B. Hagen and A. Zucchiella (2011, pp. 484-504) notice, two main studies by Rialp at al. (2005, pp. 147-166) and by Keupp and Gassmann (2009, pp. 600-633) are comprehensive sources of the state-of-the-art. Such enterprises of specific nature challenge conventional internationalization theories and the long-held belief that the strategic options of small firms are constrained by resource poverty by directly entering international markets at or near their founding (Oviatt, McDougall, 1994, pp. 45 – 64). Fast and broad internationalization of these businesses without any apparent path-dependency breaks the slow and incremental pattern described in the traditional process models of internationalization and consequently leads to much critique of their validity (Hagen, Zucchella, 2011, pp. 484-504).

Special attention in the existing research is paid to entrepreneur related factors and entrepreneurial capabilities. This is based on the fact that decision making in born globals often exclusively depends on just one person or only a few people - the entrepreneurs having unique and crucial role in organizations (Bloodgood et al., 1996, pp. 61-76; Westhead et al., 2001, pp. 333-358). In the above mentioned context it is vital to recall Jones and Coviello's (2005, pp. 284-303) "models of internationalization as a time-based process of entrepreneurial behavior". They identified time and behavior as primary dimensions for explaining and understanding internationalization. This leads to the conclusion that the behavior of the entrepreneur or even intentions of the entrepreneur that are the precursor of behavior should be the subject of the analysis that may enhance the knowledge on early internationalization of enterprises.

New venture success depends on how the entrepreneur or the whole founding team collectively seek and select information (Liesch, Knight, 1999, pp. 383-394), estimate environmental opportunities and consequently decide upon business position, processes and actions that result in or contribute to internationalization (Hagen, Zucchella, 2011, pp. 484-504) but it also depends on earlier attitudes and intentions towards certain aspects of the management process which, in turn, lead to higher probability of early internationalization of a new venture.

The Entrepreneur's Role in the Center of the Business Activity

Several studies have investigated aspects related to the enterprise start up process, its stages, moments and subsequent performance (Reynolds, 1991, pp. 47-67; Reynolds et al., 2005, pp. 205-231). The relevance of understanding this process lays in the predominant role that the entrepreneur fulfills in the capitalist system development, given its skills to innovate and create employment and economic growth (Baltar, Coulon, 2014, pp. 69-81). This is also underlined by S. Sudoł (2002, p. 27), who states that the entrepreneur is the key figure in the enterprise. The entrepreneur is the main causative factor in the enterprise and the driving force of the economic progress. According to R. Lessem (1990, p. 19), the characteristics of the entrepreneur determine a good way of running the enterprise. They affect the future success of the organization.

The entrepreneur plays the most important role in organizing and managing the enterprise. This is the entrepreneur that decides on whether the entrepreneurial idea will be fulfilled and whether it will bring about the intended benefits in the future. The company and the entrepreneur are the unity and these two elements cannot be referred to separately (Lemańska-Majdzik, 2009, p. 32, 37).

Entrepreneurship is a complex phenomenon in which entrepreneurs play a number of different roles. The role of an innovator is the key role. The notion of entrepreneur as an innovator has been attributed to Joseph Alois Schumpeter, who put the entrepreneur at the core of economic development. No economic development can exist without entrepreneurs and no development can exist without entrepreneurs' ability to start a new venture. To a large extent the survival of enterprises depends on the innovative abilities of entrepreneurs. Both economic and social systems require entrepreneurs who can find new combinations of production factors, leading to new products and services that will satisfy the constantly changing needs of buyers. Under the guidance of entrepreneurs, the process of "creative destruction" is born, during which existing technologies, production processes, and organizational principles, as well as old products and services, cease to exist and are substituted with new products and services (Rebernik, Širec, 2011, pp. 15-41).

In the light of the above statements, it is possible to conclude that at the stage of the intention, the entrepreneur and, more precisely, their characteristics are of the key importance for the rules of functioning of the new venture. The capabilities and the way of thinking and the approach towards entrepreneurial ideas of such a person determines the performance of a new firm. One of the tracks of the nascent entrepreneur's characteristics is their approach to the operation on foreign markets and the speed of internationalization of a newly born firm. This leads to the conclusion that while analyzing entrepreneurial intentions, it is important to study attributes that lead to different paths and patterns of internationalization of future business ventures.

Research Method and Sample

This study builds on the expected patterns associated with INV/born-global and traditional, behavioral models of export-based internationalization by Rialp et al. (2005, pp. 133-171). This model is the synthesis of the most important differences between born-global enterprises and the ones following the step-by-step internationalization process based on exports. It points out three key dimensions: the founder's (entrepreneur's) characteristics, organizational capabilities and strategic focus. Every single key dimension is built by several attributes that may reach different parameters that determine whether the nature of the enterprise is closer to rapid internationalization or to the incremental process. This concept is used in the present study so as to identify international entrepreneurial intentions in the three dimensions mentioned above. The respondents' characteristics as potential founders' characteristics is examined along with organizational capabilities and strategic focus that may be delivered to the hypothetical new venture by them.

Semantic differential (SD) method is employed in order to assess the characteristics of the respondents and their attitudes towards certain organizational features leading to the achievement of certain organizational capabilities and strategic focus.

SD measures people's reactions to stimulus words and concepts in terms of ratings on bipolar scales defined with contrasting adjectives at each end. This scale enables measuring the directionality of the reaction and also intensity (Heise, 1970, pp. 235-253). The study utilizes statements instead of adjectives as the attitudes are impossible to be described by one word only.

The sample amounted to randomly selected 107 students of FoMCUT, which accounted to 2.2% of the total population of students of the Faculty. In the research there participated 63 women and 44 men aged 20 to 39 (mean age – 23.83, whereas median - 23). The respondents were the students of both full-time studies (95 people) and part-time studies (12 people). The characteristics of the sample is presented in Table 1.

Table 1: Research Sample Demographics

N=107					
Frequency					
Female	63	Full-time studies	95	Bach./Eng.	34
Male	44	Part-time studies	12	Post bachelor master's study	73
%					
Female	58.9%	Full-time studies	88.8%	Bach./Eng.	31.8%
Male	41.1%	Part-time studies	11.2%	Post bachelor master's study	68.2%

The survey took place in March 2014. The research tool constructed by the authors was the questionnaire. The respondents were asked to describe the most suitable categories referred to maintaining their own businesses. The categories were chosen out from the concept of Rialp et al. Nine out of ten proposed in the original work were utilized as not all of the original ones were applicable for the conditions of the analysis of

perceptions and intentions. In case of intentions "market knowledge and market commitment" were removed as intentions do not cover real time (in an ongoing enterprise) market knowledge and it would be misleading to include this item in the study of intentions. In the assessment of the authors of the present paper, the perception of the level of market knowledge and its accumulation should be evaluated during real business operation on domestic and foreign markets instead of its analysis at the stage of entrepreneurial intent. In the research process there were utilized Likert scales, which enabled the respondents to disclose their attitudes.

Research Results

The results of the first part of the study are presented in the framework of work of Rialp et al. adapted accordingly to the objectives of the present study. The selected intentions towards different patterns of internationalization are presented in table 2.

Table 2: Intentions towards patterns associated with internationalization of new ventures

Key dimension	Attribute	Gradualist approach	Born-global/INV theory
Founder's (and/or founding team's) characteristics	Managerial vision	International markets to be developed gradually after a significant domestic market base	Global from inception
	Prior international experience	Irrelevant or low degree of previous experience in international issues	High degree of previous international experience on behalf of founding entrepreneurs and/or managers
	Managerial commitment	General commitment with objectives and tasks but not directly related to internationalization	High and dedicated commitment with early internationalization efforts and challenges
	Networking	Loose network of personal and business partners; only foreign distributors seem to be relevant to the firm's gradual path and pace of internationalization	Stronger use of both personal and business networks at the local and international level
Organizational capabilities	Intangible assets	Availability and role of intangible assets are less important for successful gradual internationalization	Unique intangible assets (based usually on knowledge management processes) are critical for early internationalization purposes
	Value creation sources	Less innovative and leading edge nature of products resulting in a more limited value creation capability	High value creation through product differentiation, leading-edge technology products, technological innovativeness, and quality leadership
Strategic focus	Extent and scope of international strategy	A more reactive and less niche-focused international strategy	A niche-focused, highly proactive international strategy developed in geographically spread lead markets around the world from inception
	Selection, orientation and relationships with foreign customers	In the hands of intermediaries at the earliest stages of internationalization	Narrowly-defined customer groups with strong customer orientation and close or direct customer/client relationships
	Strategic flexibility	Limited flexibility to adapt to rapidly changing external conditions and circumstances	Extreme flexibility to adapt to rapidly changing external conditions and circumstances

Source: based on Rialp, A., Rialp, J., Urbano, D., & Vaillant, Y. (2005). The Born-Global Phenomenon: A Comparative Case Study Research. *Journal Of International Entrepreneurship*, *3*(2), 133-171

The respondents were asked to describe (to mark graphically) their attitude to the listed descriptions of attributes of the gradualist approach and the born-global approach on a seven point scale (1-closest to the

gradualist approach listed on the left, 4-neutral and 7-closest to the born-global concept listed on the right). The respondents knew only the descriptions of the attributes but were not aware of the purpose of the questions.

The results of the research concerning the intentions towards patterns associated with internationalization of new ventures are shown in Figure 1 and table 3.

	Attribute	Gradualist approach			Neutral	Born-global/INV theory		
		1	2	3	4	5	6	7
A	Managerial vision			2.8				
B	Prior international experience		2.0					
C	Managerial commitment				3.3			
D	Networking						5.6	
E	Intangible assets					4.4		
F	Value creation sources						5.4	
G	Extent and scope of international strategy					4.4		
H	Selection, orientation and relationships with foreign customers						5.1	
I	Strategic flexibility						5.5	

Figure 1: The respondents' patterns associated with internationalization of new ventures (N=107)

Table 3: Selected descriptive statistics of intentions towards patterns associated with internationalization of new ventures (N=107)

	A	B	C	D	E	F	G	H	I
Mean	2.80	1.97	3.31	5.58	4.36	5.40	4.41	5.06	5.46
Std. Err.	0.14	0.16	0.12	0.13	0.12	0.13	0.14	0.13	0.12
Median	3	1	3	6	4	6	4	5	6
Std. Dev.	1.41	1.63	1.24	1.30	1.28	1.34	1.45	1.39	1.28
Variance	1.99	2.65	1.54	1.68	1.65	1.79	2.11	1.92	1.65
Min	1	1	1	1	2	1	1	2	1
Max	6	7	6	7	7	7	7	7	7

For each of the nine attributes there has been calculated the average. The average values have been inscribed in the corresponding places which, in turn, allowed for the formulation of the graphic interpretation of the respondents' profile. Three out of nine attributes reached the score below 4, which shows their strong tendency to maintain in the range characteristic of the gradualist approach. They include: managerial vision, prior international experience and managerial commitment. The remaining six attributes under research (networking, intangible assets, value creation sources, extent and scope of international strategy, selection, orientation and relationships with foreign customers and strategic flexibility) achieved the score above the neutral score (4), which shows the orientation of these attributes towards early internationalization intention. The average score for the whole set of attributes, for all the respondents, amounts to 4.3. This shows a slight tendency towards early internationalization or even creation of born-global ventures.

While aiming at completing the obtained results in the area of attributes based on the concept by Rialp et al., the respondents were directly asked about the general approach towards internationalization of enterprises. The results are shown in table 4.

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Table 4: Nascent entrepreneurs' attitudes towards the speed of internationalization (N=107)

	n	%
Immediately after starting a business activity, the internationalization of the enterprise ought to be aimed at.	4	4
Internationalization should be the fundamental idea as early as in the process of planning of a new project.	20	19
Internationalization ought to take place gradually, beginning with initiating export through undisturbed entering foreign markets.	65	61
The most important are domestic markets and internationalization is a problem of the second importance.	18	17
Total	100	100

The conclusion is evident. As much as 61% of the respondents state that internationalization should take place gradually, beginning with initiating export through undisturbed entering foreign markets. Only 4% of those questioned express the opinion that immediately after setting up a business, internationalization ought to be aimed at.

To recognize the attitude towards potential benefits resulting from internationalization, the respondents were asked to reveal their attitudes towards statements depicting potential benefits resulting from internationalization in a general sense. The responses were given at the five-point Likert scale (1-I strongly disagree, 2-I'd rather not agree, 3-I neither agree nor disagree, 4-I'd rather agree, 5-I strongly agree). The results obtained in this area are presented in Table 4. The "Yes" responses shown in the table constitute the cumulation of the answers "I'd rather agree" and "I strongly agree" whereas the " No" answers are the cumulation of the responses "I strongly disagree: and "I'd rather not agree". The results are shown in Table 5.

Table 5: Nascent entrepreneurs' attitudes towards the benefits of internationalization (N=107)

	Yes		Difficult to say		No	
	Frequency	%	Frequency	%	Frequency	%
I think that by means of the enterprise internationalization it is possible to achieve sustainable competitive advantage.	81	76	22	21	4	4
I think that due to openness to foreign markets and international cooperation, the enterprise may gain access to rare and valuable resources.	89	83	17	16	1	1
I think that due to openness to foreign markets and international cooperation, the enterprise may gain exceptional capabilities.	90	84	16	15	1	1

Generally, it is necessary to state that internationalization is regarded as a positive phenomenon since about 80% of the responses referring to all the three questions are affirmative answers. Internationalization is generally regarded as a potential source of sustainable competitive advantage and the way of gaining rare and valuable resources, as well as gaining exceptional capabilities.

Conclusions

As entrepreneurial activity in different countries differs due to differences in the country institutional profiles (Busenitz et al., 2000, pp. 994-1003), this paper contributes to the understanding of the background conditions of the internationalization of new ventures in the context of entrepreneurial intentions of Polish students' focused on entering foreign markets.

Various aspects of IEI and additional determinants are discussed in the context of demographic characteristics of the sample. The conducted research leads to the conclusions concerning the level of IEI of the students of the faculty, which is strictly connected with the science and practice of management and entrepreneurship. The sample of students was chosen intentionally as the authors recognized the stage of

education of future entrepreneurs as the earliest possible moment to assess the intentions, inclinations and foundations for early internationalization of new ventures.

The analysis of the results allows for the conclusion that at the stage of education (studies) it would be reasonable to carry out the activities directed towards international actions of potential new companies. As well as there should be conducted classes in the field of entrepreneurship, it would be advisable to activate future entrepreneurs in the area of early internationalization. The respondents are definitely aware of the benefits resulting from internationalization, however, the analysis of the individual attributes of early internationalization reveals some scarcity in attitudes and intentions which, in the future, may be reflected in the conducted business activity. Among the features which may affect the attitudes towards internationalization, it is possible to notice earlier exposition to "internationality", manifesting itself in the form of international contacts (not necessarily of a business nature), earlier activities for the benefit of the organization of an international scope and knowledge of foreign languages, which naturally eliminates communication barriers while widespreading the scope of the activity.

The students' intentions and attitudes towards internationalization of enterprises will definitely affect their future actions and decisions. The presence of the concept of internationalization at the stage of formulating plans of future activity or its lack will also have a critical impact on the fate of future enterprises set up by the respondents. At this point, it is necessary to state that the key role of nascent entrepreneurs and the person of a nascent entrepreneur is in the center of the project while affecting its competitiveness, used resources and possessed capabilities.

The entrepreneur, as early as from the stage of the intention is a carrier of future effects in the form of innovativeness, "creative destruction" or materialization of characteristics typically connected with entrepreneurial orientation. The characteristics of the entrepreneur are also the elements determining the horizons of entrepreneurial thinking, both in a sense of the entity and the place of running a business activity. The scope of thinking and perceiving the boundaries of the market and the boundaries of the organization does depend on the approach of the entrepreneur.

The descriptive study is the basis for the future research on the predictors of IEI as the foundation of new international business ventures. It outlines the background for examining entrepreneurial traits and contexts which are important both for the development of every economy and the creation of directions for the practice of management of international small and medium enterprises. The results of the research presented in the present paper obviously cannot be the subject to generalization. They may only be referred to the group of respondents under research. The applied method may, however, be used for a larger representative sample, like in case of other countries, by means of which it would be possible to conduct cross country comparative analyzes.

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Segmentation Strategies in Dermoscopy to Follow-up Melanoma: Combined Segmentation Scheme

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Abstract: — Image processing techniques constitutes an important tool to improve skin cancer diagnose, whose early detection is still the most relevant prognostic factor.
Nowadays, the follow-up of suspicious melanocytic skin lesions using standard protocols is possible after the development of digital image technology, enhancing the early detection strategy of the skin cancer diagnose.
The correct selection of the borders in these particular images of skin microscopy is sometimes demanding, as these images possess particular artifacts (hairs and air bubbles).A stable algorithm to segment the border of the lesion is also important when the following up of suspicious melanocytic lesions uses quantitative markers, as accessing the geometry of the growth border, symmetry, area, among others. In this paper a new strategy to segment dermoscopy images is presented by merging two different approaches in image processing, the Empirical Mode Decomposition of the Hilbert-Huang Transform to remove common artifacts, followed by a Local Normalization to improve segmentation.

Key words: Segmentation, Local Normalization, Hilbert-Huang Transform, Dermoscopy, Melanoma.

Introduction

Skin cancer is one of the cancer types with most prevalence and it is also one of the most common forms of malignancy in humans (Celebi, 2007). It is expected that its public health impact increases significantly in the coming decades in the absence of effective intervention today (Boyle, 2004).

Skin cancer is classified as a function of the cells from which it expands. Basal Cell Carcinoma (BCC) emerges from the lower layer of the epidermis, Squamous Cell Cancer (SCC) emerges from the middle layer of the epidermis and melanoma is derived from melanocytes, which are pigment producing cells. Although the melanoma type of cancer is least common, it is the most aggressive, the most likely to spread and, to suddenly become fatal (Kasper et al, 2007). Several studies in Europe have documented the increment of melanoma incidence in the last few decades (Baumert, 2005, Holterhues, 2010, Sant, 2009). In the particular case of Portugal, the estimated incidence for 2012 was 7.5 per 100000, mortality 1.6 per 100000 and prevalence at one, three and five years 12.08%, 33.99% and 53.93% respectively (Ferlay, 2012).

Melanocytic lesion is a term used to describe a region of the skin that differs in color from the surrounding area. This difference in color (discoloration) is often a benign nevus found in great number over the entire body and regularly called age-spot. A change in the melanocytic lesion characteristics triggers a marker of warmness and should be investigated. The early detection and monitoring of suspicions lesions is crucial for the disease prognosis. Dermatologists use epiluminescence microscopy, dermatoscopy or dermoscopy as is usually referred, to perform early diagnosis of melanocytic lesions and to track the progression thereof. Dermoscopy uses a polarized light source and a magnifying lens allowing the identification of dozens of morphological features such as pigmented works, dots/globules, streaks, blue-white areas, and blotches. A fluid is usually spread on the skin surface to minimize light scattering, and thus in-crease the performance of this technique. The use of this fluid together with the presence of hairs in the skin surface, conducts to conspicuous artifacts in dermoscopic images.

The classification of some melanocytic lesions is sometimes difficult, even for experienced specialists. The lesion border is especially relevant for diagnosis since it allows to gather information about the shape of the lesion, growth path, and growth rate. The lesion border detection algorithms applied to dermoscopic images have been widely used in recent works with dermoscopic images (Erkol, 2005, Iyatomi, 2006, Melli, 2006, Celebi, 2006, Huang, 1998). Currently dermatologists often resort to digital dermoscopes and computer storage of the information. Computers can also be used to perform automatic lesion border detection. This process in the presence of artifacts may induce artificial borders, thereby jeopardizing their efficiency. Therefore artifact removal is a required pre-processing step to improve the quality of detection.

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Segmentation in Dermoscopy

Hilbert-Huang Transform

Hilbert-Huang Transform (HHT) is a time-frequency signal processing technique whose implementation is divided into two parts, Empirical Mode Decomposition (EMD) and Hilbert Spectral Analysis (HAS). EMD is an iterative and adaptive process designed to separate in components, known by Implicit Mode Functions (IMF), the original signal. Those components, which are signal derived, avoid the use of pre-defined basis functions as is the case when using classic Fourier Techniques. Hilbert Spectral Analysis (HSA) is employed to extract the instantaneous frequency to the previous components obtained after EMD. Further details relating to HHT can be found in (Fonseca-Pinto, 2009 and 2010).

Image Empirical Mode Decomposition

The use of the first part of the HHT in the context of artifact removal in dermoscopic images was used before in a previous work whose results can be found in [15]. In that work the natural potential to identify common artifacts in dermoscopic images by using EMD is enhanced, and in particular in those images classified as "difficult" due the amount of hairs or air bubbles.
EMD was developed for one-dimensional signals but is possible to extend this procedure to two dimensional arrays, a process known by Image Empirical Mode Decomposition (IEMD). An image is an array of pixels that can be treated as a matrix. Each row of this matrix stands for the energy of this set of pixels, and therefore is possible to plot this information. By this way a one-dimensional signal is obtained and it is possible to apply EMD to this one-dimensional source. Performing EMD in succession to all rows, leads to a set of IMF's for each row, and the set of all IMF's of the same order constitutes a set of bi-dimensional IMF's (2dIMF's). The final set of 2dIMF's is obtained after each individual matrix processing, by summing up the results. An example of 2dIMF extraction by IEMD from a dermoscopic image is presented in Figure 1.

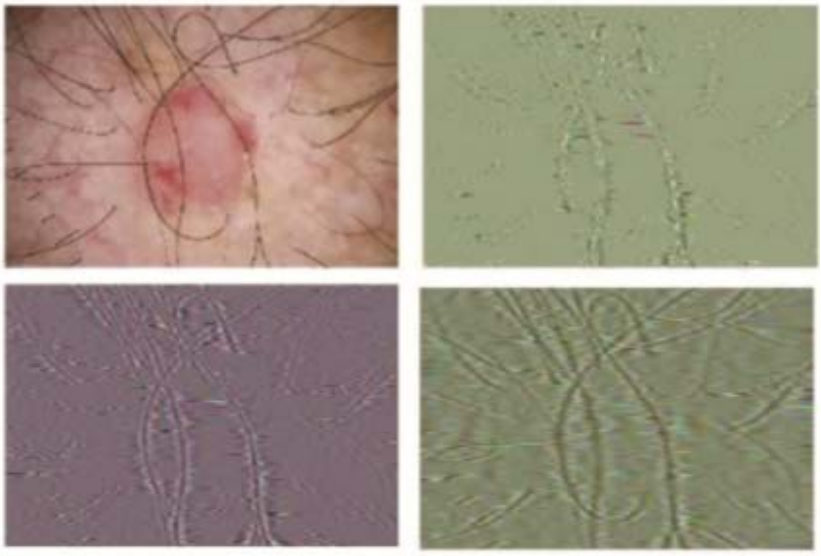

Figure 1: Dermoscopic image (top left), 2dIMF1 (top right), 2dIMF2 and 2dIMF3 (bottom images)

This 2dEMD extraction highlights artifacts, as is possible to see in Figure 1 by the identification of hairs. Artifact removal comprises two steps: 1) detection of corrupted pixels and 2) assignment of new intensity values associated to those pixels, while trying to minimize changes in the relevant image features. The above presented IEMD decomposition is used in this work to detect artifacts.
After the IEMD it is used the first component (2dIMF1) and the maximum (M) and minimum (m) energy value to calculate R=M+|m|, by using (1), where r is the number of rows in the RGB matrix and c the number of columns.

$$M = \max_{\substack{i=1,\dots,r \\ j=1,\dots,c}} \{2dIMF1(i,j)\}$$
$$m = \min_{\substack{i=1,\dots,r \\ j=1,\dots,c}} \{2dIMF1(i,j)\} \quad (1)$$

After this step, the reassignment of anomalous pixels can be made using several strategies. In (Haylo, 2001) a simple approach consisting in averaging the values of neighboring non-artefact pixel was used, conducting to interesting results. Contrary to the common filter procedures, this IEMD technique targets only those pixels where artifacts exist, leaving unchanged the remaining image. It is not a blind procedure, but rather an adaptive and oriented strategy to remove artifacts in dermoscopic images.

Local Normalization

Local Normalization (LN) processing is a center/surround operation based mainly on characteristics derived from human perception. Our perception of gray levels depends more on local characteristics rather than the absolute magnitude of the image signals. For example, we perceive a pixel with the same absolute gray level as darker if it is surrounded by light pixels, while we perceive the same pixel as light when it is surrounded by dark pixels. To incorporate this information into the processing of the image, LN separates the image into a local average or a low-frequency signal, and a surface detail or high-frequency signal. The locally normalized signal is then obtained by normalizing (i.e., dividing) the detail signal by the local average (Pereira, 2015).
The grayscale image is obtained after the RGB-averaged transformation shown in (2).

$$P_{i,j,m} = \frac{(p_{i,j,m})^2}{\sqrt{(p_{i,j,R})^2+(p_{i,j,G})^2+(p_{i,j,B})^2}}; for \begin{cases} i = 1,\dots,r \\ j = 1,\dots,c \\ m = R,G,B \end{cases} \quad (2)$$

where Pi,j,m represents the pixel (i, j) of the m channel in the image, c is the number of columns in the RGB matrix and r is the number of rows. LN can be computed by using (3)

$$LN = \frac{I-\bar{I}}{\sqrt{\overline{(I^2)}-(\bar{I})^2}} \quad (3)$$

where I is the original image and $\bar{I}$ is the output between a Gaussian kernel and I.
This LN strategy depends on the selection of a region of interest (ROI), which is computed in function of the size of the lesion and the Gaussian kernel. Using adaptive kernel orders, it is possible to detect and segment every skin lesion shape. An example of the output of this scale adapted normalization (Multiscale Local Normalization – MLN) joint with the lesion segmentation can be found in Figure 2.

Figure 2: Output of the MLN in dermoscopy

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Combined Segmentation Scheme

As reported in (Haylo, 2001), IEMD process shows good performance in removing artifacts, but the proposed methodology (the inpainting adopted scheme, and the segmentation based on a BW threshold) presents some drawbacks. On the other hand, LN and in particular the MLN shows good results when images are absent of difficult artifacts (in number and in quality). The proposed methodology combines MLN and IEMD to improve the segmentation output in those special cases where dermoscopic images are degraded by several and difficult artifacts, as result of a bad preparation of the skin, or related to the time consuming process in the acquisition.

Results and discussion

In order to illustrate the performance of the combined segmentation two images with common artifacts are employed. In the first case depicted in Figure 3(A-C), the image has a large amount of small air bubbles, whose presence interferes with the automatic segmentation.
Figure 3C shows the segmentation using IEMD, where is possible to observe the non-dependence, in this process, of air bubbles. In particular in the top right is possible to see a bigger artifact who is ignored by the segmentation, yielding a realistic border. Another characteristic of the IEMD process is also present, the high sensibility of the segmentation algorithm in the borders.
Figure 3A presents the segmentation after MLN, whose results shows a dependence of the air bubbles in the border (red circle, top right) and a smooth border. The combined segmentation is shown is Figure 3B, allowing to observe a smooth and rational border, which is independent of artifacts.

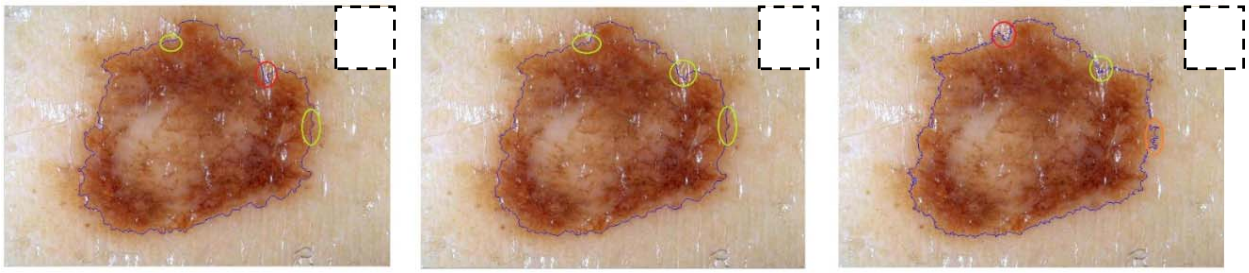

Figure 3: Segmentation strategies: A- segmentation after MLN, C - segmentation after IEMD, and B - proposed combined scheme segmentation.

In the second example (Figure 4) it is used a challenging image corrupted with hairs and air bubbles. Classical filtering and segmentation using commercial software in this image conducts to pour results. Figure 4A shows the segmentation after IEMD. It is possible to observe, as in the former case, a border irregularity and a good performance ignoring the top air bubbles in the image (red circles). In particular, it is possible to observe that the presence of hair in the bottom of the image (green circle) do not interfere with the correct segmentation. In the case of both artifacts, IEMD also demonstrates efficient results.
By using MLN, the segmentation is smoother, but in the presence of artifacts the algorithm follows the artifact path (Figure 4C, bottom, red circle). When the combined method is applied, as in Figure 4B, it is possible to observe a smoother, lesion correlated, and artifact independent segmentation, as in the former Figure 3B.

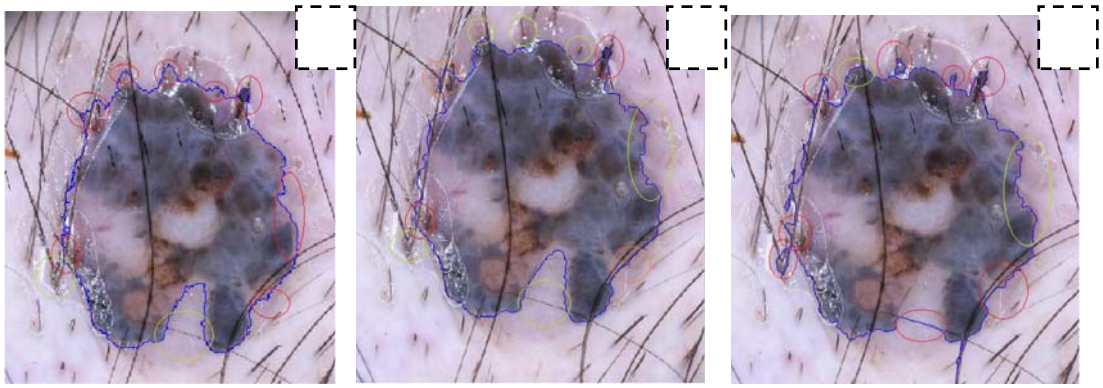

Figure 4: Segmentation strategies: A- segmentation after IEMD, C - segmentation after MLN, and B - proposed combined scheme segmentation.

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Conclusions

Strategies to follow the progression of melanocytic lesions are truly dependent on image processing techniques. A diagnosis based on quantitative markers is an important issue, implying a stable, lesion independent and accurate segmentation. In this work it is presented a combined scheme based on IEMD and MLN to segment dermoscopic images with high artifact density. The combined result proved to have a better performance than each one of their individual results. These are preliminary results, and more studies are being conducted related to the segmentation in dermoscopy in order to get independent artifact segmentation strategies. The segmentation output needs a ground truth with clinical correlation to compare results. This ground truth issue is an important open problem whose importance as led to clinical blind independent manual segmentation studies in dermatology. In the following of this work, this combined segmentation automated technique will be compared with manual segmentation.

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The Effect of Magnetic Treatment on Retarding Scaling Deposition

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Abstract: The magnetic treatment method has been applied as a scale deposition controlling and/or preventing tool for several decades in the domestic and industrial water systems. However, most of the scientific communities have remained skeptical about the viability of this water treatment method. However, the attention paid to magnetic treatment has increased during the last years as a prevention method.

Hence, a literature review was carried out to seek both positive and negative results. However, a review of the available literature is rather confusing. An experimental laboratory study on the effect of magnetic treatment method was conducted at the Kuwait Institute for Scientific Research's (KISR's) Doha Laboratory for reverse osmosis plant to investigate the effect of magnetic treatment in preventing and/or retarding scaling. Thus, the effect of magnetic treatment in retarding calcium carbonate, calcium sulfate and barium sulfate scaling was investigated within two different configurations (open and closed loop) and by using different techniques at ambient temperature. The current paper summarizes the literature survey and expresses the results of experimental work. The results showed that the magnetic treatment was effective in increasing the retention time required for scaling. Nonetheless, further investigation is recommended to optimize magnetic power, flow rate and operating temperature.

Key Words: Barium sulfate ($BaSO_4$), Calcium Carbonate ($CaCO_3$), Calcium Sulfate ($Ca\ SO_4$), Magnetic Treatment.

Introduction

Magnetic water treatment (MWT) is a proposed method of water treatment. The manufacturers of water treatment devices have claimed that powerful magnetic fields can affect the properties of solutes passing through the magnetic field, therefore, eliminating the need for chemical treatment agents as softening or antiscalant agents. Although the magnetic treatment has been applied as a scale-deposition controlling/preventing tool for the several decades in the domestic and industrial water systems, most of the scientific communities have remained skeptical about the viability of this water treatment method.

The first commercial device to be used for magnetic treatment was patented in Belgium in 1945 and used in a hot water system; in the United States of America the use of magnetic water treatment devices has been wide spread since 1975.

In 1985, Kronenberg was the first physicist who reported anecdotal evidence to the pseudoscientific theory that magnetic water treatment could prevent the formation of scale even after the magnetic field is removed.

Since the magnetic treatment is a controversial matter, a literature survey was conducted to investigate the viability and reliability of magnetic treatment in retarding the scaling deposition for membrane process.

Several scientific journals supporting magnetic treatment were found and reported positive scientific results.

Martynova et. al. (1967) found that in the presence of oxides of iron, in the industrial water and circulation process, the magnetic treatment of water enlarged the center of the crystals of a certain type of salt after the

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magnetic treatment of the water solutions. Biochenko et. al. (1977) also found that the effectiveness of magnetic treatment depends on several parameters such as temperature, type of salt, flow rate, and magnetic intensity.

In 1984, Grutsch and McClintock demonstrated a deposit control by using magnetically treated water where they conducted an extensive literature review on magnetic treatment and concluded that those who approved of the viability of magnetic treatment based their approval on proper application or specific experimental procedures. They added that the failure of previous researchers to see the effect of magnetic treatment could be due to the improper use of magnetic equipment such as magnetic intensity, polarity, material and others. They also found that the magnetic treatment equipment could successfully control salt deposition during the circulation of alkaline cooling (tower) water solutions and the treatment has positive control over calcium carbonate ($CaCO_3$) and calcium sulfate ($CaSO_4$) scale. They indicated that the proper parameter such as water velocity (6 m/s) could yield a positive scale control.

Busch et. al. (1986) were the first who suggested that the changes in voltage and current of conducting solutions passing through the field of magnetic treatment devices might be due to the effect of Faraday's law. He applied several precise magnetic field experiments using the commercial magnetic devices with normal stainless steel and plastic pipe housing. He found that the voltage and the current were both produced when the water solution was passed through an orthogonal magnetic field. He also postulated that insoluble iron produced from the magnetic material might be the center for $CaCO_3$ crystals which they believed might be the reason for suspension of $CaCO_3$ on the solution rather than depositing it on the plumbing surfaces.

A saturated solution of calcium sulfate ($CaSO_4 \cdot 2H_2O$) was tested in the magnetic field of a nuclear magnetic resonance spectrometer by Ronald et. al. (1995). Five replicates were performed for each experiment. The experiments were conducted using a magnetic device of 4.75 T and 1200 rpm. Results showed that the magnetic treatment indeed had a significant effect on the precipitation of $CaSO_4$ crystals. Conductivity, soluble Ca, and Zeta potential (ζ) all decreased, whereas the total suspended solid (TSS) increased. A transfer of Ca from the soluble to the solid phase (crystal as $CaSO_4 \cdot 2H_2O$) was confirmed using mass balance calculations. Thus, the results are consistent with claims in literature that magnetic water treatment can induce precipitation of inorganic crystals from solution, and could possibly prevent scaling by avoiding the precipitation of these salts onto solid surfaces.

A similar positive result was reported by Baker et al. (1997). The test was performed in a flow through the test ring; scale precipitation was induced by controlling a dosing of 0.1-M sodium hydroxide (NaOH) into a flowing solution of calcium chloride and sodium carbonate, the pH was adjusted to 6.5 using 37% HCl. Different strengths and configurations of magnetic fields were tested. The contact time, temperature and velocities (0.8, 1, 2 m/s) were also varied for a five-hour operation. After each experiment, the scale precipitated on the test tube section and wire loops were quantified and analyzed by a scanning electron microscope. The experiments were conducted under flow through reverse osmosis (RO) (open loop) and in a reticulated RO (closed loop) and the run continued until a sufficient flux decline occurred. On the open loop, no reproducible change was found in the nature or in the quantity of the scale adhered to the wire loops, but the physical differences were reported in the nature of the deposit when a magnetic field was applied to a supersaturated solution. The scale from untreated water formed a fine-grained uniform covering the pipe, while magnetically treated scale formed coarser-grained covering of the pipe in two different crystalline forms. The first form was calcite, and the other form was a cauliflower-type structure (aragonite). The author emphasized that these two forms of scale were not apparent

when an undersaturated solution was used. But, in the closed loop the flux and the rejection were significantly improved especially at a low flow rate (10-12 l/h). The result of analysis confirmed that the magnetic treatment produced a deposit (aragonite) which was less compact and more amenable to chemical cleaning than that formed under normal conditions.

In 1998, a laboratory experiment was undertaken by Barrett and Parsons to assess the effects of magnetic treatment on $CaCO_3$ precipitate. Static test solutions of calcium chloride, $CaSO_4$ and sodium carbonate were placed in a magnetic field. $CaCO_3$ was magnetically treated and the changes in precipitation were recorded. The results of this study support earlier work which indicates that magnetic fields may influence the formation of $CaCO_3$ by the suppression of nucleation and acceleration in crystal growth. The magnetic effect is maintained for at least 60 h after exposure and magnetic exposure exerts a greater effect on $CaCO_3$. Results indicate that the magnetic field suppresses the formation of $CaCO_3$ nucleation and crystal growth.

Gabrielli et al. (2000) tested magnetic treatment by measuring the remaining ionic calcium at the output of the device by means of ion-selective electrode. The scaling power of the treated water was estimated through an electrochemical scaling test. Chroamperometric curves and chronoelectrogravimetric curves were plotted to obtain the scaling time and nucleation time of scale deposition. Finally, an empirical equation was proposed, relating the efficiency of magnetic treatment to the length and flow velocity. The efficiency of the magnetic treatment through different types of pipe material polyvinyl chloride (PVC), stainless steel (SS) and Copper (CU) were also tested and it was concluded that copper is the most powerful material that can be penetrated through magnetic treatment, followed by SS and finally PVC. The inversion of polarity was found to improve the efficiency of the magnetic device. The scaling time was doubled when a magnetic device was used without inversion; however, that time would be increased to triple if inversion polarity were used in the magnetic device. The power of magnetic treatment was found to be greater when increasing the length of treatment or the number of polar pieces used in the treatment. The experiment was carried out in a control condition and totally confirmed the effect of magnetic treatment.

Freitas et al. 2000 investigated the effect of magnetic field on the crystallization of zinc sulfate in a series of controlled batch cooling experiments. Zinc sulfate solutions were exposed to magnetic fields of different intensities from 0.3 up to a maximum of 0.7 T (B). A clear increment of saturation temperature, growth rate, and average crystal size was found. However, a decree in the metastable zone width was also reported.

Kobe et al. 2001 and 2002 published many studies on the influence of magnetic field on the crystallization of $CaCO_3$. He concluded that the applied magnetic field can successfully prevent the hard calcite scaling; the main purpose of his work was to understand the mechanism of the beneficial influence of the magnetic treatment. However, his result also confirmed that magnetic treatment has altered the morphology of crystals forming 90% calcite and 9.6% aragonite without magnetic treatment to 28% calcite and 70% aragonite under a magnetic field of 1.22 T. Hence, the influence of the applied magnetic field on nucleation and further crystallization of $CaCO_3$ in hard water was confirmed.

Knez and Pohar (2005) conducted a laboratory study on the effect of magnetic field on the polymorph composition of $CaCO_3$ that precipitated from carbonized aqueous solutions in a closed loop. The experimental work was repeated in different magnetic flux densities, different intervals and flow velocity. The most important conclusion that was drawn from the Knez experiments was that the magnetic field clearly favors and/or promotes the precipitation of aragonite instead of calcite when nonmagnetic treatment was applied.

Saban et al. 2005 investigated the influence of static magnetic field of strength 0.75 T on the nucleation of $CaCo_3$ crystals using the particle size analysis and number of $CaCO_3$ particles formed. The experiment was conducted using 10-ml sodium bicarbonate ($NaHCO_3$) solution in a test-tube under magnetic field. The calcium chloride solution was taken from a vertical burette positioned above the test tube and mixed to a slow flow rate, drop by drop. One of the major findings was that the magnetic field can reduce the size of high percentage number of particles formed and also compress the particle size.

Kney and Parsons (2006) conducted a laboratory-based study to test the effect of treating solutions and particulate of $CaCO_3$ through magnetic treatment. Reproducible results were observed, but only when $CaCO_3$ particulates were exposed to magnetic fields, and not when a solution of sodium carbonate ($NaCO_3$) was exposed to magnetic fields. The result of the experiment was based on mixing the solution of sodium carbonate and calcium chloride in a test cuvette, and then absorbance measurements were taken at seven-s intervals over 30-min period.

Alimi F. et al. (2007) conducted a series of experiments on the effect of magnetic field on the calcocarbonic pure water containing calcium, carbonate, and bicarbonate ions only under 0.16-T magnetic field. A magnetic device consisting of five pairs of permanent magnets with north and south faces facing each other was used; the solution was flowed into a 150-mm plastic tube with a sectional area of 0.38 cm^2. The test tube was immersed in a water bath to control the temperature for 90 min. the tested solution was heated to a desired temperature Then, the concentration of dissolved calcium was measured before and after heating every 10 minutes. The difference in calcium ion concentration represents the amount of $CaCO_3$ precipitated. The influence of the applied magnetic field on the nucleation and precipitation of calcium carbonate was confirmed.

Lipus in 2007 evaluated the effectiveness of the magnetic field by the amount of scale precipitated in boilers and pipes during a three-week run using tap water, which contained (Mg^{2+}) and (Fe^{3+}) ions in a concentration exceeding the thresholds for calcite inhibition. All of the scales were identified to be aragonite, but in the case of magnetic treatment, the scale occurred in much smaller amounts. The scale on a heating copper-pipe was 2.5 times thinner due to magnetic water treatment, and the zinc-coated steel pipe occurred as a very thin powder–like coating, while in the line without treatment, abundant hard lining was formed.

Magnetic treatment recorded a revolution in solid-liquid separation as reported by Nirschl (2009), where he confirmed that he could separate between two inorganic components using magnetic field in a magnetic filter. The author also reported in another study that the magnetic field effects influence the filtration process positively.

Although Prisyazhniuk in 2009 explained different methods that are used for preventing scaling in heat exchanger, only the magnetic method was tested on his study. A predictive equation was also proposed in the study, relating the increase of power consumption to the degree of saturation of $CaCO_3$ on the surface and adjoining layer.

Purified potable water was then circulated at a constant flow rate in a magnetic field by Cai et al. (2009). Then, the physicochemical properties of water were measured; a decrease of surface tension and an increase of viscosity over the treatment time were observed. The correlation time (τ_c) was calculated in terms of spin–lattice relaxation time of proton, which verified that the rotational motions slowed down after the magnetic treatments. A two-phase model was set up to prove that the proportion of free water molecules was reduced. The results suggested that the average size of water clusters have become larger through magnetic treatments.

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On the other hand, many other researchers reporting negative results such as Eliassen et al. in 1985 reported that no positive results were achieved when the magnetic treatment was applied in preventing scaling.

Hasson and Bramson in (1985) found that the magnetic treatment failed to suppress the scale formation of $CaCO_3$. In addition, Limpert and Raber (1985) reported that the magnetic treatment device failed to prevent scale formation in a heat exchanger system. Sohnel and Mullin in 1988 believed that the magnetic treatment has no hard scientific evidence to improve the performance of tested system.

The most obvious example of the negative result was reported by Al-Qahtani in 1996, where several samples of seawater (43,000 mg/l) were circulated through a high magnetic field intensity of 7,000 gauss for several hours at fixed temperature, flow rates, and nitrogen concentration. The pH and conductivity of all of the samples were increased during the circulation time. Using RO, both the treated and untreated solutions were desalinated in a seawater RO unit at several pressures. No significant difference was seen between circulated and uncirculated solution.

Smothers et. al. (2001) tested the effect of three different magnetic devices on the type and the quantity of scaling mineral deposit on the three shell and tube heat exchangers using potable water as supplied water. The results did not indicate any clear advantage for any of the three devices tested versus a control for the inhibition of mineral scale formation or the corrosion of copper. The amount of mineral scale formed for the control versus device heat exchange tubes was relatively constant. The scale formed was found to be a type of calcite ($CaCO_3$) and had the same crystalline structure for each heat exchange tube. There was no effect on the crystalline structure of the scale formed by any of the tested devices. On the other hand, many other researchers also reported a positive result and proposed a model to explain the effect of magnetic treatment as given below.

Mergen et al., (2008) tested the magnetic ion-exchange resin treatment for the removal of natural organic material using a bench scale method in a continuous operation. Treatment shows a high percentage removal. Tai et al. (2008) used permanent magnets of different intensities to investigate its effect on the crystal growth of calcite in a fluidized bed using the constant composite technique. The result confirms that the calcite growth rate in the presence of a magnetic field was lower than those in the absence of magnetic field. Alimi F. et al. (2009) investigated the influence of the material of the pipe on calcium carbonate precipitation under magnetic treatment. The result of the experiments proved that magnetic water treatment affects calcium carbonate crystallization by favoring its formation in bulk solution, instead of its incrustation on the wall. Stuyven B. et al. (2009) offered a new explanation for the mechanism of magnetic treatment's ability to prevent scale. The results of the experimental work prove that water contains suspended micron size particles that can be fragmented by application of orthogonal magnetic field on a turbulent flow, which results in size-reduction by two to three orders of suspended salt particles and increases the surface area of these particles by four to six orders. So precipitation will occur in the larger surface area present that could explain why the precipitation will increase in the bulk solution instead of the surface area of the container or pipes.

Gryta M. (2011) investigated the effect of using magnetic water treatment to reduce calcium carbonate deposit during membrane distillation. The result confirmed that the flow of water through the magnetic field has a considerable influence on the morphology of $CaCO_3$ precipitation during the thermal decomposition of bicarbonates. Bin et al., (2011) investigated the effects of magnetic field on sodium, magnesium and calcium ions in chloride solutions. He concluded that magnetic treatment leads to an increase of diffusion coefficients of

magnesium, sodium and calcium and a decrease of chloride ions. The result confirms that magnetic treatment is beneficial for the separation process of brine water from seawater. Madsen (2004) reported that the calcium carbonate crystal formed from mixing calcium chloride solution with sodium carbonate solution under magnetic treatment, results in the crystal-size decrease with increasing strength of the magnetic field.

Cefalas et al., (2008) used the x-ray diffraction analysis to analyze the effect of 1.2 T magnetic fields on the calcium carbonate precipitated crystal form. The magnetic field was found to increase the precipitation of aragonite and decrease the formation of calcite. Cefalas et al. also proposed a quantum mechanical model which stated that, magnetic fluctuation inside the liquid can be amplified by exchanging energy with the magnetic field through an angular momentum of the water molecular rotors and with the macroscopic angular momentum of the turbulent flow. The gain is higher if the magnetic fluctuation is in resonance with the rotational frequencies of the molecular rotors or low frequencies of the turbulent flow. The authors added that, at low external magnetic field, the formation of aragonite takes place when a vacuum state electromagnetic mode is trapped, amplified and sustained in a coherent antisymmetric state, which is created by an ensemble of individual molecular rotors which are excited coherently by the external magnetic field. The amplified magnetic mode will not decay to the ground symmetric state of the ensemble of water molecular rotors due to the forbidden nature of transition between the antisymmetric and the symmetric state. The ensemble of water molecular rotors is then driven to a higher, free-energy state for a longer period of time, allowing thus the $CaCO_3$ precipitants to be crystallized as aragonite. Furthermore, the existence of the coherent antisymmetric state, elucidate the memory effects observed previously in water solutions. Coey and Stephen also reported an increase in aragonite and/or calcite ratio in the deposit when using a magnetic field of 0.1 T, and the authors also confirmed that the memory of magnetic treatment can last up to 200 hrs. Szczes et al. (2011) reported that, when an electrolyte solution was exposed to a weak static magnetic field (MF) generated from a stack of magnets (B = 15 mT) at the flow rate of 1.4 ml/s, a change in the electrolyte conductivity was recorded. it was found that the changes in electrolyte conductivity depended on the kind of electrolyte and the magnetic exposure time and are related to the thermodynamic function of hydration. The magnetic treatment was founded to increase the amount of evaporated water. The literature review showed that the effect of magnetic treatment was tested in numerous scientific journals, which obviously showed that the attention to this treatment method has been increasing in recent years. However, a review of the available literature is rather confusing due to the often contradictory results that are reported. The main drawback in the literature is that a part from many conventional theories, the effect of magnetic field on the physical and chemical properties of water, was recently interpreted on the basis of quantum field theory which was proposed by Cefalas et al., (2008) in agreement with previous work. Moreover, there is difficulty in getting reproducible results on a laboratory scale. However, it can be said that the available literature generally agrees on some principles of operating conditions for such devices given as follows:

- The magnetic treatment can lead to the formation of $CaCO_3$ particles in the bulk of scaling solution, instead of precipitating on the internal surface, and these particles are carried away by the water flow.
- The result of experimental research confirmed that homogenous nucleation increased in the presence of magnetic treatment, resulting in the formation of crystals that are greater in numbers with smaller sizes
- Furthermore, it has been reported that the fluid must be orthogonal with respect to the direction of the applied magnetic field (Busch et al., 1986). However, some studies have mentioned that a magnetic field

strength of at least 0.05 T is required for successful treatment, although this would depend on the composition of water and the type of device.

Testing the Magnetic Treatment at Doha Reverse Osmosis Plant (DROP)

The magnetic treatment methods have been tested at KISR for a different client at DROP. Different types of experiments were conducted on the magnetic treatment but with different objectives. The first experiment studied the effect of magnetic treatment on the quality of feed water (chemical-physical and biological effect) using a stagnant magnetic field. The second experiment was conducted at DROP to test the effect of magnetic treatment on the operation parameters of RO system as salt passage, salt rejection, recovery, and differential pressure in an open cycle system. The result of both the experiments proved to be negative, except for a few physical parameters showing a little difference, as TSS and turbidity, and the effect of magnetic treatment were considered to be invisible. However, when a further research was conducted to investigate the previous research done on magnetic treatment, it was found that the pH, conductivity, salt passages, chemical compositions are not suitable tools for evaluating the efficiency of magnetic treatment. Similar treatment methods used by many other researchers also yielded a negative result, since the effect of magnetic treatment is visible only when there are suspended particles or during the formation of scale particles. The magnetic treatment was found to have a positive effect only when either the morphology of crystals formed or the number and size of crystals formed was studied. In addition, the magnetic treatment showed a positive effect on the retention time required for scale formation.

Therefore, the effects of magnetic treatment on different types of scaling compounds were tested in KISR at DROP using other tools for evaluation. $CaCO_3$, calcium sulfates ($CaSO_4$) and barium sulfates ($BaSO_4$) were tested in two identical operating conditions with magnetic treatment and without magnetic treatment.

Experimental Details

The magnetic unit used in the experiments consisted of three pairs of permanent magnets with north and south poles facing each other. Each polar piece is the assembling of two rectangular permanent magnets. Fixed at steel frame 14 mm apart (The induction of the magnetic field (B) is 0.16 T in the air gab, for each pair of magnet device. The magnetic effect on the formed scaled was tested under an ambient temperature at DROP (22°C). The effect of the magnetic treatment on retarding scaling deposition was tested using three different synthesis-saturated scaling solutions.

Each solution was saturated with one type of scaling compounds such as BaSO4, CaCO3, or CaSO4. The prepared saturated solution in the feed water tank will flow to the test tank, through a magnetic device oriented orthogonally to the direction of flow as shown in the tested unit in Fig 1. First NaCO3 solution will be circulated through the magnetic device without mixing with CaCl2 solution for 24 hours before starting the experiment. Then the zero time will be considered exactly as the time of mixing CaCl2 solution with NaCO3 solution, and then a sample will be drawn from the test tank every one minute for analyzing the scaling species. Turbidity and concentration of scaling species were used for evaluation the magnetic treatment. Turbidity was measured continuously using a dipping turbidity meter as shown in the tested unit. Dipping turbidity meter is able to display an automatic reading for turbidity. All of the proposed test solutions were tested under the same magnetic field's strength and at stagnant condition. The turbidity and concentration of soluble scaling ions versus

time used as indicators for scaling precipitation versus time. Whereas, when the initial concentration of the scaling compounds in the tested solution decreased, the precipitation of the scaling compound is indicated. However, if the magnetic treatment is effective in retarding the precipitation of the scaling compounds, the concentration of the scaling species will be constant for a period equal to the retention time. Then, the concentration of scaling species will be plotted versus time and the evaluation of magnetic treatment will be based on these graphs.

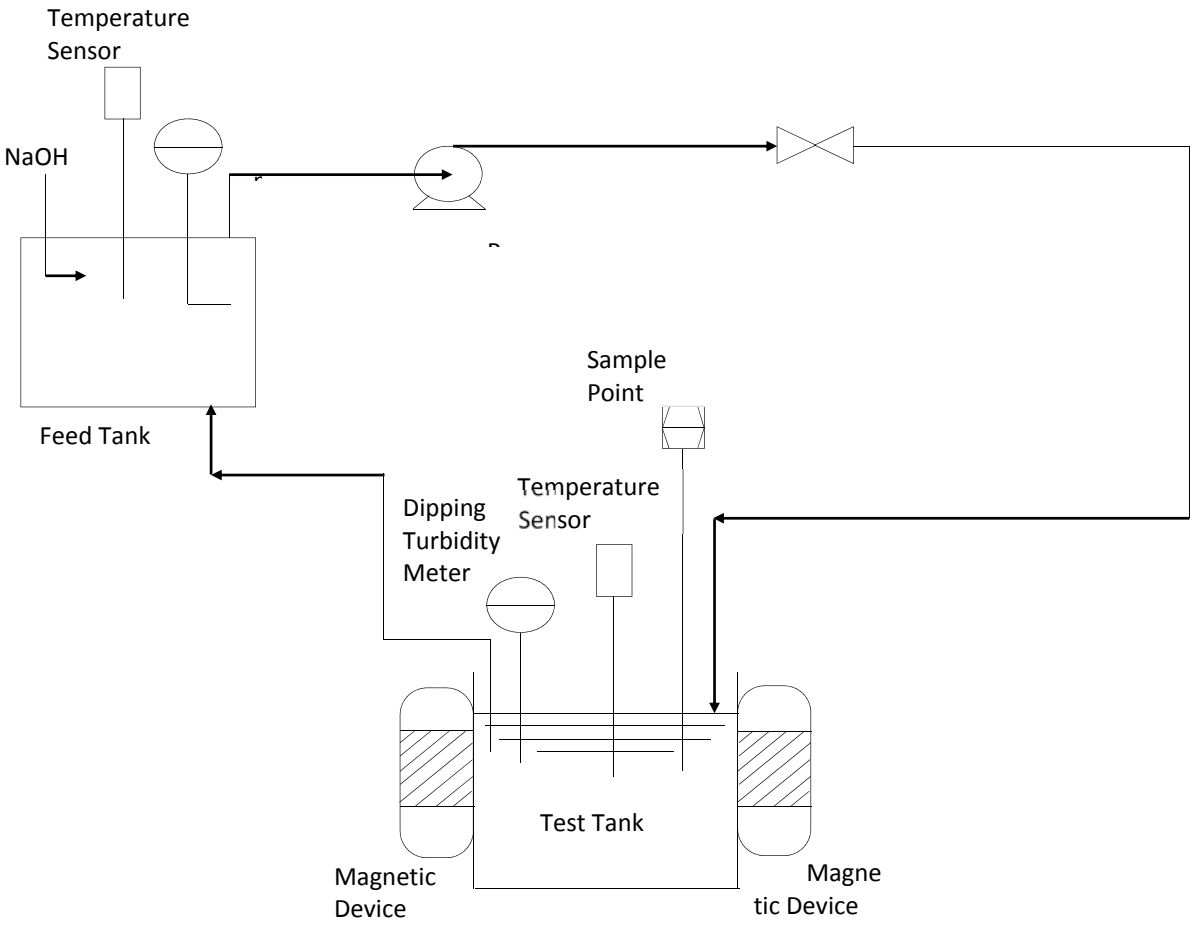

Fig. 1. The schematic of the experimental test plant.

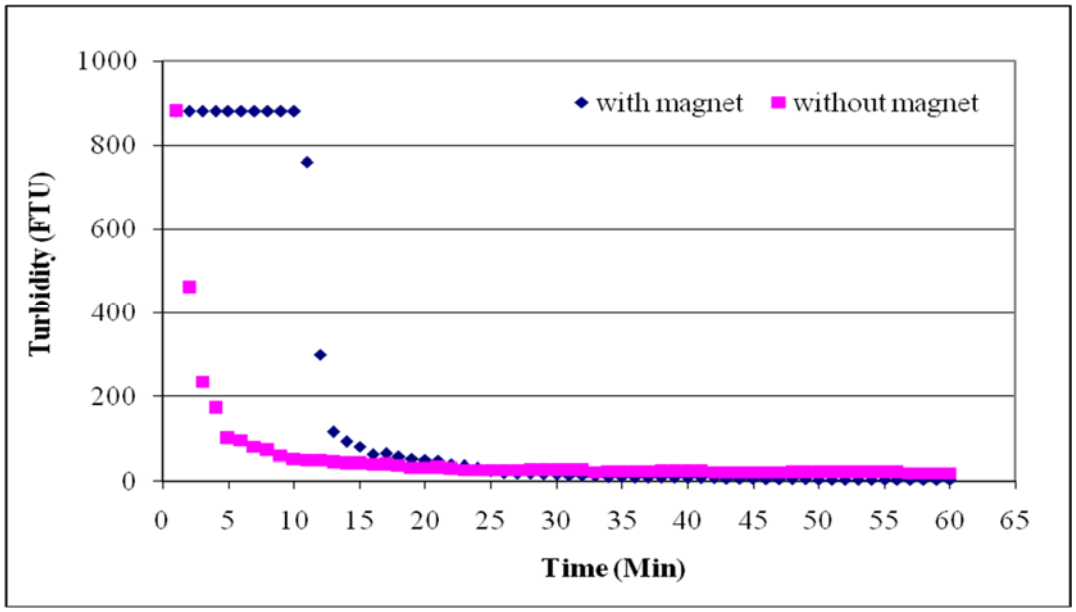

Fig. 2. Turbidity of $CaCO_3$ solution under stagnant condition versus time.

The Effect of Magnetic Treatment on Calcium Carbonate Scaling

Calcium carbonate ($CaCO_3$) solution was prepared by mixing 0.5 M of calcium chloride ($CaCl_2$) with 0.5-M sodium carbonate ($NaCO_3$) in the feed tank. When applying a magnetic treatment, the $NaCO_3$ solution was treated with the magnetic unit for about 24-h before mixing. Then turbidity of the solution was measured immediately after mixing in the tested tank. The turbidity of the mixed solution, which contained $CaCO_3$ particle solution was measured every one minute; the first solution under the magnetic treatment, the second solution without magnetic treatment. The measurement of the turbidity was continued for about 60 min. Fig. 2 shows the effect of magnetic treatment on a solution containing $CaCO_3$ particles in a stagnant condition. The effect of the magnetic treatment on the $CaCO_3$ scale particles was confirmed. Hence, the magnetic treatment succeeded in keeping the particles of $CaCO_3$ formed in a suspension state for almost 10 min. Furthermore, without any treatment, the turbidity of $CaCO_3$ solution decreased after one minutes of mixing from 800 FTU to 500 FTU. The decreasing trends continued until it reached 100 FTU after 6 min of mixing.

Zero turbidity was reached after about 13 min of mixing. Under the magnetic treatment, the turbidity of the CaCO3 solution reached the 100 FTU turbidity after about 16 min instead of six min without magnetic treatment. However, figure 2 shows that the effect of magnetic treatment was almost negligible after 16 min of CaCO3 formation. The second experiment was conducted using similar conditions as the previous experiment, but the dissolved calcium ion was analyzed before mixing and after mixing every 10 s to three minutes, then the analysis was conducted every one minute for almost one h. The decrease in Ca2+ ion from the initial concentration represented the precipitated salt as CaCO3 scale.

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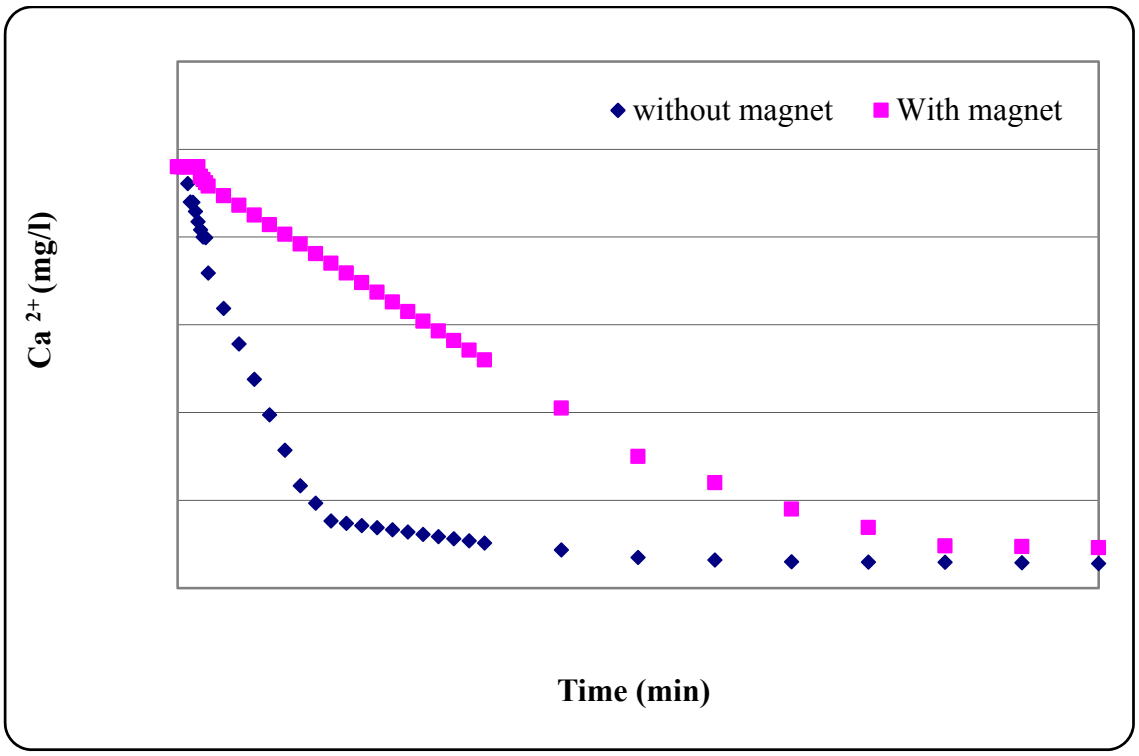

Fig. 3. Calcium ion analysis of $CaCO_3$ solution in flowing condition versus time.

Figs. 3 shows the analysis of Ca^{2+} ion in a flowing solution directly after the formation of $CaCO_3$ particles. The effect of magnetic treatment on the Ca^{2+} ions was found to be stronger than the effect of magnetic on the turbidity of $CaCO_3$ solution. Hence, a higher concentration of Ca^{2+} in the solutions would mean a higher prohibition for scale formation.

In other words, as the concentration of calcium ions becomes constant for a longer time (suspended), the scale precipitation would be lower and the scale prevention would be stronger. Fig. 3 shows that the magnetic treatment up to 25 min has succeeded in keeping the concentration of Ca2+ ions two and half times more than the concentration without magnetic treatment. This implies that the inhibition of CaCO3 precipitation was increased through the magnetic treatment by two and half times than that without any treatment. However, the effect of magnetic treatment was also negligible after 50 min of treatment (Fig. 3) It is worthy to mention that the Ca2+ was not prevented totally from decreasing, indicating precipitation of CaCO3, although in fewer times than without treatment.

The Effect of Magnetic Treatment on Calcium Sulfate Scaling

Calcium sulfate was formed by mixing 0.5-M NaSO4 and 0.5-M CaCl2 in the same procedure as described for CaCO3. Figs. 4 and 5 show the effect of magnetic treatment on CaSO4 solution directly after the formation of CaSO4 particles. It is worth noting that, the magnetic treatment was found to have a strong effect during the first five minutes after the formation of CaSO4. However, the effect of magnetic treatment on CaSO4 decreased gradually until 40 min after mixing when the magnetic effect was hardly noticeable. However, during

the first four min, the magnetic treatment succeeded to keep the turbidity of the $CaSO_4$ solution above 400 FTU. Whereas, the turbidity of the same solution was found to be less than 100 FTU after only one minute of $CaSO_4$ formation without treatment. Therefore, the inhibition was almost four times compared to the solution without any treatment during the first four minutes.

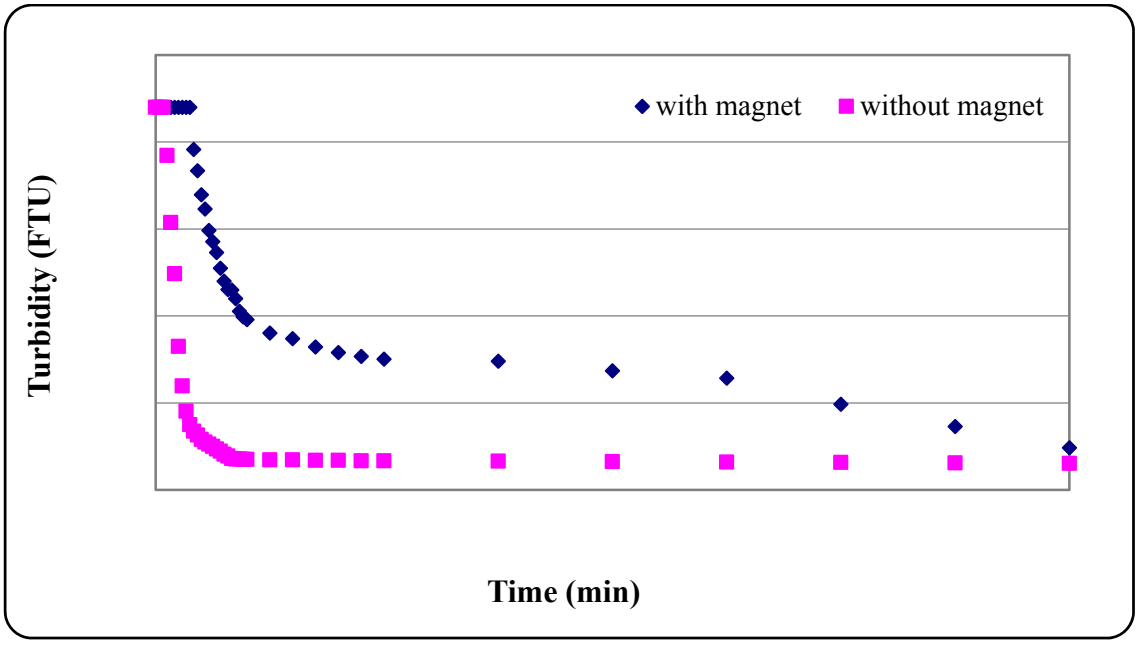

Fig. 4. Turbidity of solution of $CaSO_4$ in a stagnant condition versus time.

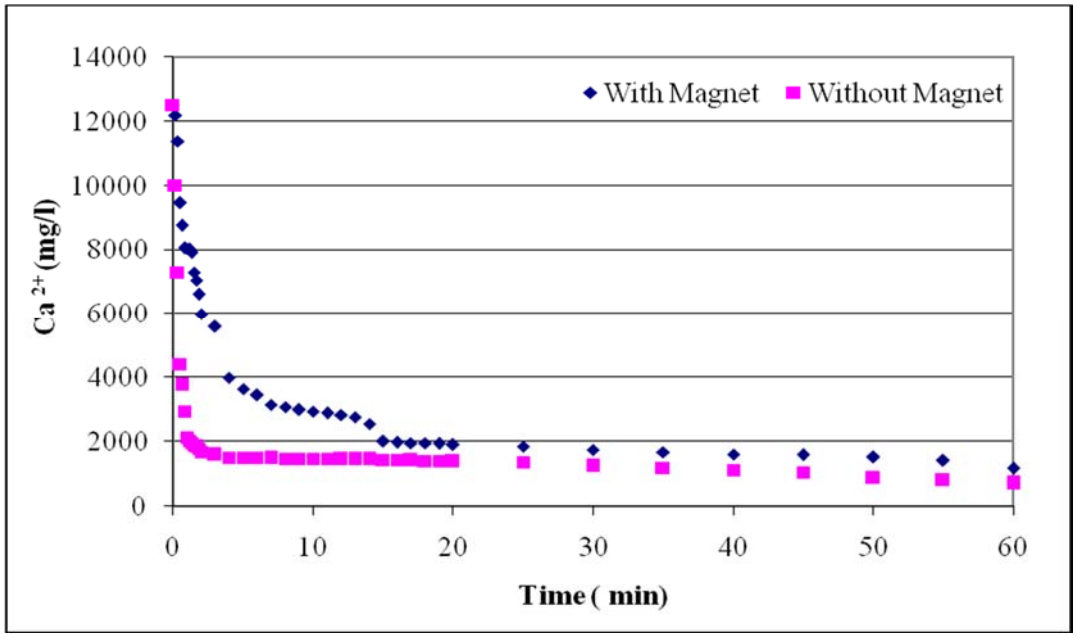

Fig. 5. The concentration of calcium ion of CaSO4 in stagnant condition.

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The effect of magnetic treatment on the Ca^{2+} was also studied and illustrated in Fig 5. The same theory was applied to the Ca^{2+} precipitation. If the Ca^{2+} ion's concentration decreased with the tested solution, this indicated a precipitation of $CaSO_4$ particles.

The concentration of Ca^{2+} ion decreased from 12000 mg/l to 4000 mg/l during the first minute of $CaSO_4$ formation without any treatment, while the concentration of Ca^{2+} ion decreased to 8000 mg/l when given magnetic treatment (Fig. 5). After two minutes, the magnetic treatment succeeded in keeping the concentration of Ca^{2+} within the range of 6000 mg/l, while the concentration was below 2000 mg/l, without magnetic treatment and in stagnant conditions. The same behavior was noticed in the flowing condition, where the magnetic treatment affected the concentration of Ca^{2+} strongly during the first 10 minutes. However, this effect decreased as time increased and became almost negligible after 20 min of $CaSO_4$ formation (Fig. 5).

The Effect of Magnetic Treatment on Barium Sulfate

$BaSO_4$ was prepared by mixing barium chloride with $NaSO_4$. The effect of magnetic treatment on the turbidity of $BaSO_4$ solution is shown in Figs. 6 . It is worth mentioning that the figure shows that for almost 6 to 7 minutes, no changes or differences were seen directly after mixing $BaCl_2$ and $NaSO_4$, and whether the tested solution was magnetically treated or not.

The turbidity of BaSO4 solution was 450 FTU for about 10 min with the magnetic treatment, decreasing to 250 FTU after 11 min and continued to decrease to 100 FTU after 12 min of mixing. However, the turbidity of the same solution decreased from 450 FTU to 250 after 7 min of BaSO4 formation and reached zero FTU after only 8 min of mixing (Fig.6).

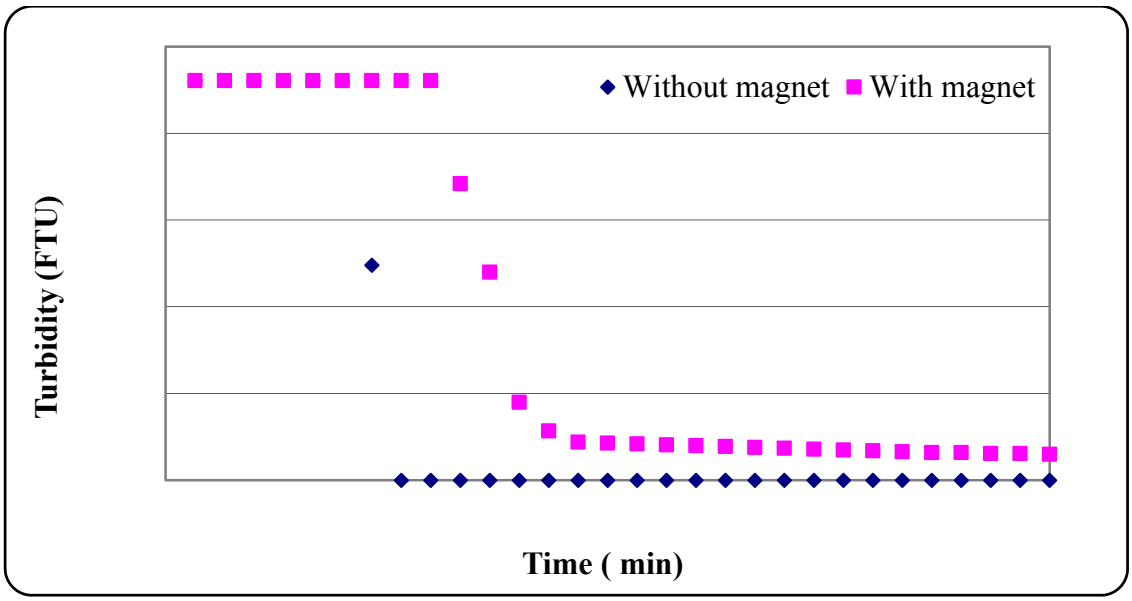

Fig. 6. Turbidity of $BaSO_4$ solution in a stagnant condition versus time.

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Figs. 7 shows the concentration of SO_4^{2-} in a stagnant condition, in a $BaSO_4$ solution. The magnetic treatment succeeded in keeping the concentration of SO_4^{2-}at the same initial concentration (7000 mg/l) for 45 min (fig.7), while without magnetic treatment, the concentration of SO_4^{2-} was found to decrease to 6000 mg/l after only five minutes in a stagnant

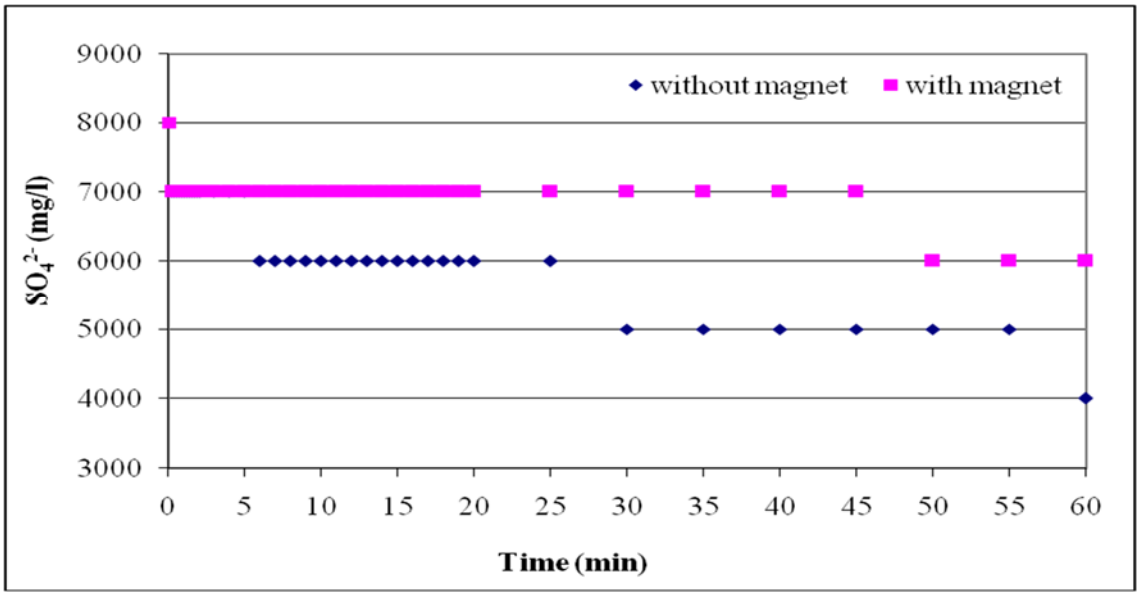

Fig. 7. The SO_4^{2-} concentration in $BaSO_4$ solution in stagnant condition versus time.

Conclusions and Recommendations

The literature survey and the results of the experimental investigation both confirm that the magnetic treatment could be effective in scale control, but the effect of the magnetic treatment on $CaCO_3$ was found to be stronger than the effect of the magnetic treatment on $CaSO_4$ or $BaSO_4$. Another major finding was that the magnetic treatment could not prevent the formation of $CaCO_3$, $CaSO_4$, and $BaSO_4$ scaling although it could reduce or retard the scale, where the experimental investigation showed that the magnetic treatment could keep the scale formed in a state of suspension long enough for it to be disposed along with the brine discharge even without any treatment. Since it is well-known that the time required for the feed water to enter and exit the desalination plant is not longer than 15 minutes. From the experimental investigation, the magnetic treatment succeeded in keeping the scale suspended for 45 min for $BaSO_4$, and 20 min for $CaCO_3$. On the other hand, the magnetic treatment inhibited the $CaSO_4$ from precipitation, for only 10 min. Thus, the effect of magnetic treatment proved to be different depending on the type of scale formed. However, in general, the effect of magnetic treatment in preventing scaling species from precipitation on the inside surface of pipes cannot be ignored. The result of the experimental investigation confirmed that the magnetic treatment depended on different parameters such as the magnetic power used, type of scale tested, and the condition of water, whether stagnant or flowing. Further investigation is recommended on this regard.

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Utilisation of Intelligent Systems in the Economical Evaluation of Transportation Projects

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Abstract: Transportation projects are high-cost investments. For this reason in order to perform correct decision making process special approaches and methods have to be used in feasibility analysis. Benefit Cost Analysis (BCA) is a widely used method all over the world and in Turkey for the economical evaluation of the transportation projects. But, the most important disadvantage of this method is the difficulties in predicting the costs, missing and lacking data and the uncertainty in the long-term analysis period risks affecting the results negatively. In order to avoid this risk, protective measures such as sensitivity analysis and probability distributions are used in the traditional benefit – cost analysis. But, in a project where there are high uncertainties and approximate data are present the said methods are becoming insufficient in real-life applications. Especially, the countries with a quickly changing socio-economic structure, for the transportation projects having long-term analysis period there are uncertainties in predicting parameters such as traffic volumes, accident data, time value etc. As a result of all those items the evaluation of the feasibility of the transportation projects is always facing risks of wrong decision-making. Therefore, the need to develop a more sophisticated method eliminating all the uncertainties of the traditional benefit cost analysis becomes evident. This paper, aims to develop a model that will contribute to the traditionally widely used benefit cost analysis in economical evaluation of transport projects by the Turkish State Highway Authority. Through this proposed model it is also aimed to eliminate the missing and uncertain data and wrong estimations in feasibility analyses. As a result the paper is proposing an intelligent system framework, utilising The Fuzzy Cognitive Map for the transportation projects' benefit cost analysis

Keywords: Economic evaluation, Benefit Cost Analysis, Transportation Projects, Fuzzy Cognitive Map, Intelligent Systems

Introduction

There are different methods for analysis of the evaluation of the transportation projects. The main idea of all of those methods is based on calculations by updating the inputs and outputs or revenues and expenses related to the project [Aktan & Sakal, 2006]. The most widely used method in the economical evaluation of the transportation investments is the Benefit Cost Analysis (BCA) method [Bilgiç & Evren, 2002]. Besides this method there are other methods such as, Net Present Worth (NPW), Annual Equivalent Cost (AEC) and Internal Rate of Return (IRR) method [Akbıyıklı, 2014].The choice of the method in the economical evaluation process is depending on the amount and content of the analysis and uncertainties of some parameters in analysis. As an example; in the developing countries, since the interest rates are high and uncertain, the IRR method is selected. On the other hand when the economic life of the project is uncertain the AEC method is applied [FHWA, 2004].

Until now benefit-cost analysis is considered as the primary economic analysis method for the infrastructure Project investments in our country. This method is a technique used in public sector as an economical tool to evaluate the efficiency of the investment projects and to choose the projects having the maximum benefits to the society or determining the priority of the projects [Aktan & Sakal, 2006]. For this reason it is considered to a very important economic analysis for big infrastructure transportation investment projects. With the help of this analysis, benefits and costs in different alternatives are determined and measured systematically and used a decision making tool to decide for the feasibility of the project.

Benefit Cost Analysis method is requiring a lot of data to be analysed. At the same time this method is also including future predictions in its long evaluation period. In order to obtain a correct result from the analysis the mentioned data and estimations also have to be correct and complete. But, it is very difficult to make correct estimations for the future in countries having social and economic indeterminacy and ambiguities. Besides not systematic data collection creates wrong statistical data and in conclusion resulting an economic analysis that is totally based on wrong inputs and as a result fatal wrong decision making becomes unavoidable. Therefore, it is

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needed to develop a model that will eliminate all of these ambiguities faced in the traditional benefit – cost analysis method.

In this study, it is attempted and aimed to develop a model that will contribute to the existing benefit – cost analysis used by the Turkish Highway Directorate in economic evaluation and feasibility studies of highway investments. In this respect through this proposed model it is aimed to eliminate the missing and uncertain data and wrong estimations in feasibility analyses and propose an intelligent system framework, utilising The Fuzzy Cognitive Map for the transportation projects' benefit – cost analysis.

General Directorate of Highways Traditional Benefit Cost Analysis

The economic analysis of Turkish Highway Directorate is based on two pillars: The first is costs which are composed of expenses starting from the Project Initiation to Project Handover. The second is benefits which consist of revenues expected during the Project evaluation period [KGM, 2013]. The benefit and cost parameters used in economic analysis by the Turkish Highway Directorate is shown in Table 1.

Table 1: Parameters used by Turkish highway directorate for benefit cost analysis

Agency Costs (Costs)	Road Users' Costs (Benefits)
• Road construction costs • Operation and maintenance costs	• Time costs • Accident costs • Vehicle operating costs

The benefit and costs indicated in Table 1 is discounted to net present values by suitable discount rate. There are two fundamental concepts in dealing with compounding and discounting process in engineering economics. These are:

1. Compounding Process

To solve for the future sum F we use Equation 1;

$$F = P\,(1+)^n = P\,(\frac{F}{P}\,, i\,, n) \qquad (1)$$

Here, P is the present value, n is the interest periods and i is the interest rate. F is the accumulated sum at the end of the n periods. The factor $(1 + i)^n$ is known as the single - payment compound-amount factor. Given this factor, all other important interest factors can be derived. The (F/P) factor is referred to as compounding factor and the process of finding F is known as compounding process [Akbıyıklı, 2014].

2. Discounting Process

Finding the present worth P of a future sum F is simply the reverse of compounding and is known as the discounting process [1].

$$\mathrm{P}=\mathrm{F}\left[\frac{1}{(1+\mathrm{i})^{\mathrm{n}}}\right]=\mathrm{F}\left(\frac{\mathrm{P}}{\mathrm{F}}\,,\,\mathrm{i},\,\mathrm{n}\right) \qquad (2)$$

Here, the $(1/(1+i)^n$ factor is known as the single-payment present-worth factor and is designated as (P/F) factor. This factor is also referred to as the discounting factor and the process is known as discounting process [Akbıyıklı, 2014].

The economic discounting process and the decision rule for benefit – cost analysis and (B/C) ratio is shown in Equation 3.

$$P_{Benefits} = \sum_{1}^{n} \frac{F_{i\ accident}}{(1+i)^n} + \sum_{1}^{n} \frac{F_{i\ time}}{(1+i)^n} + \sum_{1}^{n} \frac{F_{i\ vehicle\ operating}}{(1+i)^n}$$

$$P_{Costs} = \sum_{1}^{n} \frac{F_{i\ maintenance}}{(1+i)^n} + P_{construction}$$

$$\frac{P_{Benefits}}{P_{Costs}} > 1$$
$$\rightarrow \quad accept \qquad (3)$$

In equation 3 all the benefits and costs (including the first capital investment cost) are discounted to the present value and established the ratio (B/C). If we are to accept the project the ratio has to be greater than 1. The most important features of the analysis are that all the data related to time values, vehicle operating costs, accident costs, construction costs and operation and maintenance costs have to be correct and without ambiguities. Otherwise wrong data will create wrong decision making accordingly no value for money for the taxpayers. Ultimately a sensitivity analysis is done as final step of the economic evaluation process for the investment project.

Benefit- Cost Analysis Proposal

It is aimed to remove all the indefinite and imprecise and missing data and wrong estimations in the developed benefit-cost model. It is aimed to evaluate the traditional benefit-cost analysis from a wider perspective of risk analysis framework. The constituent parts of the proposed framework are shown in Figure 1 below.

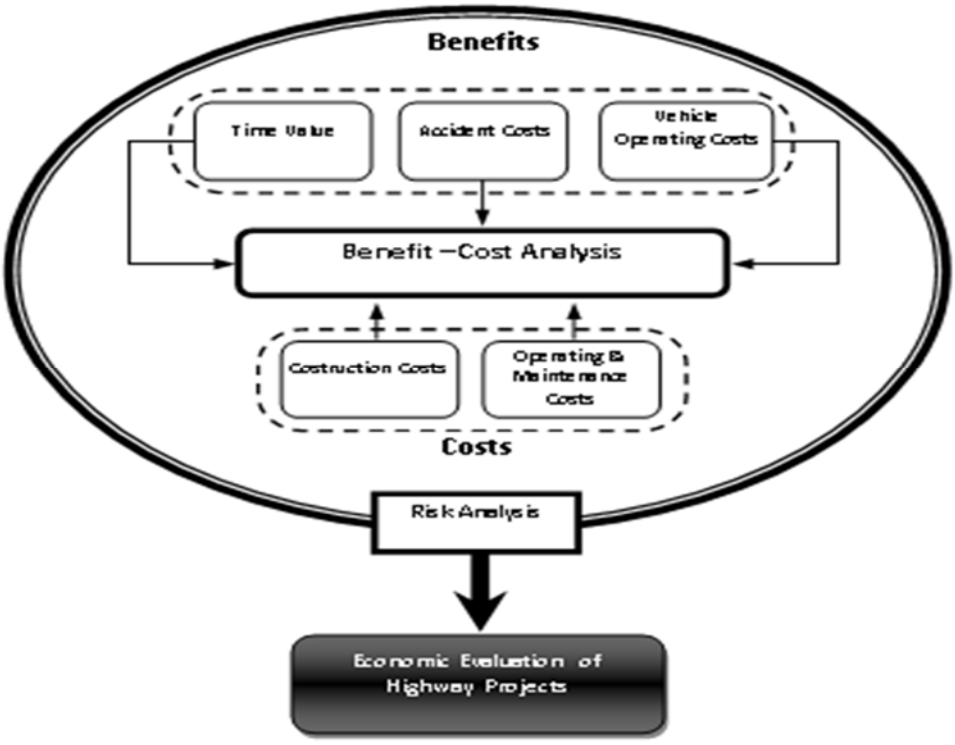

Figure 1: The constituent parts of the developed model

As it is shown in Figure 1 the parameters of traditional benefit-cost analysis it is evaluated within the domain of risk analysis framework. It is needed an intelligent system in order to realise this new analysis process. The intelligent system to be used in the proposed model is expected to have a structure that minimise the negative

effects of non-linear, missing and doubtful data. It is assumed that the Fuzzy Cognitive Map method has the ability to fulfil the necessities for the development of the model.

The Fuzzy Cognitive Map plays an important role in defining and modeling complex systems. The Fuzzy Cognitive Map is sheltering solutions depending on the human experience and knowledge in the direction of the dynamics of the system and against different conditions. With this structure the method is widely and effectively applied in decision making analyses.

The Fuzzy Cognitive Map, as shown in Figure 2, is consisted of the conceptual variables of the nodes or the elements composing the system and the lines between the nodes having both directions and weights showing the relations between the conceptual variables [Yaman & Polat, 2009].

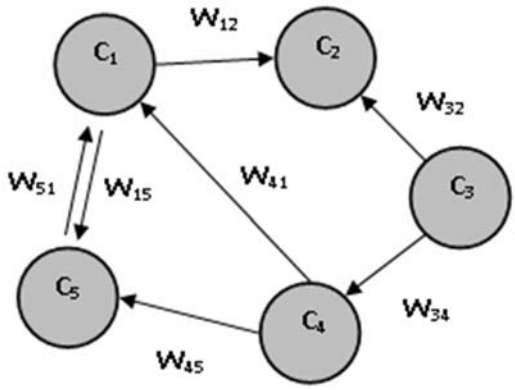

Figure 2: A simplified fuzzy cognitive map [Kosko, 1986]

Conceptual variables or concepts; can indicate mode, variable, event, activity, aim, etc. every conceptual variable, takes variable values by time as result of interaction with other In the Classical Fuzzy Cognitive Map conceptual variable values can within the range of (0,1).. The relations between conceptual variables are defined as fuzzy and have a value in [-1,1] range [Groumpos, 2010]. The conceptual variable value (A_i) for each conceptual variable is calculated with equation 4:

$$A_i^t = f\left(\sum_{\substack{j=1 \\ j\neq i}}^{n} A_j^{t-1} W_{ji}\right) \quad (4)$$

A_i^t, gives the value of C_i conceptual variable at time t; A_i^{t-1}, gives the values of C_j influencing the conceptual variable C_i at time (t-1); W_{ji}, is the influence value to C_i from C_j conceptual variable; and f is the threshold function [Xirogiannis et. al, 2004]. The most used threshold function for the fuzzy cognitive map is given in Equation 5:

$$f(x) = \frac{1}{1 + e^{-\lambda x}} \quad (5)$$

The most important matter in fuzzy cognitive map is establishing the skeleton of the model to be improved and the prediction of the concepts in the system influencing each other. In a later step the determination of the weights between the concepts are realised. The fuzzy cognitive map structure for the developed benefit cost model is shown in Figure 3.

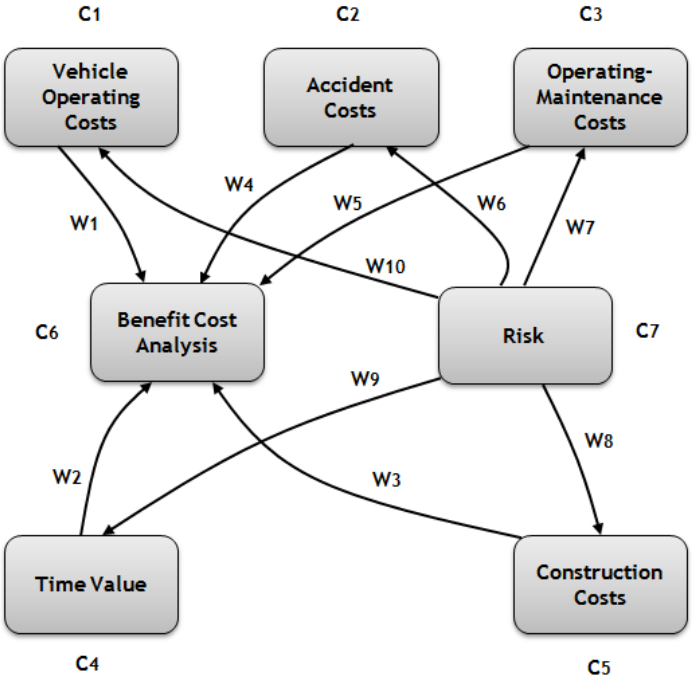

Figure 3: The fuzzy cognitive map of the developed model

As shown in Figure 3, the traditional benefit-cost analysis is put forward in fuzzy cognitive map method. The Model, contains the fundamental parameters of traditional benefit – cost analysis namely, accident costs, time value, vehicle operating costs, construction costs and maintenance costs. In the developed model it is included the risk parameter in the traditional benefit-cost analysis and the effect of this parameter on the other parameters is considered. The system is considered in two ways: The first, predicting the relations and effect levels between the results of basic parameters of the benefit-cost analysis and fuzzy cognitive maps method. The second, fuzzy risk analysing of these basic parameters and predicting the risk value effects on the system. As a result of the analysis and by predicting the weights between the concepts an adjacency matrix will be determined. In Figure 4 is shown such an adjacency matrix for the developed model.

	C_1	C_2	C_3	C_4	C_5	C_6	C_7
C_1	0	0	0	0	0	W_1	0
C_2	0	0	0	0	0	W_4	0
C_3	0	0	0	0	0	W_5	0
C_4	0	0	0	0	0	W_2	0
C_5	0	0	0	0	0	W_3	0
C_6	0	0	0	0	0	0	0
C_7	W_{10}	W_6	W_7	W_9	W_8	0	0

Figure 4: Adjacency matrix

In Figure 4 it is shown the adjacency matrix expressing the effectiveness weight levels between the concepts in the system. The W_1, W_4, W_5, W_2, W_3 in the matrix show the effect values related to the result of the parameters in the traditional benefit – cost analysis; the W_{10}, W6, W_7, W_9, W_8 weights show the effect of the risk parameters on the other concepts. As a result of the creation of this matrix and with the help of the Equation 5 the system will be ready to be operated.

The most important matter here is how the calculation of the effect of other concepts will be done after the inclusion of the risk parameter in the developed model.

The risk parameter included in the model will affect the concepts in the system in different levels. Therefore this parameter with a special evaluation method must effect each of the concepts in the system. At this stage the techniques used to determine the weights used in the fuzzy cognitive map method will not be sufficient for this parameter. Now, a new approach is necessary for the prediction of the effects of the risk parameter on other concepts. The steps of the new proposed approach are as follows:

Traditional risk analysis steps have to be used in finding the effect of risk parameter on the other concepts in the system. In this respect the main steps of the traditional risk analysis have to be followed in order to the prediction of the risks, identification of the risks, estimation of the risks and evaluation of the risks.

The prediction and definition of the risks have to be obtained from a deep literature review of benefit-cost analysis of the General Directorate of Highways in Turkey.

1- At the stage of the estimation of risk done have to get help from the specialists of feasibility studies in the General Directorate of Highways in Turkey.
2- The evaluation of the risks has to be done using fuzzy risk analysis method in order to obtain the weight values.

The developed method is aiming to reach the result by risk analysis of each concept in the traditional benefit cost analysis. In this respect each concept will be included in the result as specified risk coefficients. These coefficients are not dynamic and will be obtained after some analysis. These, as shown in Figure 4, will be included in the matrix as static coefficients. The evaluation of these coefficients is in progress.

Conclusion

The highway investments' economic evaluations is depending mainly on future predictions and estimations and obtaining of correct information and data. On the contrary, the wrong decision making by the decision makers will choose Project that are no feasible and no benefits to the society, As a result of this view many economically and socially unpredictable countries with insufficient data for economic analysis are preparing analysis that barely are numbers without applicability in real-life projects. The sensitivity analysis, made at the end of the economic analysis, remains as a general risk analysis on the determined parameters depending on the foresight of the analyst foresight of the analyst. But, since the benefit-cost analysis is the project's "feasibility" evaluation, it has to be put forward as a complete risk evaluation analysis since it will affect the project for many years in future. In this paper risk parameter is included in the proposed benefit-cost analysis model and all the system is evaluated with this parameter aiming to get the most correct result. The final result will be obtained by the inclusion of risk parameter together with the traditional benefit-cost analysis concepts (time value, vehicle operating costs, accident costs, operation and maintenance costs) a final risk analysis will be done. Such an approach will give more reliable conclusions.

The calculation of weights for the model proposed using fuzzy cognitive maps method is continuing. When the model is final the economic evaluation of transportation projects will be closer to the real result.

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