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# **The Cyprus Journal of Sciences**

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## From the Editor

Dear Readers, I acknowledge the worthy contribution of all the authors and friends of our Journal. Their commitment and loyalty to science and society have been expressed in variegated forms throughout the development of the academic journal edition summer 2006.

A special “thank you” is extended to the many academics who consciously serve in the Editorial Board. Appreciating the role of the Editorial Board for the successful development of our Journal, in this current edition the Editorial Board is enriched with the participation of new academics from various fields such as Humanities and Social Sciences, Information and Engineering Systems, Management, Leisure, Tourism and Hospitality, Accounting, Economics, Finance and Marketing. Namely, Anton Anthonissen and Paul Verweel of the University of Utrecht, the Netherlands, Caroline Ann Wiscombe of the University of Wolverhampton, the UK., Constantinos-Vasilios Priporas of Athens Graduate School of Management, Greece, Costas Zafiropoulos and Vasiliki Vrana of the Technological Educational Institute of Serres, Greece, Vasilios Grammatikopoulos of the Thessaly-TEFAA, Trikala, Greece, Evangelos Charos of Merrimack College, the USA, Graham Orange of Leeds Metropolitan University, the U.K., Kalliope Agapiou-Josephides and Savvas Katsikides of the University of Cyprus, Cyprus, Marianna Sigala of the University of the Aegean, Greece, Sofiane Aboura of Essec Business School, France and Suzanne Gatt of the University of Malta, Malta.

In the edition summer 2006 of *The Cyprus Journal of Sciences*, an impressive variety of articles is presented that should be of interest to readers due to their insights into theoretical issues in various scientific areas, their innovative methodologies and the substance of their findings. I truly believe that you will find them interesting. With this volume our aim was also to minimize the time that elapses between acceptance and publication of articles. I believe that we have succeeded in this.

I express my appreciation and my best wishes to all the contributors and readers of *The Cyprus Journal of Sciences*.

*Charalambos Louca*



## SUCCESS FACTORS FOR DISTANCE EDUCATION COURSES

ARETI VALASIDOU\*

### ABSTRACT

*Distance education has rapidly developed due to the need of people who are geographically isolated or with limited free time to be educated. Therefore, institutions who decide to offer a course via distance need to take into consideration some issues regarding the instructors' and students' characteristics and technology in order to succeed. The main aim of this paper is to describe the results of a primary research that took place at the Greek Open University and identify the main factors that lead to the distance education success.*

*Keywords: Distance Education; Technology; Success Factors; Greek Open University; Factor Analysis.*

### 1. INTRODUCTION

Advancements in information and communication technologies have created opportunities for educational institutions to expand the educational process beyond the traditional classroom without any geographical or time constraints. Thus, distance education programmes have rapidly expanded.

This increased investment in distance learning initiatives appears to have occurred as a reaction to the view that higher education is in crisis centered on three issues: access to education, the cost of providing education and dwindling public revenues (Daniel, 1997; Simonson et al, 1999). Both authors believe that the use of information and communication technologies (ICTs) in teaching and learning will provide at least a part of the solution to many of these issues. Specifically, Daniel (1997) believes that technology can effectively help university's renewal by offering lower costs and unique attractions for potential students.

However, in order for the modern universities to take advantage of these new opportunities that the development of ICTs offers, there is a need to explore this evolving methodology of e-learning, determine its specific benefits and obstacles and clarify a vision for the future (Miller and Honeyman, 1993). The integration of information and communication technologies into a distance teaching and learning-process reflects a change in the classroom-based model that teachers have used until

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\* Scientific Collaborator at the Department of Accounting and the Department of Business Administration of the Technological Educational Institution (T.E.I.) of Serres, Greece

now. From the perspective of the students, there is a need to understand the new role of the educator as a facilitator and a guide rather than the knowledge transmitter. This new role of the educator as well as of the students creates the opportunity to explore the factors that are connected to them and contribute to the effectiveness of distance education courses.

This paper aims to identify the success key factors of distance education based on the case of the courses that the Greek Open University (GOU) offers. The first section defines the concept of distance education. In the second section a review of the literature will identify the key factors that contribute to the success of distance education courses and the third section will describe the method used to conduct the research. The last section presents the findings and a discussion.

## 2. CONCEPT OF DISTANCE EDUCATION

Formal distance education has existed since the late 1800s when it was known as correspondence education. This initial form of distance education was offered using some kind of technology, either to deliver instructional materials or to teach courses. Holmberg (1986) supports that the recognition of distance education was made when the International Council for Correspondence Education changed its name to the International Council for Distance Education (<http://www.uni-oldenburg.de/presse/uni-info/ui-9510/icde.htm>).

Many different researchers have applied the terms “distance education” or “distance learning” interchangeably to a great variety of programmes, providers, audiences and media. Distance education has been defined as an educational process in which a significant proportion of the teaching is conducted by someone removed in space and/or time from the learner (Keegan, 2000:68). Its characteristics are the separation of teacher and learner space and/or time, the volitional control of learning by the student rather than the distant instructor (Jonassen, 1992), and noncontiguous communication between student and teacher, mediated by print or some form of technology.

Distance education has many advantages for both the instructor and the students as well as for the institution or the company that will implement it. According to Picciano (2002:35) the main advantages of distance learning can be summarized into the following statements:

- Reach a wider student audience.



- Broad array of choices: earn a degree, sharpen ones work skills, obtain continuous education credits and prepare for a new job, all without leaving the computer.
- Meet the needs of students who are unable to attend on-campus classes.
- Involve outside speakers who would otherwise be unavailable.
- Link students from different social, cultural, economic and experiential backgrounds.
- Usually distance learning programs are self paced.

However there are many challenges that distance education faces during its implementation. It tends to isolate students physically, which can have negative effects on team building and sociability. Students with an aptitude for verbal expression may suffer in the virtual classroom because the opportunities for them to speak up are very limited. On the other hand, those who feel shy about speaking up in a classroom may be more likely to ask their questions in this environment. Students who get frustrated with technology may lose faith. Finally, distance students need to be self-motivated and self-directed in order to succeed on their studies, characteristics that are difficult to develop (Picciano, 2002).

Course materials and communication with the instructors may rely on traditional (such as print and telephone) or newer technologies (such as electronic communication) (Simonson et al, 2000). Consequently, distance learning can be defined as any approach to education delivery that replaces the same-time, same-place, face-to-face environment of a traditional classroom.

### 3. LITERATURE REVIEW

Many authors attempted to explore the factors that contribute to the success of distance education courses based on literature sources or findings of research.

McAlister et al (1999) pointed out the important role that design plays during the implementation of this type of programmes. A set of twelve questions is proposed and the institution needs to answer them in order to ensure the quality and success of the educational process. According to the answers, the educators need to be familiar with the latest technological developments that the course uses. They also have to interact with the students in order to replace the face-to-face communication during the conventional class-based teaching.

Alexander (2001) proposed a more comprehensive framework for the design, development and implementation of distance learning systems in higher education. According to this framework, successful distance learning takes place within a

complex system involving the student's experience of learning, teachers' strategies, teachers' planning and thinking, and the teaching/learning context. Especially for e-learning courses, staff development focuses on the level of technological delivery strategies when other issues such as the instructors' conception of learning has a major influence on the planning of courses, development of teaching strategies and what students learn.

Volery and Lord (2000) paper is drawn upon the results of a survey conducted amongst students enrolled in one distance management course at an Australian university. Three critical success factors were identified: technology, the instructor and the previous use of the technology from a student's perspective. They also argue that the lecturer will continue to play a central role in distance education, though his or her role will become one of a learning catalyst and knowledge navigator. Specifically, the lecturer can engage the students at many different levels and catalyse students so they can discover their own learning that is crucial.

Another study (Sigala, 2001) attempted to identify the critical success factors that affect the effectiveness of online distance learning environments, which in turn would give fruitful insight into the development, design and implementation of such virtual learning environments. The paper first analysed the theoretical underpinnings of online learning and then discussed several potential factors that can affect its effectiveness. The latter fall into three categories: technology factors, characteristics of instructor and characteristics of learners. The significance of these factors was tested by gathering data from students participating in a distance learning environment.

Levy (1999) attempted to define six factors that an institution needs to consider during the planning of distance learning programmes in higher education. Her paper dealt with the following six areas: vision and plans, curriculum, staff training and support, students' services, training and support, copyright and intellectual property and change in organisational structure. The time it takes to appropriately plan for all areas of distance learning will aid the institution in using its limited resources effectively, efficiently and wisely.

Honey's (2001) paper attempted to define the factors that can provide successful teaching. The first factor refers to the effective use of technology from both the instructor and students. Second, it is very important that the students have basic knowledge of the use of computers and the learning process to be actively encouraged and supported. Honey insists that distance education is good in parts – it clearly has plenty of potential and is a welcome addition to a long and varied list of learning opportunities. However, there is certainly room for improvement.

Schrum and Hong (2002) tried to identify the dimensions of successful distance students by examining the results of primary research and combining them with the results of literature review. The second step was to ask the opinion of expert distance educators about these dimensions and propose strategies of ensuring success. Seven dimensions were identified and include: student expectations, their learning preferences, experience of technology use, study characteristics, work and family obligations, personal characteristics and habits. Moreover, many strategies were identified in order to succeed in distance education such as conferencing, subject variety, frequent interaction and participation.

During a survey conducted on the postgraduate programme in Information Management, Van Brakel (1999) presented the requirements of a successful distance learning course and the process of implementing them to the specific programme. One of the most important factors for success was the fact that the students came from quite different working environments and thus they had the opportunity to meet different cultures and ideas.

#### 4. AIMS OF THE STUDY

Based on the findings of the literature review and especially the surveys of Sigala (2001) and Volery and Lord (2000) there was an attempt to explore the significance of some factors on the success of distance education courses. These factors are included into three main subject areas, which according to the literature review refer to student and instructor characteristics and technology.

#### 5. RESEARCH METHODOLOGY

The survey was conducted during the period March-April 2004 in Thessaloniki. The students that took part in the survey enrolled in a course of the Greek Open University in the academic year 2003-2004.

Primary quantitative data gathered through questionnaires distribution on a convenience sample of 340 respondents (students) who study at the Greek Open University. The questionnaire that was used for the data collection was based on the results of the literature review (Hamilton et al, 2002; Rolfe, 2002). The questionnaire contained close questions to assist in determining the degree of the respondents' agreement. Also, questions based on a five point Likert scale were used and the five scales were scored from 1 (Totally Disagree) to 5 (Totally Agree) measuring the respondents' opinion regarding the educator's behaviour and the quality of the programme services. The structure of the questionnaire was quite simple in order not to cause any problems to the respondents.

The sample of the study consists of 340 adults, current students of any programme of the Greek Open University. More specifically, the respondents studied in courses at an undergraduate level. These courses cover areas that deal with social and economic sciences. The sample size for the intent and purposes of this study and the statistical analysis that has been developed was significant enough to help the investigator to identify the success factors of distance education.

All the courses of the Greek Open University are designed similarly and according to the distance learning methodology. Students study using books and study – guides designed to be compatible with the distance learning methodology, they participate in 5 tutorials for each module taking place in 8 towns, communicate with the corresponding tutor by telephone, fax, email and letters, prepare 4 – 6 assignments for each module and finally take a final examination 10 months later, that is at the end of each module. The students of each module (Statistics, Total Quality Management, Human Resources) are placed into several students – groups. A tutor is allocated for each group, which consists of a maximum 32 students who inhabit in a certain geographical region (Thessaloniki, Athens).

The computer programme SPSS (ver.11.00) was used for analysing the data in this study. The data analysis process had two phases, the preliminary and main phase. The preliminary included descriptive statistics (i.e. frequencies, percentages, tables, charts). In the second phase multivariate analysis such as factor analysis (PCA) has been conducted in order to identify the main factors contributed to success.

## 6. RESULTS

Most of the respondents (54.4%) were 26-35 years old, married with at least one child. Managers and employees in the public or private sector were the most frequently reported occupations and they work for more than 8 hours per day. Thus the students of Greek Open University are very busy with very limited free time to study. The majority of the sample (81,1%) has very good or excellent knowledge in the use of new technologies (internet, e-mail) and the 83,2% have access to the internet through their homes.

Most of the students usually submit their assignments on time and only 15,4% takes part in a discussion with other students or in a group assignment (19,6%). Very interesting is the fact that 56,2% very rarely or never uses the library for data collection while most of them (85,9%) very often seek the lecturer's help and guidance.

The second stage of the research refers to the factor analysis and the results are presented below. Factor analysis was used to define the underlying components of agreement and frequency scales. For this, a choice of items (variables with loadings equal to or greater than 0,5) was chosen to determine which items are those that mainly contribute to the development of factors. These factors explain the underlying components of the students' opinion about the educators' behaviour and issues regarding the technology used.

Factor analysis for the question regarding the educator's characteristics and behaviour defined two factors (Table 1). The first factor interprets 27,9% of total variance, its reliability is 0,799 and consists of seven variables. This factor can be named "Motivation, Guidance and Time spending to students". The second factor interprets 26,077% of total variance; its reliability is 0,684 and consists of five variables. This factor can be named "Friendly and frequent interaction with the students". The factors with their variables are presented in Table 1.

**TABLE 1: FACTORS DEFINED FROM THE FACTOR ANALYSIS REGARDING INSTRUCTOR'S CHARACTERISTICS**

Factors	Variables	Loading on construct	Cronbach Alpha
<p>1<sup>st</sup></p> <p><i>«Motivation, Guidance and Time spending to students»</i></p> <p><b>27,9%</b> of total variance</p>	<ol style="list-style-type: none"> <li>1. The instructor motivated me to finish my assignments on time</li> <li>2. The instructor seems to spend a lot of time with the students</li> <li>3. The instructor motivated me to study for the programme</li> <li>4. I believe that the meetings with the instructor are very useful</li> <li>5. The instructor guided me to use the website of the module</li> <li>6. The instructor encouraged the discussion</li> <li>7. The instructor showed enthusiasm</li> </ol>	<p>0,789</p> <p>0,738</p> <p>0,735</p> <p>0,715</p> <p>0,536</p> <p>0,524</p> <p>0,501</p>	<p><math>\alpha=0,799</math></p>
<p>2<sup>nd</sup></p> <p><i>«Friendly and frequent interaction with the students»</i></p> <p><b>26,077%</b> of total variance</p>	<ol style="list-style-type: none"> <li>1. It was easy to conduct with the instructor</li> <li>2. The instructor was friendly with the students</li> <li>3. The instructor encouraged the interaction between him and the students</li> <li>4. The instructor encouraged the interaction between the students</li> <li>5. The instructor motivated me to participate to discussions.</li> </ol>	<p>0,755</p> <p>0,743</p> <p>0,737</p> <p>0,703</p> <p>0,505</p>	<p><math>\alpha=0,684</math></p>

Kaiser-Meyer-Olkin Measure of Sampling Adequacy=0,833; Bartlett Test of Sphericity=1592,246; Significance=0.000, Total Variance:53,977%

For the question regarding students' characteristics and behaviour, Factor analysis defined 5 factors (Table 2). The first factor interprets 15,126% of total variance; its reliability is 0,901 and consists of three variables. This factor can be named "Assistance by instructor and other students". The second factor interprets 14,324% of total variance; its reliability is 0,746 and consists of four variables. This factor can be named "Study conditions and Discussions". The third factor interprets 12,084% of total variance and its reliability is 0,615. This factor consists of two variables and can be named "Concepts and Module Requirements Understanding". The fourth factor interprets 10,308% of total variance and it consists of 3 variables. It can be named "Curriculum, assignments and educational material". Finally, the fifth factor interprets 9,006% of total variance, its reliability is 0.5 and it can be labelled "Library and Attendance". The factors with their variables are presented in Table 2.

**TABLE 2: FACTORS DEFINED FROM THE FACTOR ANALYSIS REGARDING STUDENTS' CHARACTERISTICS**

<b>Factors</b>	<b>Variables</b>	<b>Loading on construct</b>	<b>Cronbach Alpha</b>
<b>1<sup>st</sup></b> <i>«Assistance by instructor and other students»</i> <b>15,126%</b> of total variance	1. Participation in group assignments 2. Assistance to other students 3. Ask for help from the instructor	0,818 0,711 0,651	$\alpha=0,901$
<b>2<sup>nd</sup></b> <i>«Study conditions and Discussions»</i> <b>14,324%</b> of total variance	1. Study in a quite place 2. Study instead doing something more interesting 3. Module handouts understanding 4. Participation to discussions	0,831 0,649 0,588 0,522	$\alpha=0,746$
<b>3<sup>rd</sup></b> <i>«Concepts and Module Requirements Understanding»</i> <b>12,084%</b> of total variance	1. Concepts from books understanding 2. Module requirements understanding	0,827 0,771	$\alpha=0,615$
<b>4<sup>th</sup></b> <i>«Curriculum, assignments and educational material»</i> <b>10,308%</b> of total variance	1. On time assignments submission 2. Different material used 3. Good planning of curriculum	0,806 0,491 0,391	$\alpha=0,545$
<b>5<sup>th</sup></b>	1. Attending all classes		$\alpha=0,500$

### Success Factors for Distance Education Courses

«Library and Attendance» <b>9,006% of total variance</b>	2. Use library for resources	0,667 0,664	
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Kaiser-Meyer-Olkin Measure of Sampling Adequacy=0,606; Bartlett Test of Sphericity=915,66; Significance=0.000 Total variance:60,849%

Factor analysis for the question regarding technological issues defined three factors (Table 3). The first factor interprets 28,09% of total variance, its reliability is 0,827 and consists of four variables. This factor can be labelled “Use of technology and internet and teaching material appearance”. The second factor interprets 22,141% of total variance; its reliability is 0,603 and consists of three variables. This factor can be named “Communication and feedback”. The third factor interprets 17,149% of total variance; its reliability is 0,554 and can be labelled “Distribution and ease of using teaching material”. The factors with their variables are presented in Table 3.

**TABLE 3: FACTORS DEFINED FROM THE FACTOR ANALYSIS REGARDING TECHNOLOGICAL ISSUES**

Factors	Variables	Loading on construct	Cronbach Alpha
1 <sup>st</sup> «Use of technology and internet and teaching material appearance» <b>28,090% of total variance</b>	1. Using internet to study 2. Ease of using module website 3. Ease of using technology 4. Teaching material appearance	0,816 0,775 0,701 0,643	$\alpha=0,827$
2 <sup>nd</sup> «Communication and feedback» <b>22,141% of total variance</b>	1. Time of Feedback from instructor 2. Instructor-student communication 3. Communication between students	0,813 0,762 0,692	$\alpha=0,603$
3 <sup>rd</sup> «Distribution and ease of using teaching material» <b>17,149% of total variance</b>	1. Teaching material distribution speed 2. Ease of using teaching material	0,794 0,527	$\alpha=0,554$

Kaiser-Meyer-Olkin Measure of Sampling Adequacy=0,736; Bartlett Test of Sphericity=1016,092; Significance=0.000 Total variance: 67,380%

## 7. DISCUSSION

The main results of the study can be well compared with the results of similar studies (Volery and Lord, 2000; Sigala, 2001) and ascertain that generally the main factors that need to be considered in distance education are the students' and instructors' characteristics and technology.

Based on the results of the survey, the students in distance education courses believe that the characteristics of the instructor that are important to be examined for the success of the programme can be summarised into two main categories: Motivation, guidance and time spending to students, friendly and frequent interaction with the students. It is important to point out that the instructor's experience of using new technologies has not been highly evaluated by the distance students as happened during other studies (Volery and Lord, 2000; Sigala, 2001). The role of technology at the distance education course of GOU is respectable but not major. Thus the main issue is the instructor to assist students and play the role of the facilitator, not only the knowledge transmitter.

The second area that the study was revealed as crucial for the success of distance learning describes the students' characteristics and more specifically issues such as the assistance by instructor and other students, the study conditions and discussions, concepts and module requirements understanding, the curriculum, assignments and educational material and finally the library and attendance to classes.

Distance education does not reduce the importance of the instructor's role; on the contrary, the distance educator can be the facilitator, the one who supports the student's learning and studying. On the other hand distance education students need to be self-motivated and self-directed, determined to study on their own despite their job and family obligations.

## 8. LIMITATIONS OF THE STUDY AND RECOMMENDATIONS

The present study has some limitations that are described below:

First, despite the fact that the sample size that was used for the survey is adequate for the needs of the study, it can not be considered representative of the whole population. Thus, there is a need for another survey to be conducted using a larger sample. Although the findings of the study can not be generalised for the general population, they can satisfy the study purposes and can be characterised as satisfactory.



Another limitation is the fact that the questions that constitute the questionnaire are not enough in order to cover all the issues that are researched. However, more questions refer to more time for the respondents to spend, in order to answer them.

Finally, it should be pointed out that, according to the literature review there are more factors that contribute to the distance learning success. For the purposes of this study these factors were limited to the main areas revealed from the review as crucial for distance education.

Most of the studies aimed to examine the distance education in Greece, are based on the technology used and not on the pedagogical characteristics of the distance students. A very interesting research would be to conduct a survey about the learning and teaching methods that are used in distance education and evaluate them in order to select the most appropriate. Studies concerning these issues have already been done for US and European institutions but not for Greek distance courses.

The present study did not deal with the evaluation and assessment procedures of the courses that the Greek Open University offers. The purpose of this study is to examine the design and implementation of the course and not the result of it which is represented by the evaluation of the students' performance. It is worthwhile to explore the connection between the students' performance and the interaction with the instructor.

## REFERENCES

- Alexander, S. (2001). E-Learning developments and experiences, *Education & Training*, Vol.43, No. 4/5, 240-248.
- Daniel, J.S. (1997). Why universities need technology strategies, *Change*, Vol.29, No. 4, 11-17.
- Holmberg, B. (1986). *Growth and Structure of Distance Education*, London: Croom Helm.
- Honey, P. (2001). E-Learning: A performance appraisal and some suggestions for improvement, *The Learning Organisation*, Vol. 8, No. 5, 200.
- Jonassen, D.H. (1992). *Applications and limitations of hypertext technology for distance learning*, paper presented at the Distance Learning Workshop, Armstrong Laboratory, San Antonio, TX.
- Keegan, D. (2000). *Foundations of Distance Education* (3<sup>rd</sup> Edition) Athens: Metaixmio.
- Levy, S (1999). Six factors to consider when planning Online Distance Learning Programs in Higher Education, *Online Journal of Distance Learning Administration*, Vol. 6, No. 1, Available: <http://www.westga.edu/~distance/ojdla/spring61/levy61.htm>
- McAlister M.K., Rivera, J.C. and Hallam, S. (2001). Twelve Important Questions to Answer Before You Offer a Web Based Curriculum, *Online Journal of Distance Learning Administration*, Vol.4, No.2, 35-47.

- Miller, G. and Honeyman, M. (1993). *Agricultural distance education: A valid alternative or higher education?* Proceedings of the 20th Annual National Agricultural Education Research Meeting, 67-73.
- Picciano, A.G. (2002). Beyond Student Perceptions: Issues of Interaction, Presence and Performance in an Online Course, *JALN*, Vol. 16, No. 1, 21-40.
- Schrum, L. and Hong S. (2002). Dimensions and Strategies for Online Success: Voices from Experienced Educators, *Journal of Asynchronous Learning Networks*, Vol. 6, No. 1, 57-67.
- Sigala, M. (2001). Factors Evaluation for the Development and Design of Distance Education via Internet, *Proceedings of the 1<sup>st</sup> Hellenic Conference in Open and Distance Education*, Patra, Greece, 25-27 May.
- Simonson, M., Schlosser, C. and Hanson, D. (1999). Theory and Distance Education: A New Discussion, *The American Journal of Distance Education*, Vol. 13, No. 1, 10-19.
- Simonson, M., Smaldine, S., Albright, M. and Zvacek, S. (2000). *Teaching and Learning at a Distance, Foundations of Distance Education*, New Jersey: Prentice-Hall.
- Van Brakel P. (1999). Teaching Information Management via a Web-Based Course, *The Electronic Library*, Vol. 117, No. 6, 389-394.
- Volery, T. and Lord, D. (2000). Critical Success Factors in Online Education, *The International Journal of Educational Management*, Vol.14, No. 5, 216-223.

## STUDENTS' ATTITUDES ABOUT EDUCATIONAL SERVICE QUALITY

COSTAS ZAFIROPOULOS\*

### ABSTRACT

*Assessment of education service quality is an important issue in higher education worldwide. This paper presents students' perceptions of education service quality as experienced at a Higher Technological Education Institute based in Greece and measured by the SERVQUAL questionnaire. After shortly reporting the findings produced by the use of SERVQUAL, the paper explores the capabilities of the instrument to distinguish segments of students according to their expressed quality scores. The findings suggest that perceived and expected quality are closer to each other for new students, students of newly founded departments and students of specific faculties.*

*Keywords: Quality of Services; Higher Education; SERVQUAL; Quality Dimensions; Students' Segments.*

### 1. INTRODUCTION

Quality improvement systems were initially implemented in product engineering but soon became evident that the concept of quality also applies to services. Despite the fact that service quality is more difficult to be measured than goods quality instruments for measuring service quality have been developed and validated (Parasuraman et al. 1985). Relative research gives emphasis to the executive perceptions of service quality and the tasks associated with service delivery (Parasuraman et al. 1985, Zeithalm et. al.1988, 1990). The search of quality has become an important consumer trend (Parasuraman et al. 1985) and a major field of concern in the literature of marketing.

Higher education is a service since it exhibits all the classical features of services: it is intangible and heterogeneous, meets the criterion of inseparability by being produced and consumed at the same time, satisfies the perishability criterion and assumes the students' participation in the delivery process (Cuthbert 1996a). The concepts of service quality are therefore directly applicable to higher education. According to Tam (2001), however, quality in higher education is a "relative concept", with respect to the stakeholders in higher education and the circumstances in

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\* Assistant Professor, Department of Business Administration, Technological Educational Institute of Serres, Greece

which it is involved. In other words, quality means different things to different people as well as the same person may adopt different conceptualisations at different moments. This raises the issue of “*who is the customer in education*”. Hill (1995) suggests the student as the primary consumer in higher education. Rowley (1997), on the other hand, advises that the attempt to measure quality in general terms should take into account all stakeholders' perspectives, which include students, parents, staff, employers, business and legislators.

Higher education institutes are increasingly attracting more attention to service quality mainly due to the fact that there is a social requirement for quality evaluation in education. In many countries this requirement is expressed directly through the establishment of independent quality assurance bodies, which place emphasis on student experience as one of the assessment criteria. In other countries the social requirement for improvement in education is often expressed indirectly. In Greece, for example (where there is no national system for quality assurance) the Ministry of National Education and Religious Affairs has granted to higher education institutions a number of programmes in which quality evaluation is an integral part. T.E.I. of Serres has been granted a number of curriculum reform programmes that include quality evaluation as an indispensable activity. In the framework of these curriculum reform programmes, the academic departments of T.E.I. of Serres have used a number of evaluation instruments.

This paper aims:

1. to briefly present some findings of the implementation of SERVQUAL to a Greek Higher Education Institute;
2. to explore possible score differentiations among different students segments and distinguish the most interesting segments; and
3. to make suggestions and conclude on the use of SERVQUAL in association to the Greek Higher Education context.

The paper introduces SERVQUAL and comments on the suitability of adapting it to the Greek Higher Education context. Next the paper presents the research methodology followed in order to implement the instrument in Technological Education Institute of Serres, Greece. The paper uses descriptive statistics, correlation coefficients and stepwise regression analyses. Also Cronbach's alphas are calculated to measure reliability.

## 2. THE SERVQUAL INSTRUMENT

Parasuraman et al. (1985) developed the “gap model of service quality” and proposed SERVQUAL as an instrument to measure service quality. Their research suggested that there is a set of five gaps regarding the executive perceptions of service quality and the tasks associated with service delivery (Parasuraman et al. 1985, Zeithalm et. al.1988, 1990). Based on this theoretical background, SERVQUAL was proposed as an instrument for measuring service quality. It was tested for reliability and validity in multiple service sector settings and it was considered to be a concise multiple-item scale with good reliability and validity.

There have been quite many attempts to apply SERVQUAL in the academic environment, despite the fact that the language and some of its items involved embody the philosophy of the business world (Cuthbert 1996a 1996b, 1996b, Chua 2004, Hill, 1995, Pariseau and McDaniel, 1997, Rowley, 1997, Soutar and McNeil 1996, Oldfield and Baron 2003, Soutar and McNeil, 1996, Tan and Kek, 2004).

Among other attempts to use SERVQUAL within the education context Sherry et al. (2004), used SERVQUAL to assess the perceptions of international students (as opposed to local students), with intention to serve better the legitimate needs and expectations of services offered to this group of students. They conclude that SERVQUAL offered useful insights and is a good starting point to measure education quality, but a more in-depth analysis of the areas of concern would be needed. SERVQUAL offered satisfactory findings and was proved to be at least a good starting point for this kind of educational assessment research. Darlaston-Jones et al. (2003) and LaBay and Comm (2003) did relative research to capture differences that may rise among students regarding teaching and administration staff or regarding distance learning and conventional way of learning. Pariseau and McDaniel (1997) used SERVQUAL to compare quality between two business schools by administering the questionnaire to the students and the lectures as well. Lecturer's attitudes concerning quality may be different from students'. Oldfield and Baron (2003) and Athiyaman (2000) followed some sophisticated approaches using SERVQUAL to the universities context.

## 3. STUDY DESIGN

This study uses the standardized SERVQUAL instrument to record students' attitudes towards education service quality (Zafiroopoulos et al 2005a, Zafiroopoulos et al 2005b). A total of 335 questionnaires were administered to the undergraduate students of all the departments of Technological Education Institute of Serres, Greece. The field research took place during November 2004. Table 1 presents the sample

profile. The sample was designed to include as many students with higher-class level as possible. In this way it was expected that students would have had enough time during their studies to form their perceptions regarding quality. Proportionate sampling was used to capture the various departments' size differences (Table 1). Table 1 shows that the Departments of Business Administration and Accounting are the densest, since they account for nearly one half of the students' population. Information and Communication Science Department and especially Topography and Surveying Department are two newly founded departments and hence their students' attitudes may differ from the others who attend more stabilized departments. Also Departments of Mechanical and Civil Engineering may reflect differences in their students' attitudes because of differences in infrastructure, laboratories, study practices etc.

The standardized SERVQUAL instrument was used, in which only language adjustment was made, in order to fit in the academic environment. It is constructed from 22 items, which form five factors namely:

- Assurance: Knowledge and courtesy of staff and their ability to inspire trust and confidence.
- Responsiveness: Willingness to help students and provide prompt service.
- Empathy: Caring, individualized attention the Institute provides its students.
- Reliability: Ability to perform the promised service dependably and accurately.
- Tangibles: Condition of facilities, equipment, and appearance of staff.

Each item is repeated because the students are asked to rate both the perceived service quality originated from their home institute and the expected service quality originated from the ideal institute the students have in mind using a five points Likert scale. Resembling the original SERVQUAL instrument, five more questions regarding the relative importance of SERVQUAL factors were added to the questionnaire. In this way the total SERVQUAL score could be calculated as a weighted mean of the SERVQUAL factors.

By subtracting perceived minus expected rating we can estimate the net satisfaction from quality for each student for each item. SERVQUAL factors are the means of these differences for specific questions. Total SERVQUAL score is calculated as the weighted mean of SERVQUAL factors, taking the factors importance evaluations as weights. Finally, we present the average values of the SERVQUAL factors and the total SERVQUAL score (Figure 1).

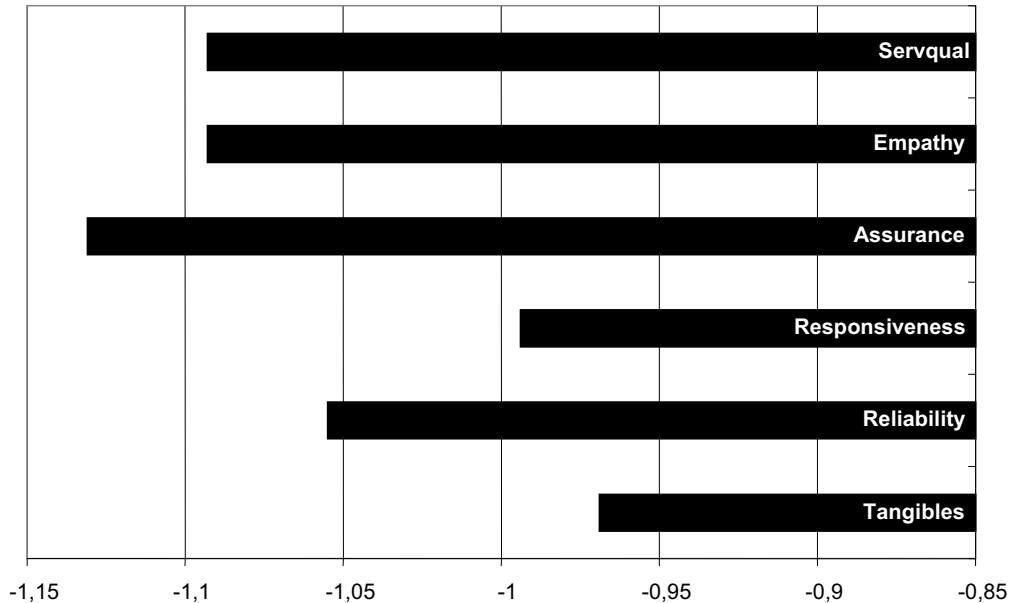
**TABLE 1: SAMPLE DESCRIPTION**

		Frequency	Percent %	Numbers of students actually attending the institute
Sex	Male	180	53.73	
	Female	155	46.27	
Class level	Freshman	11	3.28	
	Sophomore	50	14.93	
	Junior	94	28.06	
	Senior	180	53.73	
Department	Business administration	68	20.30	2015
	Accounting	83	24.78	2475
	Mechanical engineering	54	16.12	1591
	Civil engineering	57	17.01	1696
	Information and Communication Science	44	13.13	1304
	Topography and surveying	29	8.66	870
	<b>Total</b>	335	100.0	9951

**TABLE 2: CRONBACH'S ALPHAS OF SERVQUAL DIMENSIONS**

Dimensions	Cronbach's Alpha
Tangibles	.70
Reliability	.75
Responsiveness	.70
Assurance	.65
Empathy	.79

**FIGURE 1: THE SERVQUAL DIMENSIONS SCORES**



#### 4. FINDINGS

Cronbach's Alphas were used to test for reliability of the SERVQUAL factors (Table 2). All the factors produced high alphas, in most cases exceeding 0.70, with the exception of Assurance, which produced a value of 0.65. Hence SERVQUAL instrument is considered to be reliable. This is not always the case in the research that employed the SERVQUAL instrument. For example Cuthbert (1996b) calculated Cronbach's Alpha for his revised version of SERVQUAL to be about 0.50 or less. Although Cronbach's Alphas offer some support for reliability of the scales, further analyses should be performed for testing the validity of the instrument.

Students in the study were asked to evaluate the relative significance of SERVQUAL factors so that the total SERVQUAL score could be calculated. Students considered Reliability, Assurance and Responsiveness to be the most significant factors that form service quality.

Table 3 presents the mean scores for the SERVQUAL factor scores and the total SERVQUAL score along with mean factor scores for the Expected and Perceived



quality. SERVQUAL score demonstrates that Perceived Reliability, Assurance and Empathy deviate from the relative expected values more than Tangibles and Responsiveness do. The total SERVQUAL score exceeds one unit and so do Assurance, Empathy and Reliability (Figure 1). It seems, therefore that these three factors are the ones that the institute suffers more regarding service quality. Responsiveness and Tangibles follow with somewhat lesser scores.

**TABLE 3: MEAN SCORES OF SERVQUAL DIMENSIONS**

Total	Expected		Perceived		SERVQUAL factors	
	Mean	SD	Mean	SD	Mean	SD
Tangibles	3.595	.933	2.624	.829	-.969	1.154
Reliability	3.813	.869	2.765	.765	-1.055	.980
Responsiveness	3.857	.864	2.872	.780	-.994	1.001
Assurance	3.892	.845	2.760	.808	-1.131	1.040
Empathy	3.428	.959	2.346	.785	-1.093	1.135
SERVQUAL					-1.093	.899

**TABLE 4: THE SERVQUAL DIMENSIONS SCORES FOR SEGMENTS OF STUDENTS**

		Assurance	Responsiveness	Empathy	Reliability	Tangibles	Servqual
<i>Gender</i>							
Female	Mean	-0.96	-0.94	-1.11	-0.99	-0.93	-1.01
	SD	1.03	1.01	1.11	0.93	1.10	0.88
Male	Mean	-1.28	-1.05	-1.10	-1.11	-1.01	-1.17
	SD	1.02	1.00	1.16	1.02	1.20	0.90
<i>Faculty</i>							
Technology	Mean	-0.99	-0.80	-0.93	-0.91	-0.85	-0.96
	SD	1.03	1.00	1.20	1.02	1.22	0.96
Administration	Mean	-1.30	-1.23	-1.29	-1.23	-1.11	-1.25
	SD	1.03	0.95	1.03	0.90	1.05	0.80
<i>Age of the department</i>							
Old	Mean	-1.23	-1.09	-1.19	-1.15	-1.05	-1.18
	SD	1.03	0.97	1.10	0.95	1.13	0.87
New	Mean	-0.78	-0.66	-0.75	-0.71	-0.66	-0.78
	SD	1.01	1.04	1.19	1.03	1.19	0.94

**TABLE 5: CORRELATION COEFFICIENTS BETWEEN SERVQUAL DIMENSIONS AND DEMOGRAPHIC/EDUCATIONAL CHARACTERISTICS**

	Gender <sup>a</sup>	Semester	Age of the Departments <sup>b</sup>	Faculty <sup>c</sup>
Assurance	-.153(**)	-.121(*)	.177(**)	-.148(**)
Responsiveness	-.056	-.089	.177(**)	-.212(**)
Empathy	.005	-.161(**)	.157(**)	-.157(**)
Reliability	-.062	-.130(*)	.185(**)	-.166(**)
Tangibles	-.035	-.112(*)	.142(**)	-.116(**)
SERVQUAL	-.086	-.139(*)	.182(**)	-.163(**)

(a: 0 female, 1 male)

(b: 0 old, 1 new)

(c: 0 Administration, 1 Technology)

(\*\* : p< 0.01, \* : p< 0.05)

**TABLE 6: STEPWISE REGRESSIONS OF SERVQUAL DIMENSIONS VS DEMOGRAPHIC AND EDUCATIONAL CHARACTERISTICS**

		B	Std. Error	Beta	t
Assurance	Constant	-.833	.127		-6.546
	Age of the Department <sup>b</sup>	.280	.154	.111	1.815
	Gender <sup>a</sup>	-.404	.115	-.194	-3.502
	Faculty <sup>c</sup>	-.310	.132	-.149	-2.352
Responsiveness	Constant	-.645	.104		-6.188
	Faculty <sup>c</sup>	-.497	.112	-.247	-4.437
	Gender <sup>a</sup>	-.238	.112	-.118	-2.125
Empathy	Constant	-.930	.085		-10.922
	Faculty <sup>c</sup>	-.365	.125	-.160	-2.916
Reliability	Constant	-1.154	.060		-19.133
	Age of the Department <sup>b</sup>	.438	.130	.184	3.367
Tangibles	Constant	-1.058	.072		-14.744
	Age of the Department <sup>b</sup>	.384	.155	.137	2.470
SERVQUAL	Constant	-1.182	.056		-21.159
	Age of the Department <sup>b</sup>	.397	.122	.181	3.262

(a: 0 female, 1 male), (b: 0 old, 1 new), (c: 0 Administration, 1 Technology)

## 5. THE IMPACT OF DEMOGRAPHIC AND EDUCATIONAL CHARACTERISTICS

As mentioned before score differences may occur because of the different departmental origin of the students. This section attempts to explore differences that may occur because of these educational and demographic characteristics as well. Four independent variables are used:

a) Gender: Gender is considered to be a crucial factor regarding educational choices of the students and it may have some impact on perceived and on expected education quality as well.

b) Faculty: There are two faculties. Faculty of Technology and faculty of Administration. The first is consisted of Departments of Mechanical Engineering, Civil Engineering, Information and Communication Science, Topography and Surveying, and the second is consisted of the Departments of Business Administration and Accounting. Different Faculties may reflect different attitudes of the students because they experience different class and laboratories conditions or they experience different lecture and assistance styles.

c) Department age: TEI of Serres was initially consisted by Department of Mechanical engineering, Civil engineering, Business Administration and Accounting. Recently two departments were added: Information and Communication Science, and Topography and Surveying. The new departments were very active in engaging new staff and laboratories equipment and also constructed their curriculum from scratch, giving emphasis in newly developed methods and knowledge. On the other hand the more conventional and elder departments although having made severe changes to their curricula due to an extended reforming programme that the Ministry of Education Affaires granted to them, they may have different effect on their students' perceptions about quality. A binary variable that distinguishes new and old departments is added in the analysis.

d) Study semester: The semester may be a significant variable because it distinguishes the new from the older students. New students may experience differences in educational and administrative services of the Institute and on the contrary to the older ones they may have a different and even more positive attitude than the older students.

Table 4 presents the SERVQUAL scores breakdown according to faculty, age of the department and Gender. Table 5 presents correlation coefficients between SERVQUAL dimensions and demographic/educational characteristics. Gender has a minor impact. It affects only Assurance since male students present lower scores and so they are more dissatisfied than female students in terms of knowledge and courtesy of staff and their ability to inspire trust and confidence. On the other hand educational characteristics are more influential in forming SERVQUAL scores. Semester in a lesser degree and the Age of the departments and Faculty in a greater degree affect nearly all the dimensions and the overall SERVQUAL score as well. Students who are closer to graduation are less satisfied in all the dimensions and the overall score except Responsiveness, since the correlation coefficients are negative and statistically

significant at  $p=0.05$ . Regarding the Age of the Departments and Faculty, students of the new departments and students of Administration are more satisfied in every aspect of the SERVQUAL scale, since the positive correlations are also statistically significant at  $p=0.01$ . In conclusion they are the freshmen, the students of the newly founded departments and the students of Administration Faculty who are more satisfied regarding expected and perceived quality within the educational context and by using SERVQUAL.

To make a further development in the previous analysis it is interesting to watch how all the independent variables affect the SERVQUAL dimensions jointly. Multiple linear regression models and stepwise selection of the variables are used. Table 6 presents only the independent variables which stay in the final models.

Assurance is affected by the Age of the departments, Gender and Faculty. However regarding Betas we can see that Gender has the greatest effect size while Faculty has the second. Gender has the greatest impact on Responsiveness followed by Faculty. Only Faculty affects Empathy. Reliability and Tangibles as well as the overall SERVQUAL scores are affected only by the Age of the Departments. All the effects are in the same directions as those commented for Table 5. Overall it is interesting to notice that the Faculty and the Age of the Departments are the two independent variables with major presence and impact. The specific educational institute experience differences in delivering educational services. These differences are probably greater for the newly founded departments and are reflected to students' attitudes. Also differences between faculties may reflect different levels of the alteration procedures regarding the conventional ways of delivering educational services. On the other hand, they may just reflect different ways of perception for the students of the two faculties, the students of Administration being more tolerant. To arrive to some conclusions on this matter qualitative research is needed to explore the reasons for the dissatisfaction and the different levels of attitudes.

## 6. CONCLUSIONS

SERVQUAL is a valuable instrument to measure service quality. In particular it seems to be of use for research within the educational context. Although its original purpose was to measure consumers' attitudes, previous works in the relative literature and recent practice suggest that it could fit to the educational context since. It can be used to explore differentiation in attitudes among students of different levels and faculties.

The Technological Education Institute of Serres has benefited from this exploration and managed to spot what are the segments of students that the Institute

needs to focus on and then make an effort to alter the conditions that provoke negative quality rankings. Further research, mainly qualitative, is needed and is already in progress for the explanation and understanding of the students' attitudes.

## REFERENCES

- Athiyaman A. (2000). *Perceived service quality in the higher education sector: an empirical Analysis*, ANZMAC 2000 Visionary Marketing for the 21<sup>st</sup> Century, 130.195.95.71:8081/www/ANZMAC2000/CDsite/papers/a/Athiyam2.PDF
- Chua, C. (2004). *Perception of Quality in Higher Education*, Australian Universities Quality Forum (AUQF) 7-9 July, Adelaide, Australia.
- Cuthbert, P. (1996a). Managing Service Quality in HE: Is SERVQUAL the Answer? Part 1, *Managing Service Quality*, Vol. 6(2), 11- 16.
- Cuthbert, P. (1996b). Managing Service Quality in HE: Is SERVQUAL the Answer?, Part 2, *Managing Service Quality*, Vol. 6 (3), 31- 35.
- Hill, F. M. (1995). Managing Service Quality in Higher Education: The Role of the Student as Primary Consumer, *Quality Assurance in Education*, Vol. 3 (3), 10-21.
- Oldfield B.M. and Baron S. (2000). Student Perceptions of Service Quality in a UK University Business and Management Faculty, *Quality Assurance in Education*, Vol. 8(2), 85-95.
- Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1985). A Conceptual Model of Service Quality and its Implications for Future Research, *Journal of Marketing*, Vol. 49, 41-50.
- Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1988). Communication and Control Processes in the Delivery of Service Quality, *Journal of Marketing*, April, 35-48.
- Pariseau, S. and McDaniel, J.R. (1997). Assessing service quality in schools of business, *International Journal of Quality & Reliability Management*, Vol. 14 (3), 204-218.
- Rowley, J. (1997). Beyond Service Quality Dimensions in Higher Education and Towards a Service Contract, *Quality Assurance in Education*, Vol. 5 (1), 7-14.
- Soutar, G. and McNeil, M., (1996). Measuring Service Quality in a Tertiary Institution, *Journal of Educational Administration*, Vol. 34 (1), 72 –82.
- Tam, M., (2001). Measuring Quality and Performance in Higher Education, *Quality in Higher Education*, Vol. 7(1), 47 – 54.
- Zafiropolos, C., Frangidis G., Kehris, E., Dimitriadis, S. and Paschaloudis, D. (2005a). *Service Quality Assessment in Higher Education: the case of Technological Educational Institute (T.E.I.) of Serres*, Greece, 9<sup>th</sup> International Conference on Marketing and Development (ICMD) 2005, Thessaloniki, Greece, June 8-11.
- Zafiroopoulos, C., Kehris, E. and Dimitriadis, S. (2005b). *Methodology Tools for Internal Evaluation in Higher Education. The Case of a Greek Business Administration Department*, New Horizon in Industry Business and Education, Corfu, Greece 25-26 August 2005.
- Zeithaml, V.A., Parasuraman, A. and Berry, L.L. (1988). SERVQUAL: A Multi-item Scale for Measuring Customer Perception of Service Quality, *Journal of Retailing*, spring 12-40.
- Zeithaml, V.A., Parasuraman, A. and Berry, L.L. (1990). *Delivering Quality Service. Balancing Customer Perceptions and Expectations*, Free Press.



## INTERNATIONAL POSTGRADUATE STUDENTS IN LONDON: SOME FEATURES OF THEIR EXPECTATIONS AND EXPERIENCE

JAN KATHERINE BAMFORD<sup>\*</sup>, GARY PHEIFFER<sup>\*\*</sup>,  
TIM MARR<sup>\*\*\*</sup> and INGE WEBER-NEWTN<sup>\*\*\*\*</sup>

### ABSTRACT

*The rapid growth in international student numbers raises questions about the nature of their experience at university. This paper, based on ongoing research at a UK university, presents some preliminary findings concerning international students' expectations and experiences, highlighting issues of cultural adaptation to HE learning environments in Britain, the valuation of British qualifications and the role of the English language, both as a pull factor in attracting students and a potential stumbling block after arrival.*

*Keywords: International Students; Cross-Cultural Learning; Students' Expectations; Students' Learning Experience; Language.*

### 1. INTRODUCTION

Higher education has witnessed a rapid growth in international student numbers (Halpin and Buckley 2004) with students who come from a variety of different cultures and academic backgrounds. This growth in international student numbers is not restricted to the UK Higher Education institutions. Therefore this research into the experience and expectations of international postgraduate students may be pertinent to other institutions of higher education in assessing some of the issues that may arise following their recruitment and enrolment. The paper presents an analysis of a substantial body of qualitative and quantitative data which will enable effective approaches to be developed a) to improving the overall experience of international students; and b) to equipping teaching and support staff with better information about, and better skills to deal with, international students.

The results presented are the findings of the project after one 'cycle'; that is, after one cohort of international students were surveyed at the beginning and at the end of their year of study at a university in London.

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<sup>\*</sup> Academic Leader, Dept. of Business and Service Sector Management, London Metropolitan University, London, UK

<sup>\*\*</sup> Senior Lecturer, Dept. of Psychology, London Metropolitan University

<sup>\*\*\*</sup> Senior Lecturer, Dept. of Humanities and Languages, London Metropolitan University

<sup>\*\*\*\*</sup> Principal Lecturer, Dept. of Psychology, London Metropolitan University

### *1.1. International students and the process of adaptation*

For most academic staff who teach on courses with large numbers of international students, the impact of students from different educational and cultural backgrounds on the 'identity' of a class or cohort of students is a practical and pedagogical challenge. The rise in international student numbers cannot, then, be ignored. Apart from anything else, it raises questions about the expectations and the learning experiences of students who are not familiar with the conventions of UK higher education. Research into innovative group work assessments, for example (Bamford & Johnstone, 2001), has highlighted the difficulties experienced by lecturing staff in employing new methods of assessment with students from very different cultural backgrounds, with little or no experience of the types of group work assessment now often used in UK university business schools. The project therefore undertook an exploratory study examining the reasons for choosing to study in the UK. It was assumed that these motivations would impact on the students' attitude to teaching and learning, a key focus of this research.

Following on from this the project explored the issues of adaptation once the students had arrived in the UK. Supplying a useful broad framework, Biggs (1999) identifies three problem areas for international students, linked to cultural issues: 1. social-cultural adjustments, 2. language and 3. specific learning and teaching problems. Problems that arise as a result of social-cultural adjustments may cause short-and long-term anxieties for international students, and Biggs is surely right to propose that universities have an obligation to provide strong support structures. In this context, the second potential problem area, language, can affect even students from regions where English is used as a second or official language. In general universities apply strict minimum language requirements for entrance to courses. However, acceptable, even high scores in formal tests such as IELTS or TOEFL do not necessarily guarantee linguistic competence for successful study or operation in a new environment. Thirdly, there are specific learning and teaching problems that arise due to perceived cultural differences, such as unfamiliarity with active participation in class or group discussion. These issues formed the second related focus of the research.

The study had the following propositions:

- The reason for studying in the UK would be to improve job prospects back in their home countries.
- A key reason for studying in the UK is the need for personal development.
- Students value the quality of UK university education and would have the reputation of the university and/or the course reputation as a key factor.



- The location of the university would be an important factor.

## 2. METHODOLOGY AND SAMPLE

### 2.1. Entry questionnaire

In order to obtain quantitative data a questionnaire was developed building on previous research carried out in the area (West, Dimitroulos, Hind, & Wilkes, 2000). In parallel, a series of semi-structured interviews that aimed at generating qualitative information beyond the findings of the questionnaire were also conducted. The entry questionnaire presented students with a list of 32 pre-formulated potential reasons for studying in the UK and asked them to rate how they affected their choice on a scale from “great extent” to “not at all”. Out of the list, students were then requested to give their personal top three reasons. As an indirect way of obtaining other, perhaps less obvious information, students were also asked to identify the top three most likely reasons that their peers in their home country might give. This was followed by a series of questions designed to elicit the participants’ preferences with regard to learning and teaching experiences, and some final questions exploring their thoughts about whether they were likely to be successful in their programme of study.

The entry questionnaire was administered to new international postgraduate students at the beginning of their academic year. The sample represented a range of different courses which have a high percentage of international students:

MA Teaching English as a Foreign Language	30%
MA Business Administration	23%
MA International Business	20%
MA Human Resource Management	13%
MA International Relations	8%
Other MA courses	6%

Altogether 106 usable questionnaires out of 120 were obtained. The demographics of the sample reflect the very broad range of the population of international students at London Metropolitan University from a variety of countries in the following regions:

Asia:	44.3%
Africa:	18.9%
European Union:	17.9%
North America:	1.9%
Central - Southern America:	9.4%

Central - Eastern Europe: 6.7%  
Middle - Near East: 0.9%

The university is located in a densely populated inner London area which can be characterised as multi-cultural due both to its large number of international students and British students from London's local ethnic minorities. It was anticipated that this specific characteristic would also be reflected in the results of the study.

## *2.2. Exit questionnaire*

The exit questionnaire followed the structure and areas of concern of the original entry questionnaire, but focused on the most significant results from the entry phase; it was oriented towards finding out how, with hindsight, the students now felt about their experience. It was administered to the same cohort of students. However, due to inevitable problems of availability (with a good many students away on placement, writing dissertations, or carrying out research elsewhere) the exit sample was smaller than that in the entry phase, and the students were not always the same ones: direct comparisons are therefore difficult. 67 useable questionnaires were obtained. The sample included countries from the following regions:

Asia (mainly East Asia):	39.5%
Europe:	19.5%
Africa (mainly West-Africa):	18 %
Central--Southern America:	14.8%
Middle East – North Africa:	6.6%
Others:	1.6%

## *2.3. Interviews*

The additional series of semi-structured interviews was carried out to explore in more detail the responses from both, the entry and the exit questionnaires. Besides the range of more factual information following the general structure of the questionnaire issues around motivation for studying abroad, students' expectation of their year in Britain, in particular in the educational and cultural domain and the benefits they expected were explored in individual, open-ended question and answer sessions. In order to examine whether the students' expectations matched their real experience these issues were taken up again in the series of 15 exit interviews carried out towards the end of their MA course. However, it was felt that these questions needed expansion to include, for example, pressing topics such as financial issues and those around work commitments, social experiences at university, as well as perceptions of the 'English' and the value of their Master's course.

### 3. RESULTS

The results of the research are presented here in two parts: first from the entry phase, and second from the exit phase.

#### *3.1. Entry Phase Findings*

At this early stage of the project, the most easily accessible and substantial findings concern the fundamental question: Why do international students come to study in the UK? Students were asked which factors had been important to them when they made the decision to study at the university. The top ten rated factors from the 32 factors given on the questionnaire were ranked in terms of the ten highest mean scores, with the scale range 1 = 'to a great extent' to 3 = 'not at all'. This limited scale was used to enable students a relatively quick decision on a fairly long list of reasons/factors.

**TABLE 1: ENTRY QUESTIONNAIRE: HIGHEST RATED REASONS FOR WHY STUDENTS CAME TO THE UNIVERSITY**

Mean	Factor
1) 1.31	<i>I wanted to broaden my horizons</i>
2) 1.51	<i>I thought that with a degree from the UK I would have better job prospects</i>
3) 1.51	<i>I thought that the quality of UK universities would be very good</i>
4) 1.54	<i>I wanted to experience other cultures</i>
5) 1.61	<i>I found exactly the course I wanted to study in the UK</i>
6) 1.71	<i>I wanted to get a different perspective on the subject I study</i>
7) 1.71	<i>I wanted to experience different teaching and learning methods</i>
8) 1.72	<i>I thought that my preferred course would be of a better quality abroad</i>
9) 1.75	<i>I wanted to improve my foreign language competence</i>
10) 1.75	<i>I particularly wanted to study at an institution with an international reputation</i>

This table therefore represents the reasons for students coming to study at an English university in a quantitative format. The importance of ‘broadening horizons’ seems to present a significant driving factor in their motivation.

Furthermore, from the list of 32 reasons presented students then selected their top 3 reasons for studying in the UK and ranked these from 1-3 in order of importance.

The results in order of importance for studying were:

1. I thought that with a degree from the UK I would have better job prospects	13.2%
I thought that the quality of UK universities would be very good (9.4%) + reputation of UK universities (3.8%)	13.2%
2. I wanted to improve my English (11.3%) + The UK is the home of English (0.9%)	12.2%
3. I wanted a better quality education than the one offered in my home country	6.6%
4. I wanted to broaden my horizons	6.6%

Taken together, the findings would seem to indicate that, while students’ expectations about studying in the UK are high and relatively focused, in fact their motivation for coming to this country is made up of a combination of factors. The four reasons ranked in positions 1, 4 and 6 in table 1 combine to suggest a strong desire for change, adventure, difference: study in the UK represents an opportunity to explore new academic, cultural and personal worlds. Table 2 represents an interesting deviation from the order of importance where students are provided with a free choice to rank the order of importance of reasons for studying in the UK: in this context job prospects take a clear priority. This feeling is not shared equally by all cultural groups. While 80% of Central-Southern Americans and a full 94.7% of Africans said that broadening their horizons was very important to them, only 67% of Asians felt the same. In contrast, the proportion of respondents indicating that improved job prospects were ‘very important’ in their decision to study abroad was broadly the same – around the 60% mark – for all cultures. It is proposed that students from Asian countries may be more guided by pragmatic than experiential motives for studying in the UK and this was explored further in the qualitative findings.

Factors that may be more tangible than the simple desire for change referred to above, are perhaps to do with the perceived quality of education in the students' own countries. African students in particular seem to have a relatively low opinion of the facilities available to them at home. 66.7% stated that it was very important to them to study at a university with an international reputation; 63.2% of them thought that better research experience abroad was very important (compared with only 40.9% of East Asians); 61.7% thought it very important that their course would be of better quality abroad, compared to only 50% Asians.

Naturally enough, a positive picture of the UK as an attractive study destination in itself emerges, as one would expect from a sample of respondents who have invested time, a substantial amount of money and emotion in coming to the country; the presumed quality of UK universities is generally admired, the attraction of the English language is mentioned. There is, though, a rather lukewarm feel to the answers of some of the respondents, and especially the Asian students. Only 50% of the Asian students said that their belief in the high quality of UK universities was very important for their decision, compared to 70% students from Central and South America. Similarly, only 45.5% of Asian students listed "I found exactly the course that I wanted to study in the UK" as very important, compared, again, to the 70% of (those enthusiastic, anglophile) Central and South Americans.

The interviews supported these findings and provided some further insight into attitudes. Student comments about London were ambiguous: people – except the British ones! – are generally seen as friendly, but life is considered too fast and too expensive. However, apart from the bad weather, the strongest criticism is voiced in connection with social provision and social attitudes. A Spanish student brought up in Scandinavia comments:

*"I was quite disappointed, but then I didn't know London much. Britain has the image of an advanced society but the reality is different, it's a contradiction to its image... Also, transport is poor and expensive, social services are not strong, there are big problems with cleanliness and rubbish..."*

And from a Chinese student:

*"Shanghai is in many respects a more modern city than London, not just in its architecture. The streets [in London] are not as clean as I thought and the people are not as well behaved, for example people are spitting on the streets. I did not expect this low standard of behaviour in a developed and advanced society."*

Language is a key factor: very many want to improve their English. 76.2% of East Asian respondents stated that improving their language competence was a very important factor for them. The tangible benefits of this, too, are clearly understood: 61.6% of East Asian students - and similar proportions of other students from non-English-speaking countries - rated "I thought that a higher level of English proficiency would improve my job prospects" as very important.

### *3.2. Exit Phase Findings*

When students were asked to assess their experience at the end of their stay in London, the statements with the highest mean agreement (1 = to a great extent; 3 = not at all) were as shown below in table 3. The ranking of the key factors are given with their mean score as:

**TABLE 3: EXIT QUESTIONNAIRE HIGHEST RATED ASPECTS OF THEIR EXPERIENCE OF STUDYING IN THE UK**

(1.25)	I met students from many different countries
(1.39)	When I arrived in England my English was adequate for living in London
(1.42)	I have experienced other cultures
(1.48)	My horizons have been broadened
(1.53)	When I arrived my English was adequate for studying this course
( 1.57)	I experienced different teaching and learning methods
(1.66)	I have improved my English
(1.67)	The quality of the course was good
(1.67)	The teachers in the UK were good

It is striking that the first five statements (that is, the five statements with which students most strongly agreed) all relate to what might broadly be called the cultural experience of being in London – the experience of meeting others, testing one's command of English, widening one's horizons – rather than to academic matters. The equivalent entry phase table (see Table 1 above) shows only two of the first five statements to be related to cultural matters. It is almost as if the students have been surprised by London: they expected hard academic work and intellectual challenge, and of course they knew that they were going to have a new cultural experience, but it is the latter that stands out in hindsight. Fully 79.7% strongly agreed that they had 'met students from many different countries'. This seems to be one of the most

significant aspects of the findings and one of importance for those recruiting students from other countries particularly to universities in London.

Social/cultural matters were highlighted in interviews, too. The answers concerning life in London were ambivalent, with a tendency to be slightly more critical after a year. On the one hand students characterise life in London as “*interesting*”, “*exciting*”, “*enjoyable*”, with an emphasis on the vibrancy and ethnic diversity of the place: “*we were the only white couple in the whole street, so for me that was an experience, so good the life, that’s London*”. On the other hand, such comments were often followed by a critical comment about the perceived dangerousness or dirtiness of the city.

The confidence that students show – in hindsight – about their standard of English is rather intriguing, for it seems to run counter to anecdotal evidence from a good many lecturers, who complain that a substantial number of international students, acceptable IELTS scores notwithstanding, do not have adequate English for the course they are studying. Unsurprisingly, of those who felt most strongly that their English was good enough for the demands of their course, were Africans. These students would have been educated through the medium of English or another European language – came out on top, with 81.8% agreeing with the proposition ‘to a great extent’, while at the other end of the spectrum only 36.8% of East Asians were similarly confident.

There are other differences according to cultural background. For example, while 88% of Latin Americans agreed that their horizons had been broadened ‘to a great extent’ this was true for only 47.4% of East Asians. Similarly, while 84% of EU students agreed that they had experienced other cultures ‘to a great extent’, only 57.9% of East Asians felt the same way. It is worth noting that in terms of cultural adaptation, it is the East Asian students who do not appear to have had the same cultural experience although it is beyond the bounds of this paper to explore this further.

In relation to learning and teaching methods, the data appears to show that the traditional, teacher-centred lecture format retains its appeal. Respondents were asked to evaluate the effectiveness of different teaching methods from 1 (low) to 5 (high), lectures were most highly rated with a mean score of 4.11. The mean for group work was 3.56, and for seminars 3.65. These mean scores demonstrate a significant difference between the students’ perception of the effectiveness of lectures and the effectiveness of small group sessions. There is a similar significant difference between students’ *enjoyment* of lectures and seminars. In terms of enjoyment, lectures showed a mean score of 4.11, compared to 3.39 for group work and 3.83 for seminars.

This would seem to demonstrate that international students both prefer and judge as more effective the more content-led and teacher-led format, setting less value on the opportunity to speak and to hear the opinions of others. (It would be instructive to compare the attitudes of British postgraduates on this matter). In terms of an analysis of national/regional preferences for teaching styles, 89.4% of East Asian students rated lectures as either effective or very effective whereas only 63.2% rated groupwork as effective or very effective. Amongst Europeans, opinions on groupwork were spread over the full range between very poor and very effective. The questionnaire showed strongly that UK teaching and learning methods were unfamiliar to many: 50.8% of all students agreed 'to a great extent' that they had experienced new teaching and learning methods, this includes 68.4% of East Asians.

In interview, students were rather more positive about the value of self-directed and group learning, though it was stressed that the process of adaptation was a hard one. One student came up with an apt metaphor: *"the UK system is good, although I have to adapt a lot. Before, I had just lectures, here we learn by discussing. It is more challenging - we are the navigators, not the passengers"*. But trenchant objections to the new learning style were also expressed: *"We waste a lot of time, discussions are diverted and students interrupt too much when there is so much to do. We are losing valuable time and only have three hours"*. This was echoed by a Chinese student who complained that the lecturers on her course allowed students – she particularly mentioned Brazilian and other Latin American students – to discuss and debate too much, depriving her, as she saw it, of the benefit of the lecturers' full input.

The findings from the questionnaires and the interviews presented five main themes for discussion: teaching and learning, cultural adaption, language, financial aspects and the quality of UK degrees.

### *3.3. Teaching and learning methods*

While many newly-arrived international students (conforming to the widespread perceptions discussed earlier) do indeed express a preference for teacher-centred, passive learning techniques, exposure to the more student-centred and 'hands-off' approach common in the UK seems, at least in a number of cases, to bring about a partial shift in their thinking. Some students, especially amongst the MA TEFL, who are themselves active teachers and lecturers in their own countries, expressed a strong preference for the new approach. Interview data suggests, though, that the same is not so broadly true of, for example, the MBA cohort. The implication for UK lecturers is clear: students need to be 'trained' to accept less teacher-centred methods, and need to be given time to adjust to them. For most UK-based academics, the value of class



discussion, personal opinion and group learning is self-evident. For many overseas students, especially in the early part of their course, this is not the case.

### *3.4. Social and cultural adaptation*

In terms of social-cultural adaptation, the picture is a complex one. Certainly the reality of inner-city London is very different from the (perhaps rather stereotypical?) image held by some international students of the UK. However, this is not necessarily negative. The cosmopolitan character of London is seen in a very positive light; black students, particularly, stress the appeal of ethnic diversity and a cosmopolitan environment. London also provides opportunities for work placement in international institutions, which enhance the programme of study and might help in finding the necessary part-time work.

Other aspects of London are less attractive and there were some negative comments about the amount of dirt, as seen in the two comments from a Swedish and a Chinese student above. Whatever the small differences which are perhaps informed by cultural background, this is a common theme amongst the respondents, and comes up again and again throughout the interviews, in both the entry and exit phases: that London does not feel like a 'modern' or an 'advanced' city. It is often perceived as run-down, shabby and dirty, with poor services. There is, of course, little that universities can do about this. It does, though, need to be kept in mind by lecturers and student support services that the culture shock experienced by a good many students upon arrival will contain elements of disappointment and discomfort.

The most striking difference in terms of cultural adaptation is between the mainly Chinese East Asians and the rest with the East Asians much less likely to agree strongly that they had had their horizons broadened and had experienced other cultures. This is a complex and multilayered matter, and it is not possible to account for it briefly; it might be that Chinese students are unused to meeting foreigners, or that they feel that their English is inadequate. Another way of reading this finding though, and one which would fit in with many of the other preliminary findings presented here, is that many Chinese students are characterised by an essentially *pragmatic* attitude to their UK study. They have a strong desire to improve their career prospects through gaining a UK qualification (which they prize highly, even if they do not necessarily have such a high opinion of the actual learning experience) and improving their English language skills. Meeting others from around the world, sampling new experiences and exploring new places, might for some be a welcome bonus – but it is not the main point of the exercise.

### *3.5. Language*

The English language is a major attraction of studying in the UK, above all for East Asian students. These students rated the opportunity of improving their language skills as more important to them than the cultural draw of the capital, the appropriateness of the course or the reputation of UK universities. It is perhaps worth commenting here on the cultural/linguistic context of such students.

Most European students are familiar with English from school, university and beyond; many African students use it, or another European language such as French or Portuguese, as a second (or even first) language in their own countries; many middle-class South Asians are as comfortable with English as with their mother tongues. For many East Asians, though, and the Chinese in particular, English has been (and for large segments of the population still is) a precious and relatively inaccessible resource. The learning and teaching of English has become a major educational and economic priority, for both individuals and the state. The language has come to be seen as a key symbol of globalisation, regional integration and national advance; the Chinese government has pointed to China's recent accession to the World Trade Organisation and Beijing's winning of the right to hold the Olympic Games as being reasons for a major expansion and improvement of English language teaching and learning (this official government position is routinely quoted by Chinese applicants to the MA TEFL).

This English 'fever' helps explain why many East Asian students would prefer to study in an English-speaking country – but why the UK, and why London? Part of the reason, perhaps, lies in the fact that these students come from national educational and political cultures which hold and transmit highly hierarchical, prescriptive views about matters of language, which are in many cases automatically mapped on to the new environment. Thus many East Asians tend to have a disproportionate respect for the 'original' English they assume to be spoken in the UK: it is seen as important that the UK is, to quote one interviewee, "*the motherland of the language*". Putonghua (or Mandarin), the variety of Chinese treated in China as a standard, is based on the dialect of Beijing. It is therefore simply assumed by many Chinese that the 'best' English (that is, the 'most standard', the clearest, the closest to what they have learned) is spoken in the capital city of England.

Given this background, it is unsurprising that some students who have studied 'British English' in their home countries have been amazed and horrified to find that real London speech, even within the University, too often bears little resemblance to the SSE/RP (that is, Standard Southern English spoken with Received Pronunciation) that they had learnt and - perhaps rashly - assumed to be the norm. While the speech

of the people of Britain, like the state of its public services, is hardly the responsibility of universities, it is clearly the job of universities which deal with large numbers of international students, firstly, to ensure that these students have time and support while they make the necessary adjustment; and secondly, to feed in to the ongoing debate in applied linguistics about the features and values of English as an International (or Global) Language.

### *3.6. Financial aspects*

The shock of prices in London is a consistently expressed negative factor: the interview data in particular comes back to this point time and time again. How universities can prepare potential students for this without deterring them from coming altogether is a very delicate question. One way might be to encourage students to view a moderate amount of paid work as integrative and valuable for personal (and perhaps professional) development. One Asian interviewee mentions that while the extra money is essential, this aspect is also important to her: *"I don't want to be a complete book-worm, I want to get into the English way of life and practise my English language"*.

### *3.7. Quality/value of a UK degree*

One of the main themes which runs through the interviews, and is reflected in the questionnaire data, is that of the perceived quality of UK education. This is not to suggest that the students questioned necessarily think in terms of British universities being 'the best in the world': but interestingly, British institutions appear to be thought of as offering *guaranteed* quality in comparison with courses offered in, say, the USA, where quality assurance does not apply throughout the university system. Some respondents reported that, while they were reluctant to take a risk on an unknown American institution, which might be very good or very bad, they felt safe applying to any British university even where they had very little specific knowledge of or information about it.

In general, the reputation enjoyed by UK universities overseas is a solid one, and a major factor in attracting students to the country. The rankings show unambiguously that students are aware of the reputation of British higher education; however, they also imply rather more than this. Awareness of the quality of British universities is bound up with ideas such as "I thought that with a degree from the UK I would have better job prospects". Hence, the attraction of UK education lies not only - or perhaps not even mostly - in its quality *per se*, but also in the acknowledgement and awareness of that quality amongst prospective employers. That is to say, the actual course on

offer may be of secondary importance to the image of quality which the UK HE sector retains.

#### 4. CONCLUSION

The image of quality, of course, depends in the end on the actual quality. While these findings are far from discouraging, they should perhaps provoke some reflection on the part of those whose objective is to recruit international students. If it is possible that a good many students primarily want to look for new experiences and opportunities and/or make themselves more attractive to employers, rather than primarily wanting to be in Britain or to study a particular course, then the quality of the social, cultural and educational experience that they have (and will later tell their peers about) is of the utmost importance, not least because it reinforces the image of in the this case, UK education overseas. The pragmatic attitude of, above all, Chinese students, as detailed in this paper, is a clear indication that international students cannot be taken for granted. The study has lessons for the long term recruitment strategy of international students and for their teaching and learning and for issues of the provision of student support to deal with issues of culture shock. There are also clearly regional differences that need to be taken into consideration when developing recruitment policies and support policies for international students.

#### REFERENCES

- Bamford, J., & Johnstone, S. (2001). The facilitation of postgraduate learning through the assessment of the organisation of a conference and the presentation of a series of individual papers, Paper presented at the *EDINEB International Conference*, Nice, France.
- Biggs, J. (1999). *Teaching International Students*, in *Teaching for Quality Learning at University*, SRHE & Open University Press, England.
- Chan, S (1999). The Chinese learner - a question of style, *Education and Training*, 41: 294-304.
- Gil, M.C. and Katsara, R. (1999). The experiences of Spanish and Greek students in adapting to UK higher education: the creation of new support strategies, Paper presented at *British Educational Research Association Annual Conference*, University of Sussex, Brighton, <http://www.leeds.ac.uk/educol/documents/00001725.htm>.
- Halpin, T. and Buckley, C. (2004). Forget oil, overseas students make money, *The Times*, April 23, 2004.
- West, A., Dimitropoulos, A., Hind, A., and Wilkes, J., (2000). *Reasons for studying abroad: A survey of EU students studying in the UK*, Paper presented at the European Conference on Educational Research, Edinburgh.
- Woodrow, D and Sham, S. (2001). Chinese pupils and their learning preferences, *Race, Ethnicity and Education*, 4 (4): 377-394.

## FUTURE ADVANCED LIGHT SOURCES AND LASER-INDUCED PROCESSES IN THE FEMTOSECOND REGIME

SPYROS I. THEMELIS\*

### ABSTRACT

*Pump-probe experiments combining short wavelength radiation from a free electron laser (FEL) and optical femtosecond lasers pulses are very attractive for sub-picoseconds time resolved studies. Recently, experiments using FEL combined with synchrotron radiation have been demonstrated. In this paper we describe a scheme for experiments that could be performed at already operating FEL facilities in the XUV frequency regime.*

*Keywords: Atomic Physics; Free-Electron Laser; Photon Interactions with Atoms.*

### 1. INTRODUCTION

The rapid pace of research and development into electromagnetic radiation sources over the past few decades has led to great scientific and technological successes. The laser was indented 40 years ago, and quickly had an enormous impact on many levels of science and technology. Exploitation of synchrotron radiation, in which photons are generated from accelerated relativistic electrons, has come to fruition more recently but presently there are about 50 facilities worldwide serving about 20000 scientists yearly. Synchrotron radiation has the advantageous property of covering a large spectral range down to hard x-rays, which for instance is of great importance for structural determinations with atomic resolution. Progress in recent years in accelerator and undulator technology has made it possible to further advance so-called free-electron lasers (FELs) as promising coherent light sources.

The free-electron laser offers advantages currently unavailable from conventional sources. The most important of these is spectral tunability. FELs are not limited by the need for quantum transitions since the lasing wavelength is determined by the spatial period of a sinusoidal magnetic field and the energy of the electron beam, which is the lasing medium. In recent years, FELs have been or are being developed for research applications with great potential to be fully tunable over large spectral regions down to

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\* Research Associate, Institute of Electronic Structure and Laser, Foundation for Research and Technology – Hellas (FO.R.T.H.), Heraklion, Crete, Greece

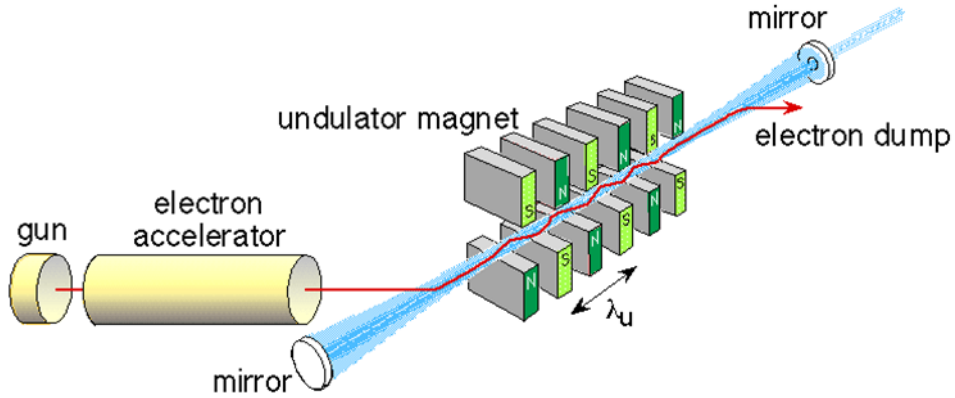
hard x-rays and will provide pulses with femtosecond time-resolution, thus opening up completely new research areas (FEL 2003).

Coherent short wavelength radiation sources of some intensity and short pulse duration, such as the accelerator based FEL, appear in readiness to open the way for the exploration of highly excited multi-electron states well beyond the standard single photon absorption probe technique. The combination and synchronization of such sources with optical lasers of ultra-short duration, and possibly controllable phase, may for the first time allow the study of the coupling between highly excited atomic or molecular states. One can thus realistically contemplate the coupling of Auger or multiply excited states, which would provide a rather unique probe of such highly correlated states offering the ultimate test of degree of validity of theoretical approaches and calculations (Lambropoulos, 2004).

Double optical resonance with one of the transitions in the autoionizing manifold, has been discussed over the years from the point of view of gaining information on atomic structure (Lambropoulos, 1980; Madsen *et al.*, 2000). If an atomic system is to be contemplated for the purposes of the present study, it should be sufficiently simple to avail itself to accurate calculations of the relevant parameters. Helium does satisfy this requirement, possessing at the same time a manifold of highly excited states, which are in the energy range of an XUV source. The few experimental investigations on record have been limited to wavelengths much longer than XUV, since only at such wavelengths have the necessary sources been available, which has placed Helium beyond reach. This of course is apt to change with the arrival of the FEL source. The question we have addressed in this paper is in the context of double resonance as a probe of the pulse duration of the XUV source.

We assume that a well known and studied autoionizing resonance in helium, namely the  $2s2p\ ^1P^o$  state, is excited with an FEL pulse, while a second source (laser) of optical frequency induces a coupling of that resonance to a higher one, namely the  $2p^2\ ^1S$  doubly excited state. The photoelectron signal, from the higher lying resonance, depends on the intensity, duration and delay of the second pulse with respect to the first. One additional interesting question we have posed is the extent to which information about the duration and shape of the XUV pulse can be obtained by monitoring the photoelectron signal from the upper resonance, combined with the judicious choice of the relative duration of and delay between the two pulses, assuming that the second (optical) pulse is well characterized and controlled.

**FIGURE 1: GENERAL LAYOUT OF FREE-ELECTRON LASER.** ( $\lambda_u$ ) IS THE UNDULATOR PERIOD



## 2. FREE ELECTRON LASER BASICS

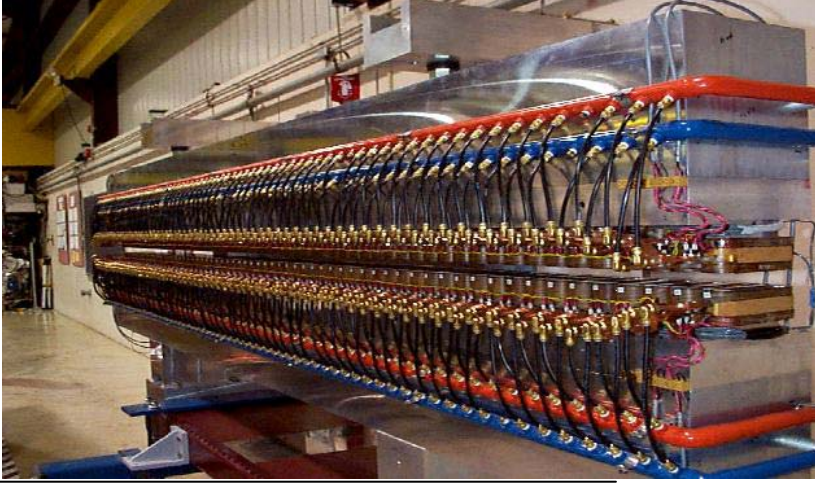
John Madey conceived the free-electron laser, in his Stanford Ph.D. dissertation in 1970. His research group developed the world's first FEL at Stanford University in 1977, demonstrating the gain, tuneability, pulse length, and bandwidth capabilities. Free Electron Laser is substantially different from conventional lasers and sometimes is characterized as an “Exotic laser”. Unlike the other types of lasers there is no medium, which contains bound electrons (Marshall, 1985; Dattoli *et al.*, 1993; Saldin *et al.*, 2000). The free electrons are stripped from atoms in an electrons gun and accelerated to relativistic velocities ( $v \approx c$ ,  $\gamma \approx 10^2$ - $10^5$ ).

The basic principle of the free electron laser can be described within the standard picture for the generation of synchrotron radiation: while traveling with relativistic velocity through the undulator - a periodic array of magnetic dipoles - the electrons are accelerated in the direction transverse to their propagation due to the Lorentz force introduced by the magnetic field. They propagate along a sinusoidal path and emit Synchrotron Radiation in a narrow cone in the forward direction. The radiation field grows exponentially and this is accompanied by pronounced longitudinal density bunching of electrons. In their rest frame the electrons emit dipole but because they are traveling at relativistic velocity the radiation in the laboratory frame is beamed towards the forward direction. The typical opening angle, of the wavelength, integrated radiation is:

$$\frac{1}{\gamma} = \frac{m_e c^2}{E_e} \quad (1)$$

where  $m_e$  is the electron mass (511 keV/c<sup>2</sup>) and  $E_e$  the electron energy.

**FIGURE 2:** THE UNDULATOR AT THE SRC UNIVERSITY OF WISCONSIN MADISON



In the undulator, the deflection of the electrons from the forward direction is comparable to the opening angle of the synchrotron radiation cone. Thus the radiation generated by the electrons while traveling along the individual magnetic periods overlaps. This interference effect is reflected in the formula for the wavelength  $\lambda_{ph}$  of the first harmonic of the spontaneous, on-axis undulator emission

$$\lambda_{ph} = \frac{\lambda_u}{2\gamma^2} (1 + K_{rms}^2) \quad (2)$$

where  $\lambda_u$  is the length of the magnetic period of the undulator,  $\gamma$  is the Lorentz factor of e-beam, and  $K_{rms}$  is the “averaged” undulator parameter:

$$K_{rms} = \frac{eB_u \lambda_u}{2\pi m_e c} \quad (3)$$

which gives the ratio between the average deflection angle of the electrons and the typical opening cone of the synchrotron radiation.  $B_u$  is the rms magnetic field of the



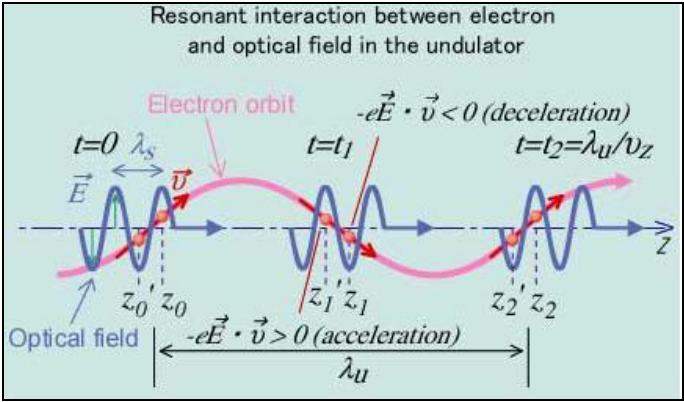
undulator and  $e$  the electron charge. It is important to notice that  $\lambda_u$  and  $K_{rms}$  have some limitations in their practical ranges. They are used to tune the FEL around a central frequency, mainly determined by the energy parameter  $\gamma$  of the electrons, which depends on the choice of the electron accelerator. It is thus clear that, in order to achieve emission at short wavelength it is necessary to use high-energy electron accelerators, implying thus high costs and large size of the facility.

**TABLE 1: CURRENTLY OPERATING AND SCHEDULED FEL FACILITIES**

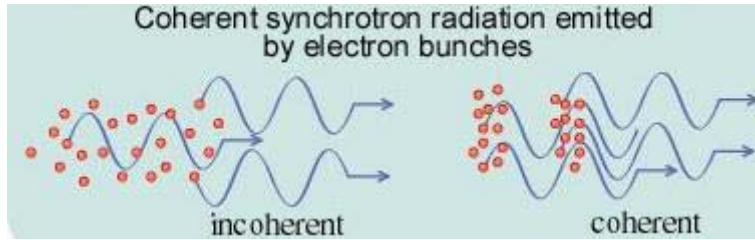
Location	FEL Name	Wavelength range	Institution, City
France	CLIO	IR	LURE, Orsay
	SUPER-ACO FEL	UV	LURE, Orsay
Germany	BESSY-FEL	VUV to X-rays	BESSY, Berlin
	FELICITA I	VIS to UV	DELTA, Dortmund
	IR-FEL	IR	TU Darmstadt
	VUV-FEL	VUV to soft X-rays	DESY, Hamburg
	XFEL	X-rays	
Great Britain	4GLS	IR, VUV, soft X-rays	Daresbury Laboratory
Italy	ENEA	MM	Frascati
	EUFELE	UV to VUV	ELETTRA, Trieste
	FERMI	VUV to soft X-rays	
	SPARC / SPARX	VIS to UV / X-rays	CNR, ENEA, INFN, Tor Vergata Univ., INFN-ST, Italy
Russia	PPL mm-FEL	MM	JINR, Dubna
Sweden	MAX IV	VUV to XUV	MAX-lab, Lund
The Netherlands	FELIX	FIR to IR	FOM, Rijnhuizen
	TEU-FEL	MM & FIR to IR	University Twente
USA	DFELL	IR & UV	Duke University, Durham NC
	DUV-FEL & ATF	VUV	NSLS, Brookhaven NY

	Free-Electron Laser Center	IR	Vanderbilt University, Nashville TE
	FEL User Facility	IR	JLab, Newport News VA
	LEUTL	VIS to VUV	ANL, Argonne IL
	LCLS	X-rays	SLAC, Stanford CA
	Mark III	IR	University of Hawaii, Manoa
	Picosecond FEL	FIR to IR	Stanford CA
	UCSB FEL	MM & FIR	UCSB, Santa Barbara CA
	Neptune, Pegasus, VISA	IR to VIS	UCLA, Westwood CA

**FIGURE 3: THE ELECTRON ORBIT ALONG THE UNDULATOR OF A FREE-ELECTRON LASER**



**FIGURE 4: SKETCH OF THE SELF-AMPLIFICATION OF SPONTANEOUS EMISSION (SASE) IN AN UNDULATOR RESULTING FROM THE INTERACTION OF THE ELECTRONS WITH THE SYNCHROTRON RADIATION THEY EMIT**



The interference condition basically means that, while traveling along one period of the undulator, the electrons slip by one radiation wavelength with respect to the (faster) electromagnetic field. This is one of the prerequisites for the self-amplified spontaneous emission (SASE) process of the FEL. To obtain an exponential amplification of the spontaneous emission present in any undulator, some additional criteria have to be met: One has to guarantee a good electron beam quality and a sufficient overlap between radiation pulse and electron bunch along the undulator. To achieve that, one needs a low emittance, low energy spread electron beam with an extremely high charge density in conjunction with a very precise magnetic field and accurate beam steering through a long undulator (Figure 1).

Oscillating through the undulator, the electron bunch then interacts with its own electromagnetic field created via spontaneous emission (Figure 3). Depending on the relative phase between radiation and electron oscillation, electrons experience either a deceleration or acceleration: Electrons that are in phase with the electromagnetic wave are retarded while the ones with opposite phase gain energy. Through this interaction a longitudinal fine structure, the so-called micro-bunching, is established which amplifies the electro-magnetic field.

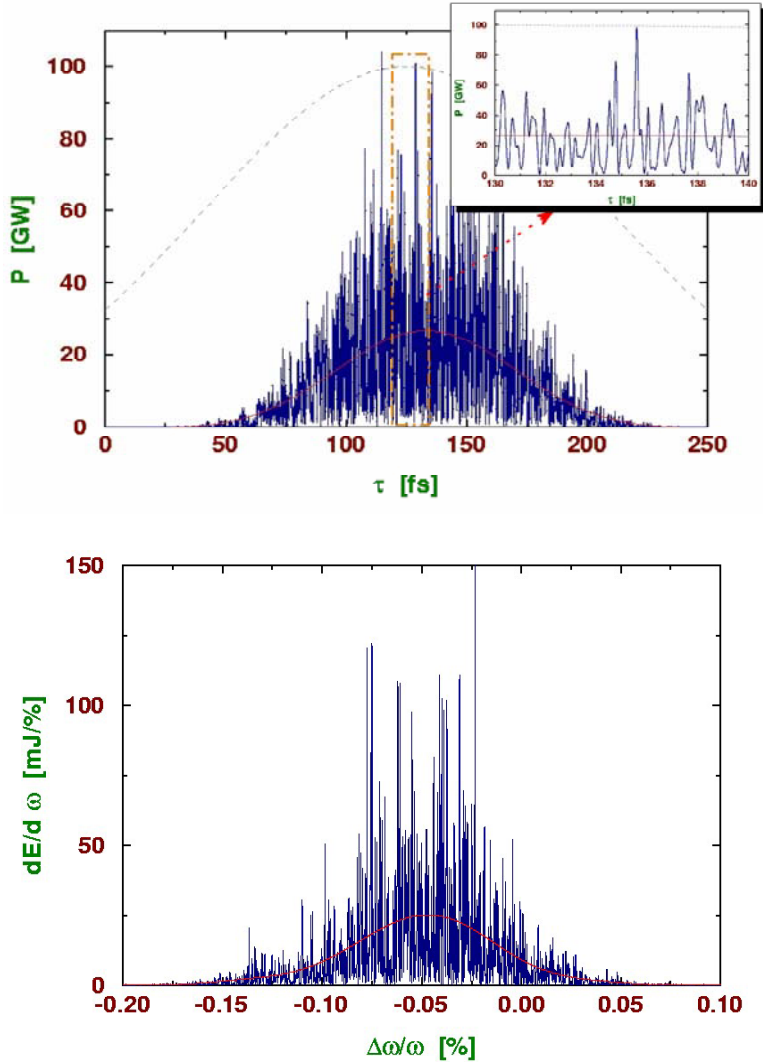
The longitudinal distribution of electrons in the bunch is "cut" into equidistant slices with a separation corresponding to the wavelength  $\lambda_{ph}$  of the emitted radiation, which causes the modulation (Figure 4). More and more electrons begin to radiate in phase, which results in an increasingly coherent superposition of the radiation emitted from the micro-bunched electrons. The more intense the electromagnetic field gets, the more pronounced the longitudinal density modulation of the electron bunch and vice versa. In the beginning - without micro-bunching - all the  $N_e$  electrons in a bunch

( $N_e \geq 10^9$ ) can be treated as individually radiating charges with the power of the spontaneous emission  $\propto N_e$ . With complete micro bunching, all electrons radiate almost in phase. This leads to a radiation power  $\propto N_e^2$  and thus an amplification of many orders of magnitude with respect to the spontaneous emission of the undulator.

The wavelength of the laser is not limited by specific transition energies but depends on the accelerator energy and the undulator properties. In table I we quote many of the operating and scheduled FEL facilities in Europe and USA and the currently possible wavelength range. VUV and X-ray wave-lengths are possible. The VUV FEL under construction at the TESLA Test Facility (TTF) at DESY (Deutsches Elektronen-Synchrotron) uses the self-amplified spontaneous emission (SASE) mode. It will deliver sub-picosecond radiation pulses with gigawatt peak powers down to a wavelength of 6 nm. The radiation from a VUV FEL has a narrow bandwidth, it is fully polarized and transversely coherent. The transverse coherence is also reflected in the development of the transverse intensity distribution along the undulator, which in the end is nearly Fourier transform limited (Saldin *et al.*, 2000).

Examples of temporal and spectral structure of the radiation pulse from an X-ray FEL are presented in Figure 5 (Saldin *et al.*, 2004). The radiation pulse consists of a large number of independent wave-packets, which give rise to "spikes" (Richman *et al.*, 1989). Within one wave-packet, the radiation is transversely and longitudinally coherent. The chaotic nature of the output radiation is a consequence of the start-up from shot noise: since the electron bunch consists of discrete charges randomly emitted from a cathode, the charge density exhibits fluctuations which are random in time and space. As a result, the radiation produced by such a beam has random amplitudes and phases in time and space. These kinds of radiation fields can be described in terms of statistical optics with, e.g., the following parameters: time and spectral correlation functions, transverse correlation functions, probability density distributions of the instantaneous radiation intensity, of its integrals (finite-time and space) and of the energy after a monochromator, coherence time, interval of spectral coherence, coherence area and coherence volume.

**FIGURE 5:** TYPICAL TEMPORAL (UP) AND SPECTRAL (DOWN) STRUCTURE OF THE RADIATION PULSE FROM A SASE X-FEL AT A WAVELENGTH OF 1Å



### 3. INTERACTIONS OF FEL WITH AUTOIONIZING MEDIUM

Two-photon pump-probe experiments offer the unique possibility to obtain very detailed information about the complex relaxation processes of atoms and molecules upon photo-excitation. The first photon is used to prepare, in a controlled way, a well-defined excited state and the second allows either to investigate directly this excited state or, alternatively, to excite another higher lying state, or to analyze the final products after relaxation. The combination of FEL and conventional lasers offers some particular advantages due to their specific characteristics, especially the large and easily tuneability in photon energy, the synchronization, and the high intensity and spectral resolution. In this section we show, how a strong coupling due to an optical laser field and excitation by a tunable FEL XUV field modifies the line-shapes of autoionizing states in He. Also, we show how time characteristics of the FEL pulses are traced in the products of the photo-excitation.

We consider Helium atom to be the subject to two linear polarized laser fields with frequencies  $\omega_1$  and  $\omega_2$  respectively. The relative phase between them is ignored and the total laser field has the form:

$$E(t) = \frac{1}{2} (E_1(t)e^{i\omega_1 t} + E_2(t)e^{i\omega_2 t}) + h.c. \quad (4)$$

The frequencies  $\omega_1$  and  $\omega_2$  are chosen to be tunable around the selected resonance transitions, namely  $1s^2\ ^1S \rightarrow 2s2p\ ^1P^o$  and  $2s2p\ ^1P^o \rightarrow 2p^2\ ^1S$ . The tuneability of FEL sources provides this facilitation. For the time dependent field amplitudes  $E_i(t)$ ,  $i=1,2$ , we can choose a convenient form for the pulse envelope, namely a  $\sin^2$  or a Gaussian, without significantly affecting the results. These types of pulses have been used, in a similar simulation, for the radiation of DESY/XFEL by Lan *et al.* (2003). For  $\sin^2$  the explicit form is:

$$E_i(t) = E_i^{(0)} \sin^2 \left( \frac{\pi t}{2\tau_i} \right), \quad 0 \leq t \leq 2\tau_i \quad (5)$$

$E_i^{(0)}$  is the maximum field strength and  $\tau_i$  is the Full Width at Half Maximum (FWHM). We assume that  $2\tau_i$  is few hundreds femtoseconds and the simultaneous synchronized action of  $E_i(t)$ , i.e.  $\tau_1 = \tau_2$ .

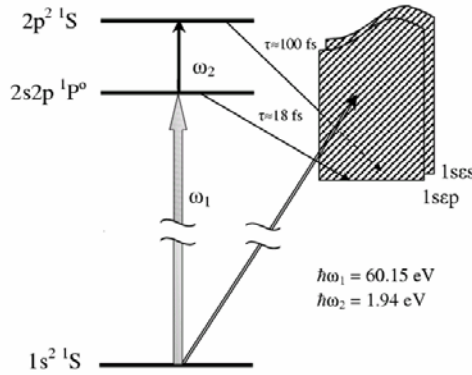
Our aim is to solve the time-dependent Schrödinger equation describing the dynamics of the system under consideration. In the following sections we use the notation  $|g\rangle$  for the ground state  $1s^2\ ^1S$  of He, and  $|a\rangle$ ,  $|E_a\rangle$  and  $|b\rangle$ ,  $|E_b\rangle$  for the discrete and continua parts belonging to the  $2s2p\ ^1P^o$  and  $2p^2\ ^1S$  doubly excited states,

respectively. Note that these autoionizing states are single channel Feshbach resonances (Figure 6).

The wave function for this very interesting model system shown in Figure 6, can be expressed as:

$$\Psi(t) = \sigma_g |g\rangle + \sigma_a |a\rangle + \sigma_b |b\rangle + \int \sigma_{E_a} |E_a\rangle dE_a + \int \sigma_{E_b} |E_b\rangle dE_b \quad (6)$$

**FIGURE 6:** A SCHEME OF DOUBLE AUTOIONIZING RESONANCE SCHEME IN THE SPECTRUM OF HELIUM CONSIDERED HERE



The Hamiltonian operator of the system is written as:  $H=H_o + V + V_d$ , with  $H_o|\varphi\rangle=E_\varphi|\varphi\rangle$ ,  $\varphi=g,a,b$  and  $V$  being the configuration interaction coupling the discrete parts of the doubly excited states to the continua and  $V_d = V_d(t)$  is the field-atom interaction. Projection of the individual states in the expansion of  $\Psi(t)$  leads to a set of coupled differential equations containing amplitudes for the discrete parts as well as for the continua.

The adiabatic elimination of the matrix elements involving the continua, and the application of the rotating wave approximation (RWA), lead to a set of equations for the discrete-state amplitudes  $\sigma_i$ ,  $i=g, a, b$  (Madsen *et al.*, 2000; Themelis *et al.*, 2004). However, in order to remove the oscillating terms in the Hamiltonian matrix  $H(t)$ , we introduce the operator  $U(t)$  defined as:

$$U(t) = \begin{bmatrix} e^{i(E_g/\hbar)t} & 0 & 0 \\ 0 & e^{i(E_g/\hbar + \omega_1)t} & 0 \\ 0 & 0 & e^{i(E_g/\hbar + \omega_1 + \omega_2)t} \end{bmatrix} \quad (7)$$

The Hamiltonian  $H(t)$  is transformed to  $\tilde{H}(t)$  with the unitary transformation:

$$\tilde{H}(t) = U(t)H(t)U^{-1}(t) + i\hbar \frac{\partial U(t)}{\partial t} U^{-1}(t) \quad (8)$$

and takes the form:

$$\tilde{H}(t) = \begin{bmatrix} s_g - (i/2)\gamma_g & \Omega_{ga}(1 - i/q_a) & 0 \\ \Omega_{ag}(1 - i/q_a) & -\delta_1 - (i/2)(\Gamma_a + \gamma_a) & \Omega_{ab}(1 - i/q_{ab}) \\ 0 & \Omega_{ba}(1 - i/q_{ab}) & -\delta_1 - \delta_2 - (i/2)(\Gamma_b + \gamma_b) \end{bmatrix} \quad (9)$$

This wave-function  $\Psi(t)$ , and the coefficients  $\sigma_i$ , are subjects to the transformation:

$\Psi(t) \rightarrow \tilde{\Psi}(t) = U(t)\Psi(t)$ , which is equivalent to the introduction of the slowly varying amplitudes  $c_i(t)$ :

$$c_i(t) = U(t)\sigma_i(t) \quad (10)$$

The coefficients  $c_i(t)$  are slowly varying, in the sense that the above transformation has removed the rapid variation of  $\sigma_i(t)$ . The time dependent Schrödinger equation to be solved is:

$$i\hbar \frac{d}{dt} \mathbf{c}(t) = \tilde{H}(t)\mathbf{c}(t) \quad (11)$$

Obviously the Hamiltonian of equation (11) is non-Hermitian. The parameters that appear in equations (9) and (11), are the Rabi frequencies  $\Omega_{ga}$ ,  $\Omega_{ab}$ , which depend on the intensities of the two laser fields, the Fano parameters  $q_a$ ,  $q_{ab}$ , the ac Stark shifts  $s_g$ ,  $S_a$ ,  $S_b$  and widths  $\gamma_g$ ,  $\gamma_a$ ,  $\gamma_b$  induced by the laser fields, and the autoionizing rates  $\Gamma_a$  and  $\Gamma_b$ . The detunings  $\delta_i$  of the pump and probe fields are defined as follows:

$$\delta_1 = \omega_1 - (E_a + S_a - E_g - s_g) \quad (12a)$$

$$\delta_2 = \omega_2 - (E_b + S_b - E_a - S_a) \quad (12b)$$

By solving the above equations the ionization yield into each channel and the total ionization probability can be calculated. The total ionization probability is:



$$P(t) = 1 - |c_g(t)|^2 - |c_a(t)|^2 - |c_b(t)|^2 \quad (13)$$

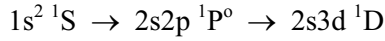
For the calculation of atomic parameters we used advanced computational methods in order to have accurate and reliable results (Themelis, 2004). However, we have to note that we confine ourselves in a perturbative treatment of the problem, since the lasers are of not very strong intensities.

#### 4. RESULTS AND DISCUSSION

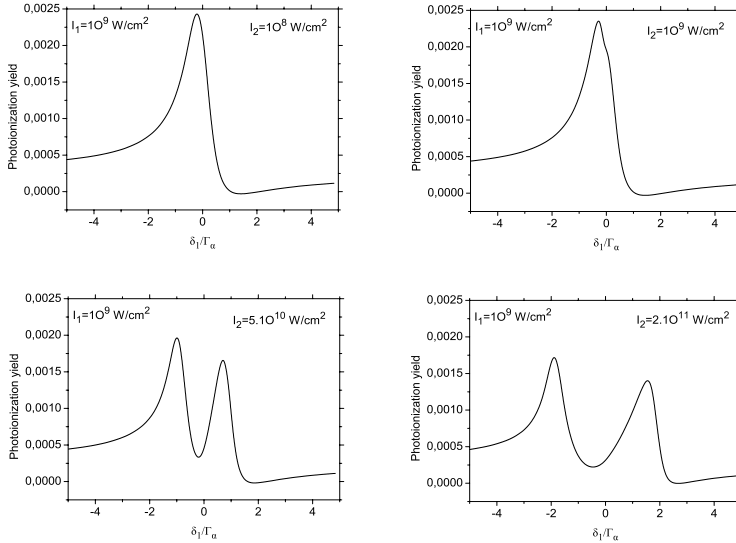
The solution of the system of differential equations given by (11) can provide us the information about the temporal evolution of the system under consideration and the photo-ionization products. We have chosen to study the response of the system under the simultaneous action of the electric field  $E_1$  with frequency  $\omega_1$  and a pulse duration  $\tau_1=5$  ps and of the electric field  $E_2$  with frequency  $\omega_2$  and the same pulse duration. Figure 7 shows the photo-ionization yield of  $\text{He}^+$  as a function of the detuning  $\delta_1$  of the FEL laser source, for a series of intensities. As it can be seen from the graphs, the line-shape changes significantly with the intensity of the laser coupling the  $2s2p\ ^1P^\circ$  and  $2p^2\ ^1S$  doubly excited states. At low intensities we have a line shape very well known for the lowest  $^1P^\circ$  Feshbach resonance of He.

As the intensity increases, a doublet appears due to the ac-Stark splitting as a result of the laser induced oscillation between  $2s2p\ ^1P^\circ$  and  $2p^2\ ^1S$ . This structure is known as an Autler-Townes doublet and the separation between the two peaks carries information about the dipole matrix element coupling the doubly excited states. In the case of having the frequency  $\omega_1$  on resonance ( $\delta_1=0$ ), while the laser frequency  $\omega_2$  is varied, the coupling of the doubly excited state show up a window resonance on the photo-ionization crosses section.

Another interesting issue is the effect of the time profile of the FEL pulses on the products of the photo-excitation and photo-ionization processes. The spikes appearing in the temporal structure of the pulses, as shown in Figure 8, are expected to have an influence in the photo-ionization products of every process induced by the FEL field. However, for some of them we may have the ability to map this structure in a unique way, in order to extract information about its temporal evolution. In an exploratory study of these possibilities, Themelis, Lambropoulos and Meyer (2004) studied the information that one can gain from a pump-probe experiment for a double autoionizing resonance scheme, similar to the one described above. The excitation procedure they considered was the following:

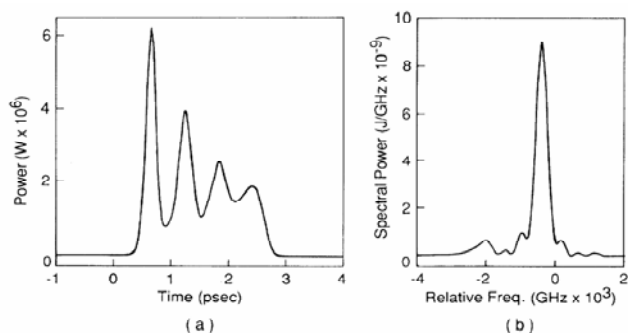


**FIGURE 7: THE PHOTO-IONIZATION YIELD FOR DOUBLE AUTO-IONIZING RESONANCE IN HELIUM FOR VARIOUS VALUES OF THE INTENSITY  $I_2$**



However, instead of using pulses of the same duration they used a short pulse for the optical laser, with duration of the order of 50 fs and a longer pulse having pulse duration 200 fs for the FEL field, with a spike-like temporal structure. The results show that the variation of the intensity of the FEL pulse can be mapped in a very accurate way to the photoelectron spectra, as a function of the time delay between the two laser pulses (Themelis *et al.* 2004).

**FIGURE 8:** A SPIKE-LIKE STRUCTURE OF (A) TEMPORAL EVOLUTION AND (B) SPECTRAL ANALYSIS OF PICOSECOND FEL PULSES, AS IT WAS FOUND BY RICHMAN, MADEY, AND SZARMES (1989)



## 5. CONCLUSIONS

In this study we showed that the coupling of an autoionizing state via a laser field of moderate intensity to another autoionizing state has significant and detectable results in the photo-ionization cross section. The pump-probe two color experiments combining Free Electron Laser and Synchrotron Radiation are able for a detection of the resonant coupling of autoionizing states. The laser intensities used in our study are attainable and proposed experiments with Free-Electron Laser (FEL) sources are readily available. Nevertheless, the generation of a beam of picosecond or femtosecond coherent x-rays, will benefit many areas of basic research such as high-field atomic and molecular physics, the study of high-energy-density phenomena, and protein dynamics.

The manifold interactions of light and matter play a critical role in the drama of life. They provide the energy that makes life possible, as well as the vision required to appreciate its beauty. In the last 200 years, scientists have learned a tremendous amount about the nature of light and of matter. Yet there are still significant gaps in our understanding of this fundamental interplay, which the Free-Electron Laser is helping to bridge.

## REFERENCES

Datoli G., Renieri A., and Torre A. (1993). *Lectures on the Free Electron Laser and Related Topics*, World Scientific Publishing, London.

- FEL (2003). *Proceedings of the 25th Free Electron Laser Conference and 10th FEL Users Workshop*, Tsukuba, Ibarabi, Japan, September 8–12, 2003.
- Lambropoulos P. (1980). Reaching VUV transitions with multiphoton processes, *Applied Optics* 19 (23), p. 3926-3933.
- Lambropoulos P. (2004). Exploring high atomic and molecular excitation with intense coherent short-wavelength radiation, ESF Meeting, *Network on Future Advanced Light Sources*, October 2004, Corsica.
- Lan K., Fill E.E., and Meyer-Ter-Vehn J., (2003). Simulation of He- $\alpha$  and Ly- $\alpha$  soft X-ray lasers in helium pumped by DESY/XFEL-radiation, *Europhysics Letters* 64 (4), p. 454-460.
- Madsen L.B., Schlagheck P., and Lambropoulos P. (2000). Laser-Induced Transitions between Triply Excited Hollow States, *Physical Review Letters* 85, p. 42-45.
- Marshall T.C. (1985). *Free Electron Lasers*, Macmillan Publishing, New York.
- Richman B.A., Madey J.M.J., and Szarmes E. (1989). First observation of spiking behavior in the time domain in a free-electron laser, *Physical Review Letters* 63, p. 1682- 1684.
- Saldin E.L., Schneidmiller E.A., and Yurkov M.V. (2000). *The Physics of Free Electron Lasers*, Springer, Berlin-Heidelberg.
- Saldin E.L., Schneidmiller E.A., and Yurkov M.V. (2004). Terawatt-scale sub-10-fs laser technology—key to generation of GW-level attosecond pulses in X-ray free electron laser, *Optics Communications* 237 (1-3), p. 153-164.
- Themelis S.I, Lambropoulos P., and Meyer M. (2004). Ionization dynamics in double resonanceinvolving autoionizing states in helium: the effect of pulse shapes, *Journal of Physics B: Atomic, Molecular and Optical Physics* 37 (21), p. 4281– 4293.
- Themelis S.I. (2004). Two-color pump-probe dynamics between doubly excited states of Helium, *Balkan Physics Letters* 12 (3), p. 158–167.

## LARGE DEVIATIONS FOR THE EMPIRICAL INDEPENDENT BUT NOT IDENTICAL DISTRIBUTED RANDOM VARIABLES

YIWEN JIANG and JINMING HUANG\*

### ABSTRACT

Consider a sequence of random variables  $(X_n)_{n \geq 1}$  and their associated empirical distributions  $L_n = \frac{1}{n} \sum_{k=1}^n \delta_{X_k}, n \geq 1$ . When  $(X_n)_{n \geq 1}$  is an i.i.d. sequence and

$\alpha = L(X_0)$  is the identical distribution, it is easy to see that  $L_n \xrightarrow{w} \alpha$ , a.s. How to estimate the deviation between  $L_n$  and  $\alpha$  is an important problem in non-parameter statistics. The well known Sanov's theorem indicates the essence of i.i.d. random sequence (Wu, 1997). But Sanov's theorem essentially relies on the separability of the space. Sanov's theorem will be invalid when Banach spaces appearing in non-parameter statistics are in general not separable. Liming Wu (Wu, 1994), obtained the sufficient and necessary conditions of large deviation principle (LDP) for empirical processes by using Talagrand's isoperimetric inequality. In this paper we will use the Talagrand-Ledoux's inequality (Ledoux, 1996) to obtain the sufficient and necessary conditions of LDP for independent but not identical distributed random variables. We also extend the conditions to unbounded functions.

Keywords: Empirical Process; Deviation Inequality; Large Deviation Principle (LDP).

Mathematical Reviews Classification (2000): 60F10, 60B12, 60G50

### 1. INTRODUCTION

Let  $(X_n)_{n \geq 1}$  be a sequence of random variables defined on the probability space  $(\Omega, \mathcal{B}, P)$  and valued in a Polish space  $E$ . The associated empirical distributions are  $L_n = \frac{1}{n} \sum_{k=1}^n \delta_{X_k}, n \geq 1$ . We equip a weak convergence topology " $\xrightarrow{w}$ " and a Borel  $\sigma$ -field  $B(M_1(E))$  on probability measurable space  $M_1(E)$ , then  $L_n$ 's are random

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\* Associate Professors, Department of Mathematics, Wuhan Economics Academy, Wuhan, China

elements in  $M_1(E)$ . When  $(X_n)_{n \geq 1}$  is an i.i.d. sequence and  $\alpha = L(X_0)$  is the identical distribution, it is easy to see that  $L_n \xrightarrow{w} \alpha$ , a.s. by Birkhoff's ergodic theorem. How to estimate the deviation between  $L_n$  and  $\alpha$  is an important problem in non-parameter statistics. The well known Sanov's theorem indicates the essence of i.i.d. random sequence (Wu, 1997). But Sanov's theorem essentially relies on the separability of the space. Sanov's theorem will be invalid when Banach spaces appearing in non-parameter statistics are in general not separable. Liming Wu (Wu, 1994) obtained the sufficient and necessary conditions of large deviation principle (LDP) for empirical processes by using Talagrand's isoperimetric inequality. In this paper we will use the Talagrand-Ledoux's inequality (Ledoux, 1996) to obtain the sufficient and necessary conditions of LDP for independent but not identical distributed random variables.

This paper is organized as follows. In the next section, we firstly introduce some notations and extend Sanov's theorem. Section 3 contains our main results, and their proofs are in section 4. In section 5, we extend our results from bounded case to unbounded functions.

## 2. PREPARATION: EXTEND SANOV'S THEOREM

We introduce the following notations:

$E$  is a Polish space,  $B(E)$  is its Borel  $\sigma$ -field;

$M_b(E)(M_1(E)) = \{\mu \mid \mu \text{ is bounded variance (probabiliy) measure on } (E, B(E))\}$

$C_b(E) = \{f : E \rightarrow R \mid f \text{ is continuous and bounded}\};$

$bB(E) = \{f : E \rightarrow R \mid f \text{ is } B(E) \text{ measurable and bounded}\};$

$\langle \beta, f \rangle = \int_E f d\beta$ , if  $\beta \in M_b(E)$ ,  $f \in bB(E)$ ;

Write weak convergence topology  $\sigma(M_b(E), C_b(E))$  as " $\xrightarrow{w}$ ";

$\sigma(M_b(E), bB(E))$  is  $\tau$ -topology, " $\xrightarrow{\tau}$ ".

Let  $(X_n)_{n \geq 1}$  be a family of independent but not identical distributed random variables defined on  $(\Omega, B, P)$  and valued in  $(E, B(E))$ . Consider the empirical measures,

$$L_n = \frac{1}{n} \sum_{k=1}^n \delta_{X_k}, n \geq 1.$$

It is easy to see that  $L_n \in M_1(E), n \geq 1$ .

Under the assumptions

$$(H1) \quad L(X_n) \xrightarrow{w} \mu$$

or

$$(H1') \quad L(X_n) \xrightarrow{w} \tau,$$

We have

$$\begin{aligned} \Lambda(f) &= \lim_{n \rightarrow \infty} \frac{1}{n} \log E(\exp(n \langle L_n, f \rangle)) \\ &= \lim_{n \rightarrow \infty} \frac{1}{n} \log E(\exp(\sum_{k=1}^n f(X_k))) \\ &= \lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \log E^{L(X_k)} e^f \\ &= \log E^\mu e^f \end{aligned}$$

Because  $\Lambda(f)$  exists,  $\Lambda(f)$  is Gateaux differential and  $\forall f_n \downarrow 0$ , then  $\Lambda(f_n) \downarrow 0$ . By L. Wu (Wu, 1997) (Proposition 1.3 in Chapter 3, Theorem 3.6 and Theorem 2.7 in Chapter 2) we can get the following generalized Sanov's theorem.

**Proposition** Under the assume (H1) (respectively, (H1')),  $P(L_n \in \cdot)$  satisfies LDP on  $(M_1(E), \xrightarrow{\tau})$  (respectively on  $(M_1(E), \xrightarrow{w})$ ) with the rate  $\frac{1}{n}$  and the rate function is

$$h(v, \mu) = \begin{cases} \int_E \frac{dv}{d\mu} \log \frac{dv}{d\mu}, & \text{if } v \ll \mu; \\ +\infty, & \text{else} \end{cases} \quad (2.1)$$

### 3. MAIN RESULTS

Let  $(X_n)_{n \geq 1}$  be a family of independent random variables defined on  $(\Omega, B, P)$  and valued in  $(E, B(E))$ . Let  $IF$  be a family of real valued measurable functions on  $E$  satisfying  $\sup_{f \in IF} |f(x)| < +\infty$ .

Write  $l^\infty(IF) = \{\gamma : \text{real bounded function on } IF, \|\gamma\|_{IF} = \sup_{f \in IF} |F(f)|\}$

Then  $(l^\infty(IF), \|\cdot\|_{IF})$  is a Banach space, and when  $IF$  is infinite, it is not separable. For any  $\beta \in M_1(E)$ , there exists a function on  $IF$  such that

$$\beta^{IF}(f) = \begin{cases} \int_E f d\beta, & \text{if } \int_E f d\beta < \infty; \\ +\infty, & \text{else.} \end{cases}$$

Thus we can regard  $L_n$  as an element  $L_n^F \in l^\infty(IF)$ . In order to avoid measurable problem, we always assume that

(H2)  $(L_n(f) = \frac{1}{n} \sum_{k=1}^n f(X_k))_{f \in IF}$  is separable in the sense of Doob or particularly,  $IF$  is countable.

Let  $B_{IF} = \sigma\{\gamma \rightarrow \gamma(f) \mid f \in IF\}$  be the  $\sigma$ -field on  $l^\infty(IF)$ , then  $L_n^{IF}$  is a random element in  $(l^\infty(IF), \|\cdot\|_{IF})$ .

We assume additionally that

(H3)  $0 \leq f \leq 1, \forall f \in IF$ .

We can define

$$Z(n, \eta) = \sup_{f \in IF_\eta} \left| \sum_{i=1}^n f(X_i) \right|,$$

$$Z(n) = \sup_{f \in IF} \left| \sum_{i=1}^n f(X_i) \right|.$$

Where,



$$IF_\eta = \{f - g; f, g \in IF, d_2(f, g) = (\int (f - g)^2)^{1/2} \leq \eta\}$$

By using Talagrand-Ledoux's deviation inequality, we can obtain the following theorem:

**Theorem 1:** Under the assumptions (H1), (H2) and (H3), the following items are equivalent:

(i)  $P(L_n^{IF} \in \cdot) (n \rightarrow \infty)$  satisfies LDP on  $l^\infty(IF)$  with the rate  $\frac{1}{n}$  and the rate function is

$$h_{IF}(F) = \inf\{h(v; \mu) < +\infty, v^{IF} = F\}, \forall F \in l^\infty(IF). \quad (3.1)$$

(ii)  $(IF, d_2)$  is totally bounded and

$$\lim_{\eta \rightarrow 0} \limsup_{n \rightarrow \infty} \frac{EZ(n, \eta)}{n} = 0. \quad (3.2)$$

(iii)  $(IF, d_2)$  is totally bounded and  $\forall \delta > 0$ ,

$$P(\|L_n^{IF} - \mu^{IF}\| > \delta) \rightarrow 0, (n \rightarrow \infty). \quad (3.3)$$

i.e. the weak law of large number is valid.

#### 4. PROOF OF THEOREM 1

**Lemma 1** (Talagrand-Ledoux): Under the assumption (H3), there exists some constant  $K > 0$  such that

$$P(Z(n) \geq E(Z(n)) + t) \leq \exp[-\frac{t}{k} \log(1 + \frac{t}{EZ(n)})], \forall t \geq 0 \quad (4.1)$$

See the proof of Theorem 2.4 in (Ledoux, 1996).

**Lemma 2**  $(IF, d_2)$  is totally bounded if and only if  $h_{IF}$  is inf-compact in  $l^\infty(IF)$ , i.e. all the level sets  $\{h_{IF} \leq L\} (L \geq 0)$  are compact in  $l^\infty(IF)$ .

**Proof 1** (Proof of sufficiency): If  $h_{IF}$  is inf-compact, for a fixed  $L \geq 0$  and  $F \in \{h_{IF} \leq L\}$ , by the definition of  $h_{IF}$  and  $v \rightarrow h(v; \mu)$  is inf-compact in

$(M_1(E), \tau)$  (see Wu(1997), Proposition 1.2 in Chapter 3), there exists  $v \in M_1(E)$  such that  $\int f dv = F(f)$ ,  $\forall f \in IF$ . Hereby the compactness of  $\{h_{IF} \leq L\}$  is equivalent to the compactness of  $\{f \rightarrow \int f dv \mid h(v; \mu) \leq L\}$ . Since  $g \log g \leq g^2$ , then  $\{f \rightarrow \int fg d\mu; g \in B_2^+(1)\}$  is relative compact, where  $B_2^+(1) = \{g \in L^2(\mu) \mid \int g^2 d\mu \leq 1, g \geq 0\}$ . Consequently,  $\forall \varepsilon > 0$ , there exists a finite many  $(g_i)$  such that for any  $g$  there exists  $g_i$  satisfying,

$$\sup_{f \in IF} \left| \int fg d\mu - \int fg_i d\mu \right| < \frac{\varepsilon}{3}. \quad (4.2)$$

Moreover, for every  $g_i$ , because  $IF$  is relative compact in  $(\sigma(L^2(\mu), \sigma(L^2, L^2)))$ , there also exists a finite number of  $(f_{ij})_j$ , such that  $\forall f \in IF, \exists f_{ij}$ ,

$$\left| \int fg_i d\mu - \int f_{ij} g_i d\mu \right| < \frac{\varepsilon}{3}. \quad (4.3)$$

Therefore, for  $\forall f \in IF, g \in B_2^+(1)$ , we can choose  $g_i$  satisfying (4.2),  $f_{ij}$  satisfying (4.3). Consequently we have,

$$\begin{aligned} \left| \int fg d\mu - \int f_{ij} g d\mu \right| &\leq \left| \int fg d\mu - \int fg_i d\mu \right| + \left| \int fg_i d\mu - \int f_{ij} g_i d\mu \right| \\ &\quad + \left| \int f_{ij} g_i d\mu - \int f_{ij} g d\mu \right| < \varepsilon. \end{aligned}$$

Namely there exists a finite many  $(f_{ij})_{i,j}$ , for  $\forall f \in IF, \exists f_{ij}$  s.t.

$$\sup_{g \in B_2^+(1)} \left| \int fg d\mu - \int f_{ij} g d\mu \right| < \varepsilon$$

Then we have,

$$\begin{aligned} d_2(f, f_{ij}) &\leq \sup_{g \in B_2^+(1)} \left| \int fg \, d\mu - \int f_{ij} g \, d\mu \right| \\ &\leq 2 \sup_{g \in B_2^+(1)} \left| \int fg \, d\mu - \int f_{ij} g \, d\mu \right| < 2\varepsilon \end{aligned}$$

$(IF, d_2)$  is totally bounded.

**Proof 2** (Proof of necessity): If  $(IF, d_2)$  is totally bounded, in order to prove the inf-compactness of  $h_{IF}$ , it is only to be verified that  $\{f \rightarrow \int fg \, d\mu \mid \int g \log g \leq L\}$  is relatively compact and  $h_{IF}$  is lower continuous.

We first prove that  $h_{IF}$  is lower continuous. Let  $F_n$ 's uniformly converge to  $F$ . In order to prove  $\liminf_{n \rightarrow \infty} h_{IF}(F_n) \geq h_{IF}(F)$ , we assume that  $\lim_{n \rightarrow \infty} h_{IF}(F_n) = l < \infty$ . Then there exists  $v_n$  such that  $h_{IF}(F_n) = h(v_n; \mu)$ ,  $v^{IF} = F_n$ .  $\{v_n\}$  is relatively compact under  $\tau$ -topology. Namely  $(\frac{dv_n}{d\mu}) \subset L^1$  is relatively sequential compact (Dellacheir & Meyer, 1976) in  $\sigma(L^1, L^\infty)$ . Hence there exists a sub-sequence such that  $v_{n_k} \xrightarrow{\tau} v$ . Therefore  $v^{IF} = F$ , and

$$\lim_{n \rightarrow \infty} h_{IF}(F_n) = \lim_{n \rightarrow \infty} h(v_{n_k}, \mu) \geq h(v, \mu) \geq h_{IF}(F).$$

Next we prove that  $\{f \rightarrow \int fg \, d\mu \mid \int g \log g \leq L\}$  is relatively compact. Because  $(IF, d_2)$  is totally bounded, by Arzelá-Ascoli's theorem, it is only to be verified that  $\{f \rightarrow \int fg \, d\mu \mid \int g \log g < L\}$  is equicontinuous. By Donsker-Varadhan's variational formula [1], for  $\forall \lambda_0 > 0$ , we have

$$\begin{aligned} \lambda_0 \left| \int fg \, d\mu - \int f'g \, d\mu \right| &\leq \int \lambda_0 |f - f'| g \, d\mu \\ &\leq \int g \log g \, d\mu + \log \int e^{\lambda_0 |f - f'|} \, d\mu \end{aligned}$$

For  $\forall \varepsilon > 0$ , take  $\lambda_0 = \frac{2L}{\varepsilon}$ , for  $\forall f, f' \in IF$  satisfying

$$\|f - f'\|_{L^2(\mu)} < \frac{\varepsilon}{2e^{2L\varepsilon}} = \delta.$$

Then,  $\forall g \geq 0$ ,  $\int g \log g \, d\mu \leq L$ , we have,

$$\begin{aligned} \left| \int fg \, d\mu - \int f'g \, d\mu \right| &\leq \frac{1}{\lambda_0} (L + \log \int \exp(\lambda_0 |f - f'|) \, d\mu) \\ &\leq \frac{\varepsilon}{2} + \frac{1}{\lambda_0} \log \int \exp(\lambda_0 |f - f'|) \, d\mu \end{aligned}$$

We also have by mean value theorem,

$$\begin{aligned} &\frac{1}{\lambda_0} \log \int \exp(\lambda_0 |f - f'|) \, d\mu \\ &\leq \frac{\int |f - f'| e^{\lambda_0 |f - f'|} \, d\mu}{\int e^{\lambda_0 |f - f'|} \, d\mu} \\ &\leq e^{\lambda_0} \int |f - f'| \, d\mu \\ &\leq e^{\lambda_0} \|f - f'\|_{L^2(\mu)} < \frac{\varepsilon}{2}. \end{aligned}$$

Consequently,

$$\int |f - f'| g \, d\mu < \varepsilon.$$

#### 4.1. Proof of Theorem 1

When  $IF$  is finite, the theorem is directly a corollary of the proposition and contraction principle. Next we assume  $IF$  is unbounded.

(i)  $\Rightarrow$  (iii) We can obtain that  $(IF, d_2)$  is totally bounded by Lemma 2. By the assumption of LDP and by Borel-Cantelli's lemma, we have,

$$(L_n - \mu)^{IF} \rightarrow 0, a.s.$$

(iii)  $\Rightarrow$  (ii) Because  $\|L_n^{IF}\|_{IF} \leq 1$ , by dominated convergence theorem,  

$$E\|L_n^{IF_\eta} - \mu^{IF_\eta}\| \leq 2E\|L_n^{IF} - \mu^{IF}\| \rightarrow 0.$$

Therefore,

$$\begin{aligned} \limsup_{n \rightarrow \infty} E\|L_n^{IF_\eta}\| &\leq \limsup_{n \rightarrow \infty} E\|L_n^{IF_\eta} - \mu_n^{IF_\eta}\| + \limsup_{n \rightarrow \infty} E\|L_n^{IF_\eta}\| \\ &\leq \limsup_{n \rightarrow \infty} \sup_{f, g \in IF; \|f-g\|_2 < \eta} \left| \int (f - g) d\mu \right| < \eta. \end{aligned}$$

(ii)  $\Rightarrow$  (i) It is only to be verified that,

$$\lim_{\eta \rightarrow 0} \limsup_{n \rightarrow \infty} \frac{1}{n} \log P(\|L_n(\cdot) - \mu(\cdot)\|_{IF_\eta} \geq \delta) = -\infty, \forall \delta > 0 \quad (4.4)$$

In fact, if (4.4) holds, for  $\eta > 0$ , we can take a finite  $\eta$ -net  $IF^\eta$ , such that there exists a map  $f \rightarrow f^\eta$  from  $IF$  to  $IF^\eta$  satisfying  $\|f - f^\eta\| < \eta$ .

a) Upper bound: By lemma 2,  $\{h_{IF} \leq a\}$  ( $a > 0$ ) is compact in  $l^\infty(IF)$ . For any closed set  $C \subset l^\infty(IF)$ ,  $b = \inf_{F \in C} h_{IF}(F)$ . We want to prove,

$$\limsup_{n \rightarrow \infty} \log P(L_n^{IF} \in C) \leq -b.$$

If  $b = 0$ , then the result is obviously true. Next we assume  $b > 0$ .

For any  $0 < a < b$ , let  $K = \{h_{IF} \leq a\}$  be the rate function defined by (3.1) on  $IF^\eta$ . Take  $p_\eta(F)$  as the restriction of  $F$  on  $IF^\eta$ , and let  $K^\eta = \{h^\eta \leq a\}$ , then  $K^\eta = p_\eta(K)$ . Consequently for every  $\delta > 0$ , there exists an  $\eta > 0$ , such that for all  $F \in l^\infty(IF)$ . When  $p_\eta(F) \in K^\eta(\delta)$  and

$$\sup\{|F(f) - F(g)|; f, g \in IF, d_2(f, g) < \eta\} < \delta,$$

We have  $F \in K(3\delta)$ , where  $K(\varepsilon)(K^\eta(\varepsilon))$  is the neighborhood of  $K(K^\eta)$ . Now we can choose a  $\delta > 0$ , such that  $C \cap K(3\delta) = \emptyset$ . If  $\eta$  is sufficiently small, we have,

$$\begin{aligned}
 P(L_n^{IF} \in C) &\leq P(L_n^{IF} \notin K(3\delta)) \\
 &\leq P(L_n^{IF^\eta} \notin K^\eta(\delta)) + P(\|L_n\|_{IF_\eta} \geq \delta) \\
 &\leq \exp(-na + o(n)) + \exp(-L(\eta) \cdot n)
 \end{aligned}$$

where  $L(\eta) \rightarrow \infty$  as  $n \rightarrow \infty$ , is from (4.4). Because  $a (< b)$  is arbitrary, the upper bound is verified.

b) Lower bound: In order to prove the lower bound, it is only to be verified that for  $\forall F \in l^\infty(IF)$ ,  $\forall \delta > 0$ ,

$$\liminf_{n \rightarrow \infty} \frac{1}{n} \log P(L_n^{IF} \in N_\delta(F)) \geq -h_{IF}(F)$$

$$\text{where } N_\delta(F) = \{F' \mid \sup_{f \in IF} |F'(f) - F(f)| < \delta\}.$$

Without losing generality we assume  $h_{IF} < +\infty$ . Now we have  $F = v^{IF}$ . For any  $\delta > 0$ , we can choose an  $\eta > 0$ , such that,

$$|F(f) - F(f^\eta)| = \left| \int (f - f^\eta) dv \right| < \frac{\delta}{3}$$

(see the proof of Lemma 2).

Write

$$N_\delta^{IF^\eta} = \{F' \mid |F'(f) - F(f)| < \delta/3, \forall f \in IF^\eta\}$$

$$M_{\delta,\eta} = \{F' \mid |F'(f) - F(f^\eta)| < \delta/3, \forall f \in IF^\eta\}$$

then we have

$$N_{\delta,\eta} \stackrel{\Delta}{=} M_{\delta,\eta} \cap N_\delta^{IF^\eta} \subset N_\delta(F)$$

(because of

$$\begin{aligned}
 |F'(f) - F(f)| &\leq |F'(f) - F'(f^\eta)| + |F'(f^\eta) - F(f^\eta)| \\
 &\quad + |F(f^\eta) - F(f)| < \delta
 \end{aligned}$$

Consequently,

$$\begin{aligned}
 -h_{IF}(F) &= -\inf\{h(v; \mu) \mid v^{IF} = F\} \\
 &\leq -\inf\{h(v; \mu) \mid v^{IF} = F \mid_{IF^\eta}\} \\
 &= -h_{IF^\eta}(F \mid_{IF^\eta}) \leq \liminf_{n \rightarrow \infty} \frac{1}{n} \log P(L_n^{IF^\eta} \in N_\delta^{IF^\eta}) \\
 &\leq \liminf_{n \rightarrow \infty} \frac{1}{n} \log \left[ P(L_n^{IF^\eta} \in N_\delta^{IF^\eta} \cap M_{\delta, \eta}) + P(L_n^{IF^\eta} \in N_\delta^{IF^\eta} \cap M_{\delta, \eta}^c) \right] \\
 &\leq \max \left\{ \liminf_{n \rightarrow \infty} \frac{1}{n} \log P(L_n^{IF^\eta} \in N_{\delta, \eta}), \limsup_{n \rightarrow \infty} \frac{1}{n} \log P(L_n^{IF^\eta} \in M_{\delta, \eta}^c) \right\} \\
 &\leq \liminf_{n \rightarrow \infty} \frac{1}{n} \log P(L_n^{IF} \in N_\delta(F))
 \end{aligned}$$

Then the lower bound is verified.

Next we prove the key (4.4). By Lemma 1, we have,

$$\begin{aligned}
 P(\|L_n^{IF^\eta}\| > \delta) &= P\left(\sup_{f \in IF_\eta} \left| \sum_{i=1}^n f(X_k) \right| > n\delta\right) \\
 &\leq \exp\left(-\frac{n\delta - EZ(n, \eta)}{K} \log\left(1 + \frac{n\delta - EZ(n, \eta)}{EZ(n, \eta)}\right)\right)
 \end{aligned}$$

For  $\forall L > 0$ , we can choose a sufficiently small  $\eta$ , when  $n$  is sufficiently large, we have  $\frac{EZ(n, \eta)}{n} < \frac{\delta}{L}$ , and (4.4) is verified.

**Note:** If  $IF \subset C_b(E)$ , the assumption (H1) in Theorem 1 can be replaced by (H1').

## 5. EXTENDING TO UNBOUNDED CASE

**Theorem 2:** Let  $IF \subset L^2(E, \mu)$  such that,

$$h(\lambda) = \sup_k^\Delta E^{L(X_k)} \exp(\|\lambda f\|_{IF}) < \infty, \forall \lambda > 0. \quad (5.1)$$

Then the items (i), (ii) and (iii) in Theorem 1 are equivalent.

**Proof** (i)  $\Rightarrow$  (iii)  $\Rightarrow$  (ii) See the proof of the Theorem 1.

(ii)  $\Rightarrow$  (iii) Take a finite number  $\eta$ -net  $IF^\eta$ , such that for  $\forall f \in IF, \exists f^\eta \in IF^\eta$ , we have  $\|f - f^\eta\|_2 < \eta$ . Then  $\{f - f^\eta; f \in IF\} \subset IF_\eta$ .

By (ii), for  $\forall \varepsilon > 0$ , we have,

$$\limsup_{n \rightarrow \infty} \sup_{f \in IF} |L_n(f - f^\eta) - \mu(f - f^\eta)| < \varepsilon,$$

and consequently

$$\begin{aligned} \limsup_{n \rightarrow \infty} E \sup_{f \in IF} |L_n(f) - \mu(f)| &\leq \limsup_{n \rightarrow \infty} E \sup_{f \in IF} |L_n(f - f^\eta) - \mu(f - f^\eta)| \\ &\quad + \limsup_{n \rightarrow \infty} E \sup_{f \in IF} |L_n(f^\eta) - \mu(f^\eta)| < \varepsilon. \end{aligned}$$

(ii)  $\Rightarrow$  (i) For every  $N > 0$ , let

$$IF_N^\Delta = \{f_N^\Delta = (f \vee (-N) \wedge N), f \in IF\}.$$

Because of  $d_2(f_N, g_N) \leq d_2(f, g)$ ,  $IF_N$  is also totally bounded in  $L^2(E, \mu)$ , and we have,

$$E\|L_n^{IF_N} - \mu^{IF_N}\| \leq E\|L_n^{IF} - \mu^{IF}\| \rightarrow 0 \quad (n \rightarrow \infty).$$

In order to prove the LDP in (i), like the proof of the Theorem 1, it is only to be verified that,

$$\lim_{N \rightarrow \infty} \limsup_{n \rightarrow \infty} \frac{1}{n} \log P(\|L_n(f - f_N) - \mu(f - f_N)\|_{IF} \geq \delta) = -\infty \quad (5.2)$$

But we have

$$\begin{aligned} &P(\|L_n(f - f_N) - \mu(f - f_N)\|_{IF} \geq \delta) \\ &\leq \exp(-n\delta\lambda) E(\exp(n\lambda\|L_n(f - f_N) - \mu(f - f_N)\|_{IF})) \\ &\leq \exp(-n\delta\lambda) (\sup_k E^{L(X_k)} \exp(\lambda\|f - f_N - E(f - f_N)\|_{IF}))^n. \end{aligned}$$

Consequently,



$$\begin{aligned} & \lim_{n \rightarrow \infty} \frac{1}{n} \log P(\|L_n(f - f_N) - \mu(f - f_N)\|_{IF} \geq \delta) \\ & \leq -\delta\lambda + \log \sup_k E^{L(X_k)} \exp(\lambda \|f - f_N - E(f - f_N)\|_{IF}) \end{aligned}$$

For  $\forall \lambda > 0$ , by dominated convergence theorem, and integrabel conditions (5.1), (5.2), (i) is verified.

## 6. CONCLUSIONS

How to estimate the deviation between  $L_n$  and  $\alpha$  is an important problem in non-parameter statistics. The well known Sanov's theorem indicates the essence of i.i.d. random sequence. But Sanov's theorem essentially relies on the separability of the space. Sanov's theorem will be invalid when Banach spaces appearing in non-parameter statistics are in general not separable. We firstly extend Sanov's theorem from i.i.d. case to general case, then we obtain the sufficient and necessary conditions of large deviation principle (LDP) for independent but not identical distributed random variables by using Talagrand-Ledoux's inequality. It is also important to extend our results from bounded case to unbounded case which is more interesting to practical researchers.

## REFERENCES

- Dellacheir, C. and Meyer, P.A. (1976). *Probabilities et potentiel, Vol 1*, Hermann.
- Ledoux, M. (1996). On the Talagrand's Deviation inequalities for product measure, *ESA IM, Probability and Statistic*, Vol. 1, 63-87.
- Wu, L. (1994). Large deviations, moderate deviations and LIL for empirical processes, *Annals of Probability*, Vol. 22, 17-27.
- Wu, L. (1997). *An introduction to large deviations*, in *Several Topics in Stochastic Analysis* (J. A. Yan, S. Peng, S. Fang and L. M. Wu, Eds.), 225-336, Academic Press of China [In Chinese].



## GLS-GIS APPLIED TO WORKFORCE SCHEDULING PROBLEM

ISSAM A.R. MOGHRABI\*

### *ABSTRACT*

*The main interest in this paper emphasizes on two aspects. A Fast Local Search (FLS) algorithm that helps to improve the efficiency of hill climbing coupled with a Guided Local Search (GLS) Algorithm, which is developed to help local search to escape local optima and distribute search effort, and the integration of the above algorithms with a Geographic Information System (GIS) used to manage the workforce scheduling for an electricity company.*

*Keywords: Fast Local Search (FLS); Guided Local Search (GLS); Algorithm; Geographic Information System (GIS); Workforce Scheduling.*

### 1. INTRODUCTION

The mechanisms of the GLS – GIS coupling are applied in solving a real life workforce-scheduling problem (for Electricity of Lebanon - EDL). A scheduling problem mainly involves resource allocation. This normally takes the form of assigning values to a set of variables, satisfying a set of constraints and optimizing a certain function. The various requirements of the scheduling problem are analyzed and represented as constraints or optimization criteria. The workforce is then distributed over a spatial area according to the determined schedule.

The basic motivation behind the project was to provide EDL with an application that could be used to efficiently schedule its workforce over the electric distribution network. Workforce scheduling, however, can be considered as a real life constraint optimization problem that is hard to solve using complete methods, such as branch & bound, due to its combinatorial explosion nature. One way to contain the combinatorial explosion problem is to use local search methods that sacrifice completeness. One basic form of local search methods is often referred to as hill climbing.

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\* Computer Science Dept., Faculty of Science, Beirut Arab University, Beirut, Lebanon

## 2. HILL CLIMBING AND LOCAL SEARCH

### *2.1. Hill Climbing Background*

Hill Climbing or Neighborhood Search is the basis of many heuristic methods for combinatorial optimization problems. In isolation, it is a simple iterative method for finding good approximate solutions.

To perform hill climbing, one must define the following:

- (a) A representation for candidate solutions.
- (b) An objective function: given any candidate solution, this function returns a numerical value. The problem is seen as an optimization problem according to this objective function (which is to be minimized or maximized).
- (c) A neighborhood function that maps every candidate solution  $x$  (often called a state) to a set of other candidate solutions (which are called neighbours of  $x$ ).

Hill climbing works as follows: starting from a candidate solution, which may be randomly or heuristically generated, the search moves to a neighbor which is 'better' according to the objective function (in a minimization problem, a better neighbor is one which is mapped to a lower value by the objective function). The search terminates if no better neighbor can be found, or resources run out. The whole process can be repeated from different starting points.

One of the main problems with hill climbing is that it may settle in local optima points that are better than all their neighbors but not necessarily the best possible solution.

### *2.2. From Local Search to Guided Fast Local Search*

Guided Local Search is a general and compact optimization technique suitable for a wide range of combinatorial optimization problems. Guided Local Search takes advantage of problem and search related information to guide local search in a search space. This is made possible by augmenting the cost function of the problem to include a set of penalty terms. Local search is confined by the penalty terms and focuses attention on promising regions of the search space. Iterative calls are made to Local search. Each time local search gets caught in a local minimum, the penalties are modified and local search is called again to minimize the modified cost function. Furthermore, to speed up neighborhood search, Fast Local Search is used to break the current neighborhood down into a number of small sub-neighborhoods and attaches an

activation bit to each one of them. GLS combined with FLS compose a very powerful optimization tool.

### 3. THE EDL WORKFORCE SCHEDULING

#### 3.1. Problem description

The problem is to schedule a number of engineers to a set of jobs, minimizing total cost according to a function, which is to be explained below. Each job is described by a triple:

$$(\text{Loc}, \text{Dur}, \text{Type}) \quad (1)$$

Here Loc is the location of the job (depicted by its x and y coordinates), Dur is the standard duration of the job and Type indicates whether this job must be done in the morning, in the afternoon, as the first job of the day, as the last job of the day, or at any time of day.

Each engineer is described by a 5tuple:

$$(\text{Base}, \text{ST}, \text{ET}, \text{OT\_limit}, \text{Skill}) \quad (2)$$

Where Base is the x and y coordinates at which the engineer locates, ST and ET are this engineer's starting and ending time, OT\_limit is his/her overtime limit, and Skill is a skill factor between 0 and 1 which indicates the fraction of the standard duration that this engineer needs to accomplish a job. Thus, if an engineer with skill factor 0.9 is to serve a job with duration (Dur) 20, then this engineer would actually take 18 minutes to finish the job.

Each job can be solved by a number of engineers with the appropriate skills. The job-Engineer relation is described by the variable length n-tuple:

$$(\text{Job ID}, [\text{Eng ID1}, \text{Eng ID2}, \dots, \text{Eng IDn}]) \quad (3)$$

Where Job ID is the Id of a certain Job, Eng ID1, Eng ID2, ..., Eng IDn represent the qualified engineers for this Job; here n may vary from one Job to the Other.

The cost function that is to be minimized is defined as follows:

$$\text{Total Cost} = \sum_{i=1}^{NoT} TC_i + \sum_{i=1}^{NoT} OT_i^2 + \sum_{j=1}^{NoJ} (\text{Dur}_j + \text{Penalty}) \times UF_j \quad (4)$$

Where:  $NoT$  = number of engineers;

$NoJ$  = number of jobs;

$TC_i$  = Travelling Cost of engineer  $i$ ;

$OT_i$  = Overtime of engineer  $i$ ;

$Dur_j$  = Duration of job  $j$ ;

Penalty = constant (which is set to 60 in the project)

$UF_j = 1$  if job  $j$  is not served; 0 otherwise;

The travelling cost between  $(x_1, y_1)$  to  $(x_2, y_2)$  is defined as follows:

$$TC((x_1, y_1), (x_2, y_2)) = \frac{\Delta_x / 2 + \Delta_y}{8} \quad \text{If } \Delta_x > \Delta_y;$$

$$= \frac{\Delta_y / 2 + \Delta_x}{8} \quad \text{Otherwise.} \quad (4a)$$

Here  $\Delta_x$  is the absolute difference between  $x_1$  and  $x_2$ , and  $\Delta_y$  is the absolute difference between  $y_1$  and  $y_2$ . The greater differences of the  $x$  and  $y$  are halved before summing. Engineers are required to start from and return to their bases everyday. An engineer may be assigned more jobs than he/she can finish.

### 3.2. Fast local search applied to EDL workforce scheduling problem

#### 3.2.1. Representation of candidate solutions and hill climbing

To tackle the workforce scheduling problem, we represent a candidate solution (i.e. a possible schedule) by a permutation of the jobs. Each permutation is mapped into a schedule using the following (deterministic) algorithm:

Procedure **Evaluation** (input: one particular permutation of jobs):

1. For each job, order the qualified engineers in ascending order of the distances between their bases and the job (such orderings only need to be computed once and recorded for evaluating other permutations).

2. Process one job at a time, following their ordering in the input permutation.

For each job  $x$ , try to allocate it to an engineer according to the ordered list of qualified engineers:

2.1. To check if engineer  $g$  can do job  $x$ , make  $x$  the first job of  $g$ ; if that fails to satisfy any of the constraints, make it the second job of  $g$ , and so on;

2.2. If job  $x$  can be fitted into engineer  $g$ 's current tour, then try to improve  $g$ 's new tour (now with  $x$  in it);

2.3. If job  $x$  cannot be fitted into engineer  $g$ 's current tour, then consider the next engineer in the ordered list of qualified engineers for  $x$ ; the job is unallocated if it cannot fit into any engineer's current tour.

3. The cost of the input permutation, which is the cost of the schedule which is thus created, is returned.

Given a permutation, hill climbing is performed in a simple way: a pair of jobs is looked at a time. Two jobs are swapped to generate a new permutation if the new permutation is evaluated (using the Evaluation procedure above) to a lower cost than the original permutation.

The starting point of the hill climbing is generated heuristically and deterministically: the jobs are ordered by the number of qualified engineers for them. Jobs which can be served by the fewest number of qualified engineers are placed earlier in the permutation.

### *3.2.2. Fast hill climbing*

So far we have defined an ordinary hill climbing algorithm. Each state in this algorithm has  $O(n^2)$  neighbors, where  $n$  is the number of jobs in the workforce scheduling problem. The fast local search is a general strategy which allows us to restrict the neighborhood, and consequently improve the efficiency of the hill climbing. We shall explain here how it is applied to the workforce scheduling problem. Later we shall explain that this technique can be (and has successfully been) generalized to other problems.

To apply the fast local search to workforce scheduling, each job permutation position is associated with an activation bit, which takes binary values (0 and 1). These bits are manipulated in the following way:

1. All the activation bits are set to 1 (or "on") when hill climbing starts.
2. The bit for job permutation position  $x$  will be switched to 0 (or "off") if every possible swap between the job at position  $x$  and another job under the current permutation has been considered, but no better permutation has been found.

3. The bit for job permutation position  $x$  will be switched to 1 whenever  $x$  is involved in a swap which has been accepted.

During hill climbing, only those job permutation positions which activation bits are 1 will be examined for swapping. In other words, positions which have been examined for swapping but failed to produce a better permutation will be heuristically ignored. Positions involved in a successful swap recently will be examined more. The overall effect is that the size of neighborhood is greatly reduced and resources are invested in examining swaps which are more likely to produce better permutations.

### 3.3. Guided local search applied to EDL workforce scheduling problem

#### 3.3.1. The GLS algorithm

Like all other hill climbing algorithms, FLS suffers from the problem of settling in local optima. Guided local search (GLS) is a method for escaping local optima. GLS is built upon the connectionist method called GENET (it is a generalization of the GENET computation models).

GLS is an algorithm for modifying local search algorithms. The basic idea is that costs and penalty values are associated to selected features of the candidate solutions. Selecting such features in an application is not difficult because the objective function is often made up of a number of features in the candidate solutions. The costs should normally take their values from the objective function. The penalties are initialized to 0.

Given an objective function  $g$ , which maps every candidate solution  $s$  to a numerical value, we define a function  $h$  that will be used by the local search algorithm (replacing  $g$ ).

$$h(s) = g(s) + \lambda \times \sum_{i=1, F} p_i \times I_i(s) \quad (5)$$

Where  $s$  is a candidate solution,  $\lambda$  is a parameter to the GLS algorithm,  $F$  is the number of features,  $p_i$  is the penalty for feature  $i$  (which are initialized to 0) and  $I_i$  is an indication of whether the candidate solution  $s$  exhibits feature  $i$ :

$$I_i(s) = 1 \text{ if } s \text{ exhibits feature } i; 0 \text{ otherwise.} \quad (6)$$



When the local search settles on a local optimum, the penalty of some of the features associated to this local optimum is increased (to be explained below). This has the effect of changing the objective function (which defines the "landscape" of the local search) and driving the search towards other candidate solutions. The key to the effectiveness of GLS is in the way that the penalties are imposed.

Our intention is to penalize "bad features", or features which "matter most", when a local search settles in a local optima. The feature which has high cost affects the overall cost more.

Another factor that should be considered is the current penalty value of that feature. We define the utility of penalizing feature  $i$ ,  $util_i$ , under a local optimum  $s^*$ , as follows:

$$util_i(s^*) = I_i(s^*) \times \frac{c_i}{1 + p_i} \quad (7)$$

In other words, if a feature is not exhibited in the local optimum, then the utility of penalizing it is 0. The higher the cost of this feature, the greater the utility of penalizing it. Besides, the more times that it has been penalized, the greater  $(1 + p_i)$  it becomes, and therefore, the lower the utility of penalizing it again.

In a local optimum, the feature(s) with the greatest utility value will be penalized. This is done by adding 1 to its penalty value:

$$p_i = p_i + 1 \quad (8)$$

The  $\lambda$  parameter in the GLS algorithm is used to adjust the weight of penalty values in the objective function. The results in applying GLS to the workforce scheduling problem are not very sensitive to the setting of this parameter.

By taking cost and the current penalty into consideration in selecting the feature to penalize, we are distributing the search effort in the search space. Candidate solutions which exhibit "good features", i.e. features involving lower cost, will be given more effort in the search, but penalties may lead the search to explore candidate solutions which exhibit features with higher Cost. The idea of distributing search effort is used in Operations Research.

Following we shall describe the general GLS procedure:

Procedure **GLS** (input: an objective function  $g$  and a local search strategy  $L$ ):

1. Generate a starting candidate solution randomly or heuristically;
2. Initialize all the penalty values ( $p_i$ ) to 0;
3. Repeat the following until a termination condition (e.g. a maximum number of iterations or a time limit) has been reached:
  - 3.1. Perform local search (using  $L$ ) according to the function  $h$  (which is  $g$  plus the penalty values, as defined above) until a local optimum  $M$  has been reached;
  - 3.2. For each feature  $i$  which is exhibited in  $M$  compute  $util_i = c_i / (1 + p_i)$
  - 3.3. Penalize every feature  $i$  such that  $util_i$  is maximum:  $p_i = p_i + 1$ ;
4. Return the best candidate solution found so far according to the objective function  $g$ .

### 3.3.2. GLS applied to EDL's workforce scheduling problem

To apply GLS to a problem, we need to identify the objective function and a local search algorithm. In earlier sections, we have described the objective function and a local search algorithm, FLS, for the workforce-scheduling problem.

Our next task is to define solution features to penalize. In the workforce-scheduling problem, the inability to serve jobs incurs a cost, which plays an important part in the objective function which is to be minimized. Therefore, we intend to penalize the inability to serve a job in a permutation. To do so, we associate a penalty value to each job. The travelling cost is taken care of by the ordering of engineers by their distance to the jobs in the local search described in the Evaluation procedure. (If the travelling cost in this problem is found to play a role as important as unallocated jobs, we could associate a penalty to the assignment of each job  $x$  to each engineer  $g$ , with the cost of this feature reflecting the travelling cost. This penalty is increased if the schedule in a local minimum uses engineer  $g$  to do job  $x$ .) Integrated into GLS, FLS will switch on (i.e. switching from 0 to 1) the activation bits associated to the positions where the penalized jobs currently lie.

It may be worth noting that since the starting permutation is generated heuristically, and hill climbing is performed deterministically, the application of FLS and GLS presented here does not involve any randomness as most local search applications do.

### 3.3.3. Representation of spatial information

Spatial information, as to the locations of the engineers as well as the Job locations, is represented on a geographical map using the GIS system. A specialized software is used to process the data produced by the scheduler and represent it as a complete route for an engineer from the headquarters to the location of the assigned jobs and back to headquarters over a street network.

## 4. SUMMARY AND CONCLUSION

In this project, we have introduced a local algorithm, GLS, and applied it to a real life problem, EDL's workforce scheduling problem, with the use of GIS.

The algorithm speeds up local search by restricting the neighbourhoods to those which are more likely to contain better neighbours. It helps local search to escape local optima by adding a penalty term in the objective function. This ends up with a better optimal solution, that is, a better schedule. The schedule is then spatially mapped to visually reflect the actual route trajectories.

Adopting this solution would change the traditional way of random resource allocation still adopted in our country. It might get government Utility institutions into the information age.

## REFERENCES

- Tsang E.P.K., (1995). Scheduling techniques - a comparative study, British Telecom, *Technology Journal*, Vol.13, No.1, 16-28.
- Tsang, E.P.K. & Voudouris, C., (1997). Fast local search and guided local search and their application to British Telecom's workforce scheduling problem, *Operations Research Letters*, Elsevier Science Publishers, Amsterdam, Vol.20, No.3, 19-127.
- Voudouris, C. & Tsang, E.P.K., (1995). *Function optimization using guided local search*, Technical Report CSM-249, Department of Computer Science, University of Essex, Colchester, UK.
- Voudouris, C. & Tsang, E.P.K., (1996). *Partial constraint satisfaction problems and guided local search*, Proc., Practical Application of Constraint Technology (PACT'96), London, April, 1996, 337-356.
- Voudouris, C., (1997). *Guided Local Search for Combinatorial Optimisation Problems*, PhD Thesis, Department of Computer Science, University of Essex, Colchester, UK.



## RENEWABLE ENERGY SOURCES: AN OVERVIEW OF THE LEGISLATIVE FRAMEWORK AND PRACTICE ADOPTED IN CYPRUS FOLLOWING EUROPEAN UNION STRATEGIES AND DIRECTIVES

NICHOLAS CHRISTOFIDES\*

### ABSTRACT

*The climatic changes that threaten our planet have alerted leaders in Europe following warnings by scientists, environmentalists as well as the public. The earth is threatened by the “greenhouse effect”, a phenomenon that creates an atmospheric layer not allowing the incoming sun rays to escape back in space, causing in this way the increase of the temperature with devastating consequences. Human activity is the primary cause of the “greenhouse effect” with the constantly various gas emissions of various kinds of gas. The temperature is expected to continue increasing over the coming decades and reach +1.4° to +5.8° Celsius globally by the year 2100 (compared to the temperatures in 1990), according to the Intergovernmental Panel on Climate Change, Activities of the European Union (2005). This paper summarizes the decisions and legislations taken in order to combat this phenomenon and the harmonization of Cyprus to the Union’s legislative framework.*

*Keywords: Renewable; Energy; Sources; Greenhouse; Wind; Solar; Photovoltaic; Biomass.*

### 1. INTRODUCTION

The Cyprus Institute of Energy (CIE) is the institution responsible for all energy related matters, particularly those involving energy saving/conservation and promotion of renewable energy sources (RES). Founded in 2000, CIE was established by the Ministry of Commerce, Industry and Tourism and has the following mission, CIE (2004):

- *The development and the promotion of renewable energy sources (wind, solar, biomass, hydro or any other form of renewable energy known which proves to be of interest in the future).*
- *The promotion of the conservation and rational utilization of energy*
- *The contribution in order to expand the usage of financially viable energy technologies.*

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\* Assistant Professor, Head of Computer Science Department, Americanos College, Nicosia, Cyprus

The motive behind the establishment of this Institute rests with European Union's (EU) directive on EU Member States to collectively reduce their greenhouse gas emissions by 8% between 2008 and 2012, Activities of the European Union (2003). By 2008, the Parties have undertaken to make demonstrable progress in achieving their commitments by no later than 2005. The role of the CIE is therefore central to the overall strategy and energy policy in Cyprus.

## 2. EU LEGISLATION

Gas emissions reduction can be achieved if considerable energy, generated by conventional energy sources (oil and gas) is replaced by the generation of renewable energy. In 1997, only 6% of the total EU energy consumption was produced from renewable energy sources, TABLE 1 (for years 1995 and 1996), Communication from the Commission, (November 1997). Three key energy policy objectives, identified by the EU, where promotion of renewables is identified as an important factor to achieve them, are:

1. Improved competitiveness,
2. Security of supply, and
3. Protection of the environment.

**TABLE 1: SHARE OF RENEWABLE ENERGY SOURCES IN GROSS INLAND ENERGY CONSUMPTION**

	1990	1995
AUSTRIA	22.1	24.3
BELGIUM	1	1
DENMARK	6.3	7.3
FINLAND	18.9	21.3
FRANCE	6.4	7.1
GERMANY	1.7	1.8
GREECE	7.1	7.3
IRELAND	1.6	2
ITALY	5.3	5.5
LUXEMBOURG	1.3	1.4
NETHERLANDS	1.3	1.4
PORTUGAL	17.6	15.7
SPAIN	6.7	5.7
SWEDEN	24.7	25.4
UK	0.5	0.7
EU	5	5.3

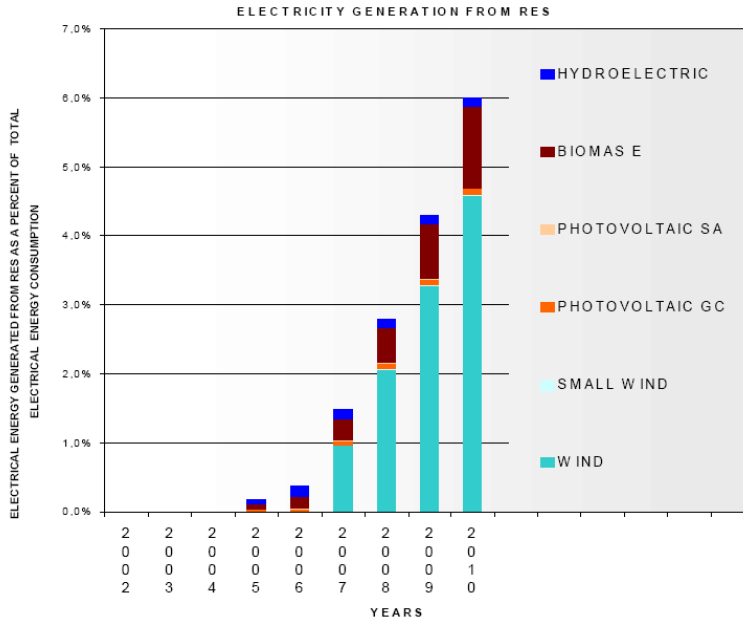
The directive 2001/77/EC, Directive (2001), states clearly the legislative framework that EU member states must follow in order to promote the use of renewable energy sources. For example, member states must require from transmission / distribution system operators to arrange and publish rules concerning to the technical adaptations and regulations, such as grid connections and grid reinforcements, which are necessary in order to integrate new producers feeding electricity generated from renewable energy sources into the interconnected grid.

It also states that EU member states should publish reports every two years (from 27 October 2003 onwards) analyzing the success in meeting the national indicative targets and indicating to what extent the measures taken are consistent with the national climate change commitment. On the basis of the member states' reports, the Commission shall assess to what extent:

- The Member States have made progress towards achieving their national indicative targets
- The national indicative targets are consistent with the global indicative target of 12 % of gross national energy consumption by 2010 and in particular with the 22.1 % indicative share of electricity produced from renewable energy sources in total Community electricity consumption by 2010. The two indicative targets set by the legislative framework for renewable energy are:
  - i. To increase the share of electricity generated by renewable energy to 22% in 2010 for EU15 (compared with 14% in 2000);
  - ii. To increase the share of biofuels in diesel and petrol used for transport to 5.75% in 2010 (compared with 0.6% in 2002).

The ten new Member States of the EU are also obliged to adopt the above legislative framework of Directive 2001/77/EC on the production of electricity from renewable energy sources. It is therefore expected that the collective target for EU25 is 21%. Forecasts made in Cyprus, indicate that the contribution of renewable energy sources (RES) to the energy balance in Cyprus will double from 4% to 9% in 2010. In addition, the contribution of RES to the total electricity production is estimated to reach 6% in 2010, as illustrated in Figure 1 below, Farconides (2006).

**FIGURE 1: ELECTRICITY GENERATED FROM RES**



### 3. BRIEF OUTLINE OF THE ENERGY POLICY HISTORY IN CYPRUS

The grant scheme, currently being offered by CIE (since January 2006) covers a wide range of Renewable Energy Systems. Photovoltaic systems, wind energy systems, solar systems, biomass utilization, hydroelectric systems and desalination plants are the types of RES for which grant schemes are currently being offered. The first, however, formulation of Renewable Energy and Energy Conservation Action Plan was in 1985 and was revised in 1998. The manufacturing industry, hotels and agriculture were the only sectors initially involved in the schemes of 1998. Later on, the establishment of “The Applied Energy Centre (A.E.C.)” and “The Cyprus Institute of Energy (C.I.E.)” appeared in 2000. An important element at that stage was the agreement with EAC to purchase electricity generated from RES. Procedures were then specified for licensing and interconnecting wind and photovoltaic installations to the national grid which subsequently formulated an Action Plan (2002 -2010) for RES in Cyprus. A legislative framework for the promotion of RES and conservation of energy (Apr 2003) was adopted by the government leading to the establishment of the Cyprus Energy Regulatory Authority (C.E.R.A.) in Jan 2004.



#### 4. DETAILS OF THE CURRENT GRANT SCHEMES OFFERED BY CIE

The scheme is twofold and concerns two main groups. The first group concerned involves households, non-profitable organizations and individuals, not engaged in any economic activities. The second group concerned is the industry and any other legal entity such as enterprises.

For each group of concerned parties there are two energy policy categories.

- Category A – Energy Saving
- Category B - Renewable Energy Sources

##### **CATEGORY A – ENERGY SAVING**

Households can benefit under the energy saving scheme by applying for a grant involving investments that are related to any improvement made to the insulation of residences. Under this category grants are also distributed for investments in hybrid or other vehicles running on alternative fuels, co-generation for companies and organizations, as well as any other investments made to energy conservation by enterprises and non-profitable organizations.

##### **CATEGORY B – RENEWABLE ENERGY SOURCES**

The aim of the renewable energy sources category is mainly to provide incentives in the form of grants and subsidies in order to promote the use of RES and subsequently to increase the proportion of energy generation that originates from RES. Details of the various RES currently available and subsidized are given below:

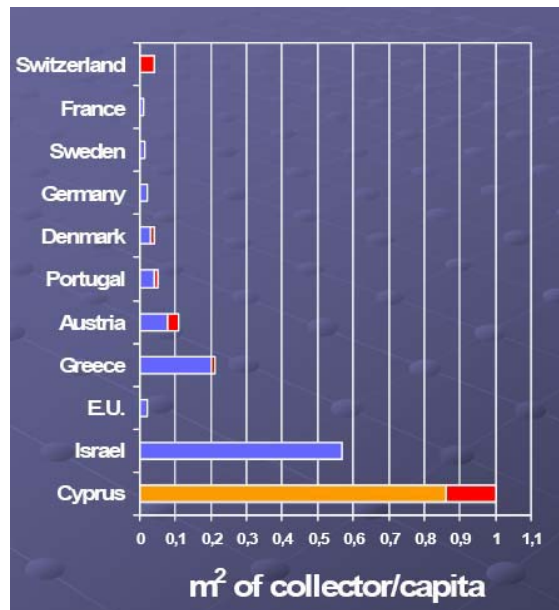
###### *4.1. Wind energy systems*

There are three types of investments in wind energy. These involve large commercial systems, small systems for up to 30kWp and small water pumping systems. Small water pumping systems for example, are popular in Cyprus. Many people are involved in agriculture as a side-activity to their main employment. Such people own property which they utilize for agricultural purposes and which very often does not have grid connection. In these properties waterholes are created for watering the various plants and trees that they harvest. They need however electrical power in order to lift the water out of these waterholes. A grant scheme has therefore been endorsed under which interested parties can obtain a grant for a small water pumping system.

#### *4.2. Solar systems*

About 90% of individual residences in Cyprus have domestic solar water heaters installed on the roofs. In addition, Cyprus is the first country in the world with solar collectors per capita installed, FIGURE 2, Farconides (2006). These solar water heaters allow water to be heated and used for the various domestic needs within the house throughout the year, saving in this way energy. The current grant schemes allow individuals to obtain grants for the replacement of old or installation of new solar water heaters.

**FIGURE 2: INSTALLED SOLAR COLLECTORS PER CAPITA**



Overall, the solar systems grant scheme provides grants for the following solar system applications, CIE (2004-2006):

1. Installation and/or replacement of central active solar thermal systems for sanitary water heating (for schools, municipalities, benevolent organizations and communities that have no economic activity). 30% subsidization of the eligible cost can be funded, maximum amount of 10.000 CYP.
2. Installation and /or replacement of solar systems for space heating and cooling (for schools, municipalities, benevolent organizations, communities and households

that have no economic activity). 40% subsidization of the eligible cost can be funded, maximum amount of 50.000 CYP.

3. Domestic solar water heating systems (mainly for households). 10% subsidization of the eligible cost can be funded, maximum amount of 100 CYP.
4. Installation and /or replacement of solar thermal systems for swimming pools (for schools, municipalities, communities and households that have no economic activity. Profitable organizations are also included under this scheme). 30% subsidization of the eligible cost can be funded, maximum amount of 10.000 CYP.

#### *4.3. Photovoltaic (PV) systems*

It is probably the most accessible RES investment in terms of reliability, ease of installation and minimal maintenance for households. FIGURE 3 illustrates PV system installations on residences with a typical tile roofs. The PV systems grant schemes offer the two following categories in photovoltaics:

1. Small PV systems of generating capacity of up to 5.25kWp connected to the electricity grid.
2. Stand-alone (autonomous) PV systems, not connected to the grid, of generating capacity of up to 5.25kWp, combined or not with other RES.

Grid connected systems are considered as long-term investments as the benefits of such an investment will be experienced some years later. The typical pay-off period is between 8-10 years for a 5.25kWp grid PV system. Under the current scheme, a person investing in a PV grid system will be trading the kWhs produced by the system with the grid company. The grid company is obliged to buy the energy produced at a contracted, subsidized rate for a period of 15 years. Within this period, the investment will have definitely been paid-off and the investor can then begin benefiting from the system. After the period of the first 15 years the electricity bill of the residence will be the balance between the generated electricity from the PV system and the electricity consumed. It should be noted here that the electricity supply to the residence will not change following a PV grid system installation. The grid connection will remain the electricity source for the energy needs of the house. The PV grid system installation is separate from the internal electrical house installation and as stated above, the generated energy is fed to the grid.

**FIGURE 3: A 2.97kWp (LEFT) AND 4.2kWp (RIGHT) PV SYSTEM INSTALLATIONS**



Residences in areas where a grid connection is not possible, due to prohibitive connection costs or because there is no power grid nearby, have the option of installing stand-alone PV system in combination with other RES. Stand-alone PV systems offer a good solution to residences built in remote areas, providing a reliable power source for essential electrical appliances such as fridges, televisions, lights washing machines and so on. In combination with other RES such as wind systems, the overall system can be significantly reinforced and become very productive and reliable.

For both types of PV systems a 55% (maximum 9.500CYP) grant on the cost of the system can be obtained, by households and non-profitable entities, and a respective 40% (maximum 7.000CYP) for profitable organizations and enterprises. Residences that are connected to the grid are not eligible for a grant on a stand-alone system.

#### *4.4. Biomass utilization*

Biomass involves the exploitation of agricultural residues, landfill gas from municipal waste disposal plants, burning of solid wastes and growing biomass from crops such as switch-grass, hemp, corn and sugarcane, FIGURE 4, Industcards (2004). Biomass may also include animal waste, which may be burnt as fuel. *“In energy production and industry, biomass refers to living and recently living biological material which can be used as fuel or for industrial production”*, Wikipedia Encyclopedia. Most commonly biomass refers to plant matter grown to be used as biofuel, but also includes plant or animal matter used for production of fibres, chemicals or heat. It excludes organic material which has been transformed by geological processes into substances such as coal or petroleum. Biomass is usually measured by dry weight.

The term *biomass* is especially useful for plants, where some internal structures may not always be considered living tissue, such as the wood (secondary xylem) of a tree.

Biofuels include bioethanol, biogas, biomethanol, biobutanol and biodiesel; the last two are direct biofuels (so they can be used directly in petroleum engines). Ethanol can be used as fuel for automobiles either alone (E100) in a special engine or as an additive to gasoline for petroleum engines. Ethanol derived from crops (bio-ethanol) is a potentially sustainable energy resource that may offer environmental and long-term economic advantages over fossil fuel (gasoline). It is readily obtained from the sugar or starch in crops such as maize, miscanthus and sugarcane. The prolonged availability and production of bioethanol is simply a matter of land availability, soil and water. Countries such as Brazil are investing enormous land for growing these plants and subsequently producing biofuels.

Production of biomass is a growing industry as interest in sustainable fuel sources is growing. It is simply a matter of time before many countries begin exploiting biomass and producing biofuels. The economic benefits of not depending on conventional fossil fuel, is a big issue and this is why biomass is being greatly exploited. The biomass utilization grant scheme offers grants for investments made by small medium enterprises and large enterprises that can reach 40% of the eligible cost or a maximum amount of 400.000CYP.

**FIGURE 4:** A 30MW BIOMASS POWER PLANT (FUEL: STRAW), SANGUESA, SPAIN

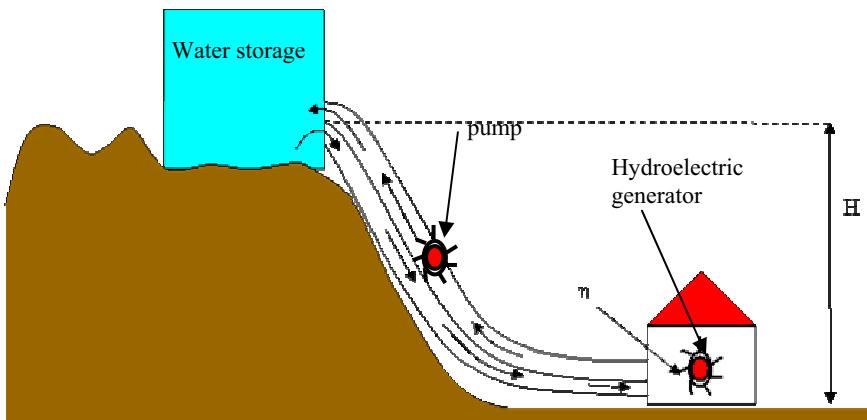


#### *4.5. Hydroelectric potential*

The potential of producing hydroelectric energy in Cyprus is limited with an estimated 1MW resource amount, Farconides (2006). FIGURE 5 below illustrates the process of hydroelectric energy generation. For large amounts of energy production vast quantities of water are involved with the overall plant size and cost being extremely high.

**FIGURE 6**, Industcards (2005), illustrates a 2.4MW pumped-storage hydroelectric power plant, one of the largest in the world, from which the relevant size of such a plant can be appreciated.

**FIGURE 5: PRODUCTION OF HYDROELECTRIC ENERGY**



**FIGURE 6:** PUMPED-STORAGE HYDROELECTRIC PLANT, GUANGZHOU, CHINA



#### *4.6. Desalination plants using RES*

Solar energy and wind energy can be used to power desalination plants for private or industrial use. The hotel industry for example can benefit a lot by the use of an autonomous desalination plant (provided there is an abundant source of water nearby the premises of the hotel), as it provides complete independence regarding water supply. The grant scheme refers to small, medium and large enterprises with a maximum grant amount of 100.000 CYP. Such projects are of course large in nature and a feasibility study should be carried out prior to any investment. Up to 40% of the eligible cost or a maximum of 100.000CYP can be granted for such investments.

## 5. SUMMARY

The two most alarming facts regarding conventional fossil fuels is firstly the damage they cause to the environment (mainly the green house effect – climate change, and pollution) and secondly the fact that they are not abundant. This suggests that a day will come when all resources will have been used up and alternative sources of energy will have to be used, either for transport or electricity. It is for this reason that measures are being taken to combat this incident by exploiting alternative energy sources before it is too late. This paper aimed to give an overview of the measures that have been adopted by the EU and the legislation that has been enforced on the member states in order to encourage and promote the use of renewable energy sources and the conservation of energy. An insight to the grant schemes offered by the Cyprus Institute of energy as incentives for energy conservation and promotion of use of RES has also been described.

## REFERENCES

- Activities of the European Union, Summaries of Legislation (2005). *Climate Change – Strategy on Climate change*, <http://europa.eu/scadplus/leg/en/lvb/l28157.htm>
- Activities of the European Union, Summaries of Legislation (2003). *Kyoto Protocol on Climate Change*, <http://europa.eu/scadplus/leg/en/lvb/l28060.htm>
- Farconides C. (2006). *Current status of Renewables in Cyprus*, Cyprus Institute of Energy.
- Communication from the Commission, (1997). *Energy For The Future: Renewable Sources of Energy*, White Paper for a Community Strategy and Action Plan, COM (97)599.
- CIE, (2004). <http://www.cie.org.cy/missioneng.htm>
- Directive 2001/77/Ec (2001). *The European Parliament and the Council on the promotion of electricity produced from renewable energy sources in the internal electricity market*.
- CIE (2004-2006). *Grant Scheme for energy conservation and promotion of renewable energy sources utilization*.
- Industcards (2004). *Power plants around the world*, Photo Gallery <http://www.industcards.com/biomass-europe.htm>
- Industcards (2005). *Power Plants around the World*, Photo Gallery <http://www.industcards.com/ps-other.htm>
- Wikipedia, <http://en.wikipedia.org/wiki/Bioethanol>



## ANALYZING THE DEMAND IN THE INFORMATION AND COMMUNICATIONS TECHNOLOGIES SECTOR: THE CASE OF GREECE

VASSILIS KOSTOGLOU\* and COSTAS ZAFIROPOULOS\*\*

### ABSTRACT

*The rapid evolution of the information and communications technologies (ICT) and their catalytic effects on the economic activities gives particular research interest to the exploration of its labour market characteristics. This work focuses on the analysis of the demand for ICT workforce. The methodology used consists of recording and analysing the total of the relevant published advertisements in Greece during a period of 12 months. Extensive statistical analysis is carried out in order to identify the existing effects and associations among the key variables portraying demand. The research findings identify the demand's crucial characteristics and mirror the existing socioeconomic framework.*

*Keywords: Demand; Labour Market; Information and Communications Technologies; Multidimensional Scaling; Multivariate Associations.*

### 1. INTRODUCTION

The information and communications technologies' (ICT) labour market presents particular investigatory interest due to its dynamics, which reflects into society and economy the tremendous evolution of informatics and its relevant technologies. Furthermore, this sectoral market constitutes a fundamental resource for organizations of all types: profiteering and not profiteering public and educational ones (Lindsay, 2002). The European Commission (2000) points out that the rapid technological rearrangements will have a direct impact on the labour market regarding the demand for specialized personnel. Thus, this market has to be conformed as soon as possible in order to avoid the lack of highly specialized workforce. However, the study of the relevant literature reveals that one of its most important parameters, the demand for specialized workforce, has not been examined sufficiently.

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\* Associate Professor, Department of Informatics, Technological Education Institute of Thessaloniki, Sindos, Greece

\*\* Assistant Professor, Department of Business Administration, Technological Education Institute of Serres, Serres, Greece

This research work focuses on the analysis of one of labour market's principal parameters: the demand for ICT personnel. For this purpose a two-stage model is introduced and implemented at national level in Greece. The first stage consists of the quantification of the total annual demand as it is presented in advertisements published in the daily press in 1807. The second stage contains the extensive statistical analysis of demand's characteristics and the relevant inferences.

Regarding the contents of the paper, the next section is devoted to the literature review of the most important relevant published research works. The third section sets out the research objectives as well as their contribution and implications. Successively the methodology adopted is described and the topics of analysis are indicated. The main part of the paper is dedicated to the descriptive and analytical statistical elaboration of the collected data. The final section comments on the findings and the conclusions drawn.

## 2. LITERATURE REVIEW

The lack of correspondence between work offer and demand in the labour market has been considered since the '80s as the main generative cause for unemployment (Dantine at al., 1990). Katsanevas (1997) identifies four different kinds of this discrepancy: qualitative, quantitative, geographical and related to time. As qualitative lack of correspondence is defined the existing difference between demand and offer in particular professions, specializations and skills. The existing numerical difference between the number of those seeking for work and the number of necessary workforce is considered as quantitative lack of correspondence. The geographical and time discrepancies express the existing differences related to location and time period. It has also been noted that the workforce's allocation in every profession reflects both employees' personal selections as well as the structure of the total demand (Lenz, 1996).

Comparative data of 17 European countries (15 countries-members of the European Union, Norway and Switzerland) referring to the numerical comparison between supply and demand in the ICT sector during the year 2002 end up in a common conclusion: in all these countries the demand from the enterprises is significantly higher than the supply of the workforce (International Data Corporation, 2003). Regarding the ICT employees' skills required by the labour market four intersected requirements have been identified: the education, the experience, the technical skills as well as the professional and general skills (Information Technology Association of America, 2001).

Very few papers investigate exclusively the Greek ICT labour market. Most of them examine mainly the sector's professions; their nomenclature and their prospects, and secondarily the occupation areas, i.e. the vocational directions of the ICT enterprises (Kostoglou and Paparrizos, 2003).

Nevertheless, it is apparent that the Greek ICT sector overstepped the three-year period (2001-2003) of demand lowering which marked nearly the whole labour market after the 'golden' period between 1998 and 2000. The first semester of 2004 was good with increasing demand for specialized personnel mainly due to the Olympic Games of Athens. The presence of imbalance in the next time interval is probable, as it will be difficult for the market to absorb a substantial number of executives who are out of work (KPMG, 2004). Despite these promising estimations, a recently published survey has found out a substantial decrease, up to 30%, of the sector's vacancies during the last two years. The overproduction of graduates, the enterprises forced landing after the great expectations of the golden period, the long-drawn-out economical recession have been recorded as the most important causes (newspapers "Express" and "Imerisia", 2005). This survey also notes that there is a lack of correspondence between the production of specialized personnel from the higher education and the creation of new assignments.

Regarding the methods used by the private sector for searching personnel, the most commonly used ones in the (decade of) '90s were the recommendations by company's employees, the connections with universities and bodies of professional training, the advertisements in newspapers, the commercial and professional editions, the local offices of the manpower employment organization, the co-operation with private employment agencies and the communication with companies reducing their workforce (Xirotiri-Koufidou, 1997; Skoulas and Oikonomaki, 1998). In a recent survey addressed the ICT enterprises at national level the three main identified sources for ICT personnel employment are the recommendations by colleagues, the announcements in newspapers and those via a website (Kostoglou et al., 2004).

In a recent research carried out by the Federation of Greek Industries (2004) on a sample of 374 enterprises, 31 peak specializations requiring post-secondary or higher education are recorded, for which the largest demand increase is expected during the period 2005-2007. Amongst them, the ICT graduates from Universities and TEI (expected demand increase 15%) as well as those from the Institutes of Vocational Training (increase 5%) are included. Furthermore a large national survey on 6228 enterprises, ordered by the Greek Ministry of Labour (2002) and carried out by the consulting company "Metron Analysis", has shown that in Attica, the most populated region of Greece, the computer programmers possess the second place regarding workforce demand, whereas at national level they lie in the ninth place.

Some published papers show that there is skills gap in the Greek ICT sector as in most European countries. The Greek Economical and Social Committee (2002) detected significant lack of highly skilled workforce supply and the existence of about 50000 relevant unoccupied positions. Another investigatory study has suggested out that enterprises face the largest difficulties in finding new graduates for employment for the specialities “persons with professional activity in the IT sector” and in “Informatics’ technologies” (Klimopoulos et al., 2001). Moreover, in the annual research of the Federation of Greek Industries (2001) is reported that 19% of the enterprises are unable or face great difficulties in finding ICT executives. Finally, Bibby (2001) has also reported certain findings of a study by the International Data Corporation, which forecasted that in 2003 the ICT skills shortage in Greece will reach 11%.

### 3. RESEARCH OBJECTIVES AND CONTRIBUTION

Any sectoral labour market includes several effecting variables and its overall clear picture is shaped after the analysis of all of them. This work focuses on a rapidly altering, therefore interesting, market, the ICT labour market. Its main objective is to examine thoroughly one of the most important variables, the demand for specialized personnel. All main parameters describing the demand are independently analyzed and some of their interactions are examined.

The results and the conclusions inferred are novel as this research, carried out at national level, is the first of its kind accomplished in Greece, and to the extent of our knowledge, in any other country. The sole found similar study examines the dynamics of the engineers’ labour market for a large period of seven years, based, however, on the advertisements on one major weekly bulletin (Goutsos et al., 2000).

This study’s practical implications derive from the importance of the demand for both labour market’s poles: workforce and employers. Newcomers as well as experienced employees will learn about the real labour market’s needs and demands: which skills, general or professional, are required and which are unimportant, which is the profile and the location of the main employers, which is the demand’s seasonality and, most importantly which are the ICT professions mostly wanted. Moreover, employers will get informed about the present situation of the demand for ICT workforce at national level. They will also understand the existing deficiencies related to the syntax of advertisements for new personnel, some knowledge that will equip them with experience for their future employments.

This research is also useful for several countries having adopted information technologies in a similar way to Greece. The methodology applied here can be

implemented in a nearly identical manner to any county or region as well as for any professional sector.

#### 4. METHODOLOGY

The model adopted for the analysis is based on the assumption that the current sectoral labour market can be represented, as far as the demand for workforce is concerned, by the total of the advertisements seeking for ICT personnel, published in the press during a certain time period. Thus, the analysis is based on the detailed elaboration of all the advertisements, which were published in the vast majority of the daily and weekly Greek newspapers during 12 consecutive months (from 1/1/2004 to 31/12/2004).

Principal source of information were the relevant detailed records of the Careers Service of the Technological Education Institute of Thessaloniki Greece, created on daily basis through a long-lasting cooperation with an indexing company. All ICT advertisements were tracked down and thoroughly tested for any multiple registrations, which were deleted. The advertisements were then classified according to their publishing date and registered using the spreadsheet MS-Excel. Totally 1807 advertisements corresponding to 5237 ICT vacancies were coded.

Twenty-three variables corresponding to the parameters portraying the ICT demand are identified and analyzed. The time and geographical spreading of the demand, the profiles of the employers, the characteristics of the vacancies, the required knowledge and skills of the candidate ICT workforce are the main investigated variables. Additionally, the demand of the most popular ICT professions is explicitly examined.

#### 5. ANALYSIS AND MAIN RESULTS

The statistical analysis was accomplished with the use of SPSS 12.0, the statistical package for the social sciences (SPSS, 2003). The analysis includes the calculation of descriptive statistics for the identification of the existing patterns in the advertisements for ICT vacancies. Multidimensional scaling is also used to identify the associations among the key research variables. Furthermore, cross tabulations of the variables, which appear to be associated in multidimensional scaling, are carried out, providing the distribution of the vacancies by critical independent variables.

### 5.1. The profile of the advertisements and vacancies

The monthly occurrences of advertisements and vacancies are presented in table 1. June, July, November and December present peaks regarding advertisements occurrence. The same table shows also the monthly distribution of vacancies. One third of all the vacancies are advertised in August. This feature will be further interpreted in a later section and is attributed to the offering of numerous secondary education teachers' vacancies just before the opening of the school year. January and November also present demand peaks. Furthermore, in most of the cases each advertisement describes one vacancy, while 11% of them describe two or three and almost 5% describe more than five vacancies.

**TABLE 1: ADVERTISEMENTS AND VACANCIES CHARACTERISTICS**

<b><i>Monthly advertisements</i></b>	<b><i>(%)</i></b>
January	8.5
February	9.4
March	5.9
April	6.8
May	5.5
June	10.2
July	9.0
August	6.6
September	7.7
October	7.4
November	12.0
December	11.0
<b><i>Monthly vacancies</i></b>	<b><i>(%)</i></b>
January	10.9
February	3.5
March	3.6
April	5.7
May	4.8
June	9.6
July	5.2
August	32.5
September	3.6
October	3.3
November	10.6
December	7.0
<b><i>Vacancies per advertisement</i></b>	<b><i>(%)</i></b>
1	80.6
2	7.8
3	3.2

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4	1.8
5	1.7
>5	4.8

Regarding the candidates' characteristics, table 2 presents the vacancies breakdowns by gender, age, degree, work experience, required ICT and foreign languages skills as well as military service fulfilment.

**TABLE 2: PREFERRED CANDIDATES' CHARACTERISTICS**

<b><i>Vacancies by gender</i></b>	<b>(%)</b>
NS*	93.7
Male	1.5
Female	4.8
<b><i>Vacancies by age</i></b>	<b>(%)</b>
NS*	90.2
<=25	0.7
26-35	7.3
> 35	1.9
<b><i>Vacancies by degree</i></b>	<b>(%)</b>
University degree (Informatics)	31.5
TEI degree	24.1
Secondary education (general)	17.3
NS*	16.2
Higher Education Institute degree	3.8
Vocational Training degree (informatics)	3.8
Secondary Technological Education degree (informatics)	2.7
Master or PhD	0.5
Specialization certificates	0.1
<b><i>Vacancies by experience</i></b>	<b>(%)</b>
NS*	87.6
1 year	1.9
2 years	3.1
3 years	1.8
4 years	0.3
5 years or more	0.4
Required but not specified	4.9
<b><i>Vacancies by military service fulfillment</i></b>	<b>(%)</b>
NS*	96.8
Required	3.2
<b><i>Vacancies by ICT skills</i></b>	<b>(%)</b>
Operating systems	6.8
Databases	5.9
Networks	5.4
Other	5.4

MS-office	5.0
Programming	5.0
Web development	2.6
Hardware	2.0
Multimedia	1.9
Web use	0.9
Accounting software	0.9
<b><i>Vacancies by foreign language requirement</i></b>	<b>(%)</b>
NS*	89.7
Knowledge of one foreign language	1.2
Knowledge of English language	7.7
Excellent knowledge of English language	1.4

(\*: NS = Not Specified)

The most interesting feature is that the majority of vacancies do not present details for several of the above characteristics. For example, most of the advertisements do not mention gender, age, experience, foreign language knowledge or ICT skills requirements. It seems that either the employer organizations lack of the expertise to describe vacancies adequately or the job positions are irrelevant to these characteristics. However, the vacancies are associated with a degree or diploma that seems to be taken into serious consideration by the employers. More than half of them seek for Higher Education Institutes' (HEI) graduates: Universities or Technological Education Institutes (TEI). Secondary education graduates are placed third in offering positions while about 16% of the vacancies do not specify the degree.

Table 3 portrays job descriptions and employer organizations characteristics. Regarding the ICT jobs, it should be noted that for reasons of economy only the densest categories are reported. Secondary education teachers and computer operators are the most populous categories among them, reaching jointly half of the offered vacancies. Almost 15% of the vacancies do not specify the exact job positions. Regarding employer organizations characteristics, the public sector offers half of the vacancies, the local authority organizations about 10%, whereas the private sector offers more than 20% of the jobs.

**TABLE 3: ICT JOBS' AND EMPLOYERS CHARACTERISTICS**

<b><i>Vacancies by offered job</i></b>	<b>(%)</b>
Secondary education professor	29.1
Computer operator	20.4
NS*	14.7
Other	11.3
Computer programmer	8.6
Computer technician	3.1



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Computers engineer	2.6
Higher Education Institutes professor	2.5
Private schools professor	2.0
Telecommunication and networks engineer	1.7
Telecommunication and networks technician	1.7
Informatics specialist	1.3
Web programmer/designer	1.0
<b><i>Vacancies by employing organization</i></b>	<b>(%)</b>
NS*	10.6
Public sector	49.7
Organizations attached to public sector law	3.8
Organizations attached to private sector law	4.4
Local authority organizations	9.9
Private sector (not ICT enterprises)	17.4
Private sector (ICT enterprises)	4.1
<b><i>Vacancies by employing organizations' region</i></b>	<b>(%)</b>
NS*	51.0
Athens	31.1
Thessaloniki	6.5
The rest of Greece	11.4
<b><i>Vacancies by offered work status</i></b>	<b>(%)</b>
NS*	39.1
Permanent employment	41.7
On contract basis employment	17.7
Tenure track employment	0.7
Part-time employment	0.7

(\*: NS = Not Specified)

## *5.2. Multivariate associations among key variables*

This section strives to present the associations among all the variables presented earlier because it is of interest to explore which of them jointly affect the vacancies offer. Job description is considered to be a core variable for the analysis. Multidimensional scaling (MDS) is used to represent the associations of all the variables. From a non-technical point of view, the purpose of multidimensional scaling is to provide a visual representation of the pattern of proximities (i.e. similarities or distances) among a set of objects. The analysis usually produces a two-dimensional common space in which all the variables are placed. The axes are themselves meaningless and the orientation of the picture is arbitrary. However, the interesting part of the application is the calculation and representation of the proximities of the variables in the common space. Two variables that are close to each other present a high association link according to a specified measure. In the present application of the method and since all the variables are categorical, Phi-square measure is used: first Chi-square measure is calculated based on the chi-square test of

equality for two sets of frequencies; next Phi-square measure is calculated from chi-square measure normalized by the square root of the combined frequency. Table 4 exhibits the distances among variables. The smaller the distances are the greater the association between two variables is for example, regarding the core variable “job,” it is obvious that it is closely associated with, thus affected by, “month”, “region” and “organization”.

**TABLE 4: DISTANCES AMONG KEY VARIABLES**

	Month	Organization	Work status	Sex	Degree/ diploma	Age	Army service	Region	Language	Experience
Month	0.00									
Organization	0.24	0.00								
Work status	0.84	0.97	0.00							
Sex	0.90	1.13	1.05	0.00						
Degree/ diploma	0.56	0.78	0.51	0.57	0.00					
Age	0.80	1.04	0.70	0.36	0.29	0.00				
Army service	0.60	0.80	1.09	0.42	0.59	0.59	0.00			
Region	0.22	0.43	0.65	0.77	0.35	0.61	0.56	0.00		
Language	0.46	0.30	1.27	1.26	1.02	1.24	0.87	0.68	0.00	
Experience	0.63	0.57	1.47	1.21	1.12	1.29	0.79	0.83	0.32	0.00
Job	0.14	0.27	0.96	0.89	0.64	0.85	0.53	0.32	0.39	0.51

Table 5 presents the two dimension co-ordinates of the variables, while Figure 1 illustrates graphically the common space. The next section uses cross tabulations of the data to describe in detail the associations between the variables.

**TABLE 5: COMMON SPACE COORDINATES IN MULTIDIMENSIONAL SCALING**

	Dimension 1	Dimension 2
Month	0.06	-0.03
Organization	-0.12	-0.19
Work status	0.84	-0.33
Gender	0.60	0.69
Degree-diploma	0.60	0.12
Age	0.76	0.36
Army service	0.20	0.55

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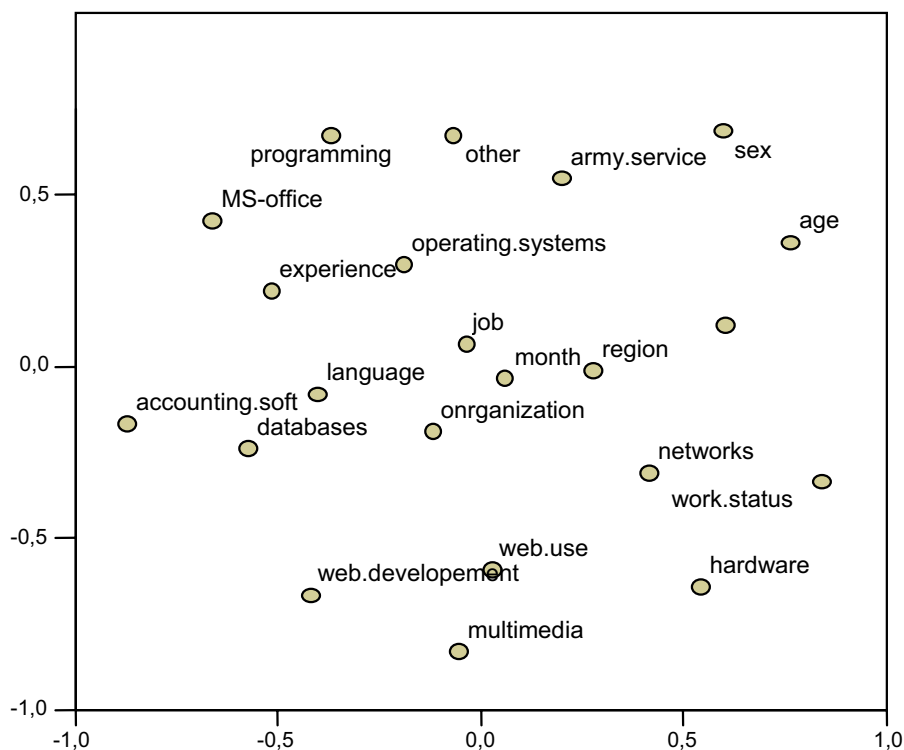
Region	0.28	-0.01
Language	-0.40	-0.08
Experience	-0.52	0.22
MS-office	-0.66	0.43
Operating systems	-0.19	0.30
Programming	-0.37	0.67
Networks	0.41	-0.31
Databases	-0.58	-0.24
Web development	-0.42	-0.66
Web use	0.03	-0.59
Hardware	0.54	-0.64
Multimedia	-0.06	-0.83
Accounting software	-0.87	-0.16
Other	-0.07	0.67
Job	-0.04	0.07

### *5.3. Bivariate associations of the key variables*

Regarding the representation of figure 1, some variables of particular interest are placed close together. The high proximities of the variables are indicative of the high associations between them; that is, they interact with each other. Four variables, namely job, month, region and employing organization, are associated with each other and presented crucial for the exploration of the vacancies distribution. The association produced by all the combinations of the variables are presented in tables 6, 7, 8, 9, 10, and 11.

Table 6 presents the vacancies in relation to month and employing organization type. Some values appear striking since they reflect seasonal trends of job offering. For example, almost all of the vacancies published in August come from public sector organizations, while the local authority organizations place their vacancies in May and the private sector places its vacancies in January and September.

**FIGURE 1: COMMON SPACE PRODUCED AFTER MDS OF KEY RESEARCH VARIABLES**



**TABLE 6: VACANCIES BY EMPLOYING ORGANIZATION AND MONTH**

Month	NS*	Public sector	Organizations attached to public sector law	Organizations attached to private sector law	Local authority organizations	Private sector (not ICT)	Private sector (ICT)
January	7.2	7.2	1.2	1.6	24.9	53.1	4.9
February	22.1	32.6	0.6	1.7	9.4	23.2	10.5
March	25.7	19.3	1.1	27.8		16.6	9.6
April	3.7	46.6	17.6	9.8	11.1	9.5	1.7
May	10.4	19.3	2.0		59.0	7.6	1.6
June	6.0	55.8	11.7	4.4	9.7	9.1	3.2
July	14.3	20.5	9.9	8.4	25.6	10.6	10.6
August	0.9	92.1	1.0	0.5	2.3	2.9	0.3

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September	10.7	18.2	3.2	9.6	8.6	40.1	9.6
October	11.6	33.1	6.4	4.7	3.5	24.4	16.3
November	24.5	22.6	0.5	7.8		40.1	4.5
December	35.6	44.9	2.7	3.8		7.1	5.8

(\*: NS = Not Specified)

Regarding the relationship of vacancies to the month and the region of the employing organization (table 7), it is interesting to notice that most of the vacancies in August do not specify the organization region.

**TABLE 7: VACANCIES BY REGION AND MONTH**

	NS*	Athens	Thessaloniki	The rest of Greece
January	53.6	15.6	4.7	26.1
February	1.7	46.4	26.0	26.0
March	18.7	39.6	5.9	35.8
April	52.7	33.1	4.1	10.1
May	1.2	69.9	4.0	24.9
June	53.0	37.5	5.4	4.2
July	26.7	48.7	8.4	16.1
August	90.9	3.6	2.8	2.6
September	7.5	50.3	33.2	9.1
October	36.0	30.2	20.3	13.4
November	33.2	55.2	3.2	8.3
December	6.0	75.1	5.8	13.2

(\*: NS = Not Specified)

Regarding the relationship between organization type and region (table 8), more than three thirds of the Public sector organizations do not specify region while local authority organizations are almost equally divided between Athens and the rest of Greece. Thessaloniki, the second largest city of Greece situated north, presents high values of private sector vacancies, along with Athens. Advertisements of organizations attached to public sector law mainly concern Athens or they do not specify region.

**TABLE 8: VACANCIES BY EMPLOYING ORGANIZATION  
AND REGION**

	NS*	Athens	Thessaloniki	Rest of Greece
NS*	9.7	54.0	13.1	23.2
Public sector	76.9	14.2	2.2	6.7
Organizations attached to public sector law	50.3	45.2	2.5	2.0
Organizations attached to private sector law	44.3	21.7	8.7	25.2
Local authority organizations	1.2	55.4	4.2	39.2

Private sector (not ICT specializations)	43.3	42.0	11.4	3.3
Private sector (ICT specializations)	6.5	65.7	27.3	0.5

(\*: NS = Not Specified)

Tables 9, 10, and 11 demonstrate the associations between job and month, and organization and region respectively. Table 9 reports percentages calculated within each month. One of the findings is directly connected to previous ones concerning job description: August advertisements mainly report vacancies for secondary education professors. September and October present higher percentages of vacancies for private schools teachers. Computer operator vacancies are advertised highly from April to July as well as in November and December.

Table 10 demonstrates that secondary and higher education professors are exclusively employed in the public sector. Vacancies for computers engineers, telecommunication and networks engineers, web programmers/designers, computer programmers, computer technicians and telecommunication and networks technicians are placed in high percentages by private organizations. On the other hand, vacancies for informatics specialists and computer operators are highly offered by public sector organizations.

**TABLE 9: VACANCIES BY JOB AND MONTH**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NS*	23.5	11.6	16.6	30.7	22.1	13.5	15.4	1.5	24.6	10.5	23.1	29.9
Secondary education professor								89.5				
Private schools professor	0.5	3.3	2.1	0.3	1.2	1.8	2.6	0.9	10.7	13.4	2.3	
HEI professor	0.2	25.4	4.8	6.8	6.8		2.9	0.4	0.5	5.8	1.1	1.4
Computers engineer	0.5	4.4	0.5	0.7	3.6	1.2	7.7	0.6	12.3	1.2	5.6	5.2
Telecommun. and networks engineer	8.1	1.1				1.0	0.7	0.5	1.1		3.1	1.6
Web programmer/designer	0.7	1.7	4.8	1.7	0.8	1.2	0.4		4.3	1.2	0.5	1.9
Computer programmer	4.6	17.7	31.6	4.1	9.2	7.4	9.5	0.9	15.5	13.4	15.2	22.5
Computer technician	5.8	13.3	3.2	2.4	2.8	1.8	8.8	0.2	7.0	4.1	2.5	4.1
Telecommun. and networks technician	0.7	3.3		3.0	0.4	1.0	3.3	0.4	2.7	1.7	6.3	1.6

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Informatics specialist			0.5	1.4	0.4	1.8	7.0	1.1	1.6	6.4	0.4	0.3
Computer operator	12.8	2.8	14.4	41.6	50.2	59.2	24.5	3.2	3.7	8.1	35.0	23.0

(\*: NS = Not Specified)

**TABLE 10: VACANCIES BY JOB AND EMPLOYING ORGANIZATION**

	NS*	Public sector	Organizations attached to public sector law	Organizations attached to private sector law	Local authority organizations	Private sector (not ICT)	Private sector (ICT)
NS*	2.3	44.1	6.8	9.9	23.4	10.5	2.9
Secondary education professor		99.9				0.1	
Private schools professor	18.3	1.0				64.4	16.3
HEI professor		100.0					
Computers engineer	12.6	14.8	10.4	6.7	17.8	31.9	5.9
Telecommunication and networks engineer	9.1	19.3	6.8			61.4	3.4
Web programmer/designer	34.0				4.0	36.0	26.0
Computer programmer	46.4	3.3	0.4	10.3	2.9	24.8	11.8
Computer technician	16.0	21.5	1.8	0.6	3.1	35.6	21.5
Telecommunication and networks technician	12.4	20.2	3.4	1.1	1.1	49.4	12.4
Informatics specialist	20.3	39.1	8.7	7.2	8.7	14.5	1.4
Computer operator	16.2	35.0	9.3	6.1	26.6	6.9	

(\*: NS = Not Specified)

In Table 11 it is interesting to notice that no vacancy regarding secondary education teacher position specifies the region. Private schools positions are mainly offered in Athens and Thessaloniki, while half of the University and TEI professor vacancies are offered in the rest of Greece and the other half is almost equally divided into vacancies in Athens and Thessaloniki. The greatest portions of vacancies for computers engineers, telecommunication and networks engineers, web programmers/designers, computer programmers, computer technicians, telecommunication and networks technicians, informatics specialists, and computer operators are those for Athens. One quarter of the web programmer/designers

vacancies is offered for Thessaloniki, and the relevant percentage is slightly higher for informatics specialist. One out of five computer programmers' vacancies are offered from organizations located in the rest of Greece.

**TABLE 11: VACANCIES BY JOB AND REGION**

	NS*	Athens	Thessaloniki	Rest of Greece
NS*	17.8	55.1	6.1	21.0
Secondary education professor	99.8	0.1	0.1	
Private schools professor	5.8	42.3	46.1	5.8
Higher education institutes professor		23.8	20.0	56.2
Computers engineer	11.1	64.4	7.4	17.1
Telecommunication and networks engineer	55.7	37.5	6.8	
Web programmer/designer	20.0	56.0	24.0	
Computer programmer	10.9	57.6	11.2	20.3
Computer technician	16.0	57.1	18.3	8.6
Telecommunication and networks technician	34.8	49.4	14.6	1.2
Informatics specialist	20.3	40.6	27.5	11.6
Computer operator	42.0	36.4	2.7	18.9

(\*: NS = Not Specified)

## 6. CONCLUSIONS

This paper focused on the analysis of the annual demand in the information and communications technologies sector. The methodology introduced was applied at national level in Greece. Extensive statistical analysis was carried out in order to identify the bivariate and multivariate associations among the key variables, which portray in detail the sectoral demand. This analysis led to some interesting findings.

Numerous published advertisements describe an about triple number of vacancies ranging through a broad spectrum regarding general and professional skills, educational background and geographical distribution. However, the majority of the advertisements address very little information to potential employees regarding crucial characteristics of the offered jobs. The job description and the required degree of studies are the characteristics that are usually addressed the public. On the contrary, ICT skills and several other characteristics such as gender, age and required working experience are hardly reported. This pattern could be attributed either to the lack of relevant know-how by the employing organizations or to the fact that these characteristics are considered by the employers as irrelevant to their vacancies.



Half of the vacancies derive from the public sector. This feature mirrors the structure of the Greek socioeconomic framework where the state has a great share of the employment. Moreover, a third of the ICT vacancies are offered in Athens. This is also particular to the pattern of urbanism occurring in Greece since about half of the total population resides in the capital.

Although the monthly distribution of the ICT advertisements is relatively smooth, the actual number of published vacancies presents very high seasonality. This feature is not that interesting by itself since seasonality is a consequence of different occupations, job types and work offer. However, the fact that this specific seasonality appears exclusively due to the pattern of the public sector vacancies makes a significant difference.

Finally, in our point of view, it would be useful to carry out this ICT demand analysis at international level, that is, to implement this model simultaneously in more countries. A comparative study of the partial national results would present particular interest. Furthermore among our aims is the continuation of the ICT advertisements' analysis covering the next five-year period in order to investigate whether the current patterns of the demand are preserved or if significant changes are noted?

## REFERENCES

- Dantine, J. P., Bean C. R., Bernholz, P. and Malinvand, E. (1990). *European Labour Markets: a long run view*, Commission of the European Communities, DG for Economic and Financial Affairs, economic paper, 78.
- European Commission. (2000). *Strategies for jobs in the information society*, European Commission DG Employment and Social Affairs. Luxembourg.
- Federation of Greek Industries. (2001). *Research for the needs of industries in peak specializations*, Unit of research and analysis, Athens.
- Federation of Greek Industries. (2004). *Research for the needs of industries in peak specializations*, Newspaper "TA NEA", issue of 9<sup>th</sup> July 2004.
- Goutsos, S., Douloukitaki, S. and Tsaknaki, S. (2000). The dynamics of the engineers' labor market in Greece, *Proceedings of the 14<sup>th</sup> National Conference of Operational Research*, Piraeus, 30<sup>th</sup> Nov. – 2<sup>nd</sup> Dec. 2000.
- Greek Economical and Social Committee. (2002). New knowledge – New employment: the results of the new technologies, *Opinion*, Vol. 85.
- Greek Ministry of Labour. (2002). *Linking the continuing training of the unemployed and the enterprise needs*, Athens.
- International Data Corporation-IDC. (2003). *ICT demand in Europe*, Retrieved August 28, 2005 from the World Wide Web:  
<http://www.palazzoehgi.it/fsi/ita/info/tabella-demand.html>.

- Information Technology Association of America - ITAA. (2000). *Bridging the gap: information technology skills for a new millennium*, Arlington VA: ITAA. Retrieved June, 27, 2005 from the World Wide Web:  
<http://www.ita.org/workforce/studies/hwoexec.summ.htm>
- Katsanevas, T. (1997). *Labour economics and labour relation*, Athens: Stamoulis.
- Kostoglou, V. and Paparrizos, K. (2003). Occupation areas, specialization sectors and professions in ICT: An overall analysis and selection methodology, *Proceedings of the 9<sup>th</sup> Pan-Hellenic Conference of the Greek Computer Society*, 310-321. Thessaloniki, Greece.
- Kostoglou, V., Paparrizos, K. and Zafiropoulos, C. (2004). Investigating human resource management in ICT labour market, *Operational Research an International Journal*, Vol. 4(1), 57-72.
- KPMG. (2004). The labour market of information technology executives in Greece, *Newspaper "Ta Nea"*, issue of 15<sup>th</sup> December 2004.
- Lenz, E. A. (1996). Flexible employment: positive work strategies for the 21<sup>st</sup> century, *Journal of Labor Research*, Vol. 17, 555-566.
- Lindsay, C. (2002). Labour market assessment, *Labour Market Trends*, Vol. 110 (10), 499-502.
- Newspaper "Express". (2005). *Up to 30% decrease in the number of vacancies during the last two years in the IT labour market*, Issue of 14<sup>th</sup> January 2005.
- Newspaper "Imerisia". (2005). *A 30% personnel decrease in informatics and telecommunications*, Issue of 15<sup>th</sup> January 2005.
- Skoulas, N. E. and Oikonomaki, K. P. (1998). *Human resources administration and development*, Athens: Kappa.
- SPSS Inc. (2003). *Base 12.0 User's Guide*, Chicago: SPSS Inc.
- Xirotitri-Koufidou, S. (1995). *Human resource management*, Thessaloniki: Kiriakidis.

## ETHNIC DIVERSITY IN ORGANISED SPORT: DEVELOPMENT OF SOCIAL CAPITAL BY DUTCH IMMIGRANTS

PAUL VERWEEL\* AND ANTON ANTHONISSEN\*\*

### ABSTRACT

*This contribution will discuss the influence of organising diversity in exclusively immigrant or multicultural sports clubs on acquiring social capital by individual immigrants. The theory of organising diversity is strongly qualified by the assumption that we are concerned with a white native context, resisting the inclusion and utilisation of diversity. The ideology of diversity promises a better future for organisations. But what if immigrants opt for their own organisations? Do they also lose the assumed advantages of diversity in organising sports? In this article we will use social capital as the measure in researching advantages and disadvantages to the organisation of diversity in immigrant or multicultural Dutch sports clubs. With the aid of empirical research data we shall critically remark on the theoretical principles.*

*Keywords: In and Exclusion; Gender; Social Cohesion; Sport.*

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### 1. INTRODUCTION

In the USA, diversity thinking has developed as a theoretical point of departure for changing organisations in the context of profit making and globalisation (see for discussion Wentling Palma-Rivas 2000; Zane, 2002). The emphasis is on the potential of diversity as a normative principle for the development of workers (capabilities) in organisations and organisations as such (Bond & Pyle 1998; Cox & Finley 1995). Critical organisation and management scientists have aired doubts about this, because the focus of processes of change is often likely to be aimed at maintaining the dominant white (male) discourse within organisations, where the making of 'difference' is regarded as a neutral point of departure (Grimes 2002; Kamp & Hagedoorn-Rasmussen 2004). Because diversity has been developed in the context of profit making organisations, it is therefore often regarded as a business strategy

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\* Professor of Management and Organization from a Multicultural Perspective, Utrecht School of Governance, University of Utrecht, The Netherlands

\*\* Associate Professor of Management and Organization from a Multicultural Perspective, Utrecht School of Governance, University of Utrecht, The Netherlands

(Wentling & Palma-Rivas 2000). It is based on the assumption that stimulating diversity in (multi-national) organisations will lead to better performance, competitive advantage and higher profits (Kirby & Harter, 2003; Point & Singh 2003; Wentling & Palma-Rivas 2000). Mostly organising diversity is regarded as the concern and responsibility of management and is therefore implemented from top down (Kamp & Hagedoorn-Rasmussen 2004; Kirkby & Harter 2003).

Organization and management studies in western European countries like Denmark and the Netherlands tend to regard organising diversity less as only a management responsibility and thinking in terms of ‘difference’ with reference to (power) distances, often on the basis of ethnic and cultural considerations (Glastra et al 2000; Kamp & Hagedoorn-Rasmussen 2004). These considerations are of importance with regard to social integration and specific issues of organisational change (product-client combination, HRM, etc.) and can therefore be seen as part of thinking on diversity.<sup>1</sup> Ethnic, racial and religious differences that play a role in integration discourse of colonial and labour immigrants, as well as ‘different’ refugees on the labour market, increasingly require attention from sporting organisations.<sup>2</sup>

Hall (2004) shows that in North American studies on organising and managing diversity in sport (and leisure), conceptual models for managing diversity are being developed and tested in empirical studies. Thereby she refers to the work of Doherty & Chellundurai (1999), Fink & Pastore (1999), Fink, Pastore & Riemer (2001) and Allison (1999). In Dutch sports studies, organising diversity is primarily studied on the basis of action repertoires in sporting practice. These focus on differences in meaning constructs by individuals and groups of athletes, managers and coaches, and connections are made with the reciprocal influence between social position and social structures (in terms of gender, ethnicity, class, etc) in the organisation of sports (Anthonissen & Dortants 2005).

In the light of the growing social discussions on the meaning of ethnic and cultural (and religious) differences and the need for integration, Dutch sports studies show an increasing interest in the way in which ethnicity/race is constructed in the practice and organisation of sports (Anthonissen & van Eekeren, 2000; Elling 2002; Knoppers & Elling 2001; Janssens & Verweel 2005; Knoppers & Anthonissen 2001; Verweel & Anthonissen 2000).

In our contribution we wish to combine the interest in organising diversity in organisations and the effects on integration in society with the way in which diversity is organised in sports and what this means for the individual immigrant.

## 2. ORGANIZING DUTCH SPORT AND THE DEVELOPMENT OF SOCIAL CAPITAL

Since the 19th century, amateur sport in the Netherlands has been organised in voluntary associations, originally (all native white Dutch) on the basis of class background and along religious lines (Christian Protestant or Catholic, atheist, etc.).<sup>3</sup> Since the 1960s, all sorts of ethnically exclusively immigrant clubs have also been established. The constitution of the Netherlands - a country characterised by religious, social and economic differences - offers groups of citizens the legal tools for organising themselves into sports clubs. Currently, the government and the world of Dutch sports are questioning this right because exclusively immigrants' organisations run counter to the aims of social integration. When the right to organise into immigrant organisations is incompatible with acceptance in society of these organisations, the question should be raised whether there is a social measure that underpins the legitimacy of this right. In the context, we shall seek this measure in the development of social capital, which is, or is not, possible for the individual (i.e. immigrant) by organising diversity in sports. When organising diversity in exclusively immigrant sports clubs, it means that individuals are restricted in their social development because they are caught in self-chosen isolation, their right still exists but the desirability of such rights is then open to legitimate criticism. A perspective that integration is a must leads to the question whether and how individual immigrants are able to build up and increase their social capital by membership of exclusively immigrant sports clubs or by participation in other sports clubs.

Social capital is regarded here as a person's ability to use reciprocity (reciprocal relations) in order to cope with demands made by society. This definition builds on the work of Coleman (1990), Lin (2001) and Putnam (2000), which connects social capital with the ability to turn networks to account. Social capital, then, becomes meaningful in the sense of the utility of networks to individuals, as well as the ability of individuals to utilise this form of capital. Putnam's work (2000) acknowledges both these aspects, but he places the most emphasis on the importance of social capital to society. Social capital thus becomes a measure of social cohesion. This means that societies with more or less social capital will, as a result, show more or less social cohesion. Following Coleman (1990) and Lin (2001), we will focus more explicitly on the individual perspective. Emphasis in our vision is on the ability of individuals to acquire social capital in interaction with their surroundings [ethnic group (and) type of organisation(s)] and their personal history. The connection between the individual ability and the type of sports club and ethnic background also keeps us focused on two societal aspects that make social capital more than just a matter of individual interest. The interaction between the individual and his surroundings can be concerned with both participation in exclusively ethnic networks and with non-exclusive networks

(Putnam 2000).<sup>4</sup> In this context Putnam refers to bonding and bridging. Bonding capital contributes to the reinforcement of personal and group identity. Bridging concerns the ability to learn to interact with others, especially others with different persuasions.

By connecting the importance of ethnically specific or non-specific networks to the ability of individuals for using them, we will try to throw light on the way in which immigrants in Dutch voluntary sports organisations develop social capital, or on the obstacles they encounter when attempting to do so. In this way social capital offers a measure for comparing two forms of organising diversity.<sup>5</sup> Social diversity can develop in originally native clubs which increasingly become multicultural by the influx of immigrant members. We will then refer to 'multicultural sports clubs'. Social diversity can also organise itself along the lines of existing traditions when groups (i.e. immigrants) choose their own exclusive clubs on the basis of ethnic and religious background. We will then refer to 'exclusive' or 'immigrant' sports clubs. In the former case diversity is organised within the clubs, in the latter case diversity is organised in events (meetings between clubs). In view of Putnam's (2000) theory, we may assume that in the former case bridging capital would be the product, and in the latter bonding capital.

### 3. METHODS OF RESEARCH

In this study we will concentrate on the political point of view we have outlined, that organising diversity along specific ethnic/racial lines leads to isolation, increased social deprivation and less social capital for immigrant sportsmen and women, and in that mixed, multicultural sports clubs lead to integration and an increase in social capital for immigrants.

On the one hand this implies the theoretical assumption that organising diversity will always benefit individuals and organisations, and on the other hand that organising diversity is aimed at benefiting white organisations for the future, as well as benefiting immigrants in providing access to these white organisations. Moreover, the proposition also assumes that managing diversity is in fact aimed at promoting meetings in traditionally native organisations/clubs. In this assumption (originally native) mixed sports clubs mainly yield bonding capital for their members, and not so much bridging capital, whereas mixed clubs would yield mainly bridging capital for their members. This is especially interesting in organising sports because in sporting activities individuals and groups are confronted with all sorts of differences, such as clubs or individuals from clubs with a different ethnic/racial identity. We shall take the concept of social capital as a point of departure for explicit analysis, both qualitative and quantitative, of (1) reciprocal service, (2) social relations, and social and

emotional development, (3) relations with others, and (4) social participation in other domains.

The research into acquisition and utilisation of social capital by immigrants has been carried out by triangulation. By means of participant observation ten sports clubs were visited intensively during a sporting season (nine months). Research was conducted in ten clubs in different sporting disciplines (soccer, basketball, boxing, judo, baseball and cricket). Members of the multicultural research team joined a club for one season<sup>6</sup>. They joined twice-weekly training sessions and a competitive game at the weekend. They spent a weekly average of eight to fourteen hours at their clubs. In this way the researchers spent about 500 hours in participant observation per club, yielding a grand total of nearly 5000 hours of participant observations. The observations were recorded in a diary describing each day's activities, a club analysis and a description of a typical week. The typical week method is based on the work of the anthropologist Oscar Lewis (1955), who described the Americanisation of Mexican life in this way. In addition to their participation, the fieldworkers conducted interviews with at least five persons from each club on several occasions. Altogether, fifty portraits were drawn up of immigrant and native players of soccer, cricket, martial arts and baseball. A total of 879 sportsmen and women from different sports participated in the survey, of whom 354 were immigrants from an exclusively immigrant club (40%), and 296 participated in multicultural sports clubs (33%). Out of the total number of immigrants, 405 were first generation and 246 belonged to the second generation. In addition there were 231 native Dutch respondents playing in multicultural sports clubs (26%), and we found only 8 natives playing in immigrant clubs (1%). All respondents were over eighteen. In this article, in view of our object, we will not consider comparisons to natives, barring an occasional exception when it yields valuable information.

Putnam (2000) mentions the number of examples and forms of social capital which can be taken as a point of departure for our study: (1) reciprocal service: this concerns the way in which individuals are able to use each other's networks for other areas of social activity, such as education, work, childcare and lifestyles; (2) social relationships and social and emotional skills: this specifically concerns honouring agreements, giving and taking criticism and compliments, trusting others, increasing self-knowledge, learning to organise, increasing self-confidence; (3) relationships to others outside the group: learning to cope with ethnic differences and dividing lines in society. In our study, on the basis of ongoing debate in society, we have added the aspect of possible isolation in a person's own surroundings or club. This covers the degree to which individuals participate and are integrated in other social areas such as education, work, politics and media. These aspects have been analysed on the basis of both qualitative and quantitative data.

#### 4. RESULTS

Breedveld (2003) found a correlation between playing sports in a club and a person's trust in his fellows. Sportsmen in clubs turned out to have more trust (70%) than unorganised sportspeople (55%) and non-participants (52%). Our survey shows that 41% of all respondents completely agree. 31% a little, and 28% disagree. Immigrants are a bit less confident than natives (completely agree 41% versus 44%; agree more or less 31% versus 31%; and disagree 29% versus 26%). The differences are remarkably small. Our results seem to indicate that sports contribute to an open attitude enhancing social cohesion, but it may of course be possible that people with more confidence in their fellow men are over-represented in organised sports clubs. For that reason we first charted the reasons which immigrants had for participating in an immigrant or a multicultural sports club. It appeared that only 13% of members had made a motivated decision in favour of an immigrant sports club, and that only 4% of immigrant members of multicultural Dutch sports clubs had made a reasoned choice. A deciding factor in favour of an immigrant sports club was the presence of friends in immigrant sports clubs (96%), and to a lesser degree, the atmosphere (30%). For 47% of immigrants in multicultural clubs friendship is the deciding factor, and again, good atmosphere has the lowest score (14%). For immigrants in multicultural clubs the proximity of the club is the deciding factor (32%), over friendship. These figures show that not self-chosen isolation but friendship is the most important factor in choosing a sports club. But, of course, this can also lead to isolation and the lack of surroundings in which the acquisition of social capital is possible.

We have analysed the question concerning the acquisition of social capital, as already mentioned, in both qualitative and quantitative ways. First of all, on the basis of the observations of the fieldworkers in the research diaries, we counted the number of times that the three aspects to be distinguished on the basis of Putnam's theory occurred (see figure A): Reciprocal service (row 1); social relationships and social and emotional skills (honouring agreements, discussing social and emotional relationships (rows 2, 3 and 4)); relations with others (confident discussion of ethnic boundaries and other differences between people (row 5)). The fourth aspect, 'social participation' is hard to express in figures and will therefore be discussed later, in the presentation of qualitative research material in the form of portraits.

With all due care needed for interpretation, it is immediately remarkable that in the different sports, and in the differences between immigrant and multicultural sports clubs, that an individual member may observe and experience between 90 and 134 distinct moments. When exclusively immigrant and multicultural sports clubs are compared, a widely varied image emerges in which the highest and lowest scores of immigrant and multicultural clubs are reasonably parallel, and differences possibly



originate from the culture of the club or the sports, rather than from the manner of organisation. In both types of clubs all three of Putnam's aspects of social capital can be observed. These data do not point in the direction that organising diversity in immigrant sports clubs leads to less social capital for the individuals involved, nor to the one-sided acquisition of bonding capital.

The quantitative presentation of the qualitative material does not reflect, however, the interwoven nature of those moments with the possibility of acquiring both bonding and bridging capital. In order to demonstrate how this works, we will present four exemplary portraits from the 50 in-depth interviews that were held in the clubs, in order to gain better insight into the way in which respondents are able to acquire and utilise social capital. The in-depth interviews add colour to the way sport gives meaning to the lives of individual sportsmen and so makes it possible to say something on the fourth aspect that we added, that of 'social participation'. It is remarkable that the interviews show that sports are important in the lives of the participants. Sport enables them to learn things about themselves and others, and that knowledge enhances their feelings of being socially successful. Sport contributes to emotional, social and cognitive self-confidence. The interwoven nature of all four aspects of social capital emerges from the four personal histories, described below by way of example. In addition, these short histories of club members show that meaning constructs cannot always be subsumed into cause/result relations and rationalisations, but that there is always a complex of interwoven, hybrid and sometimes contradictory meanings. In both organisational contexts the processes of identity development (bonding) and of learning to interact with others (bridging) occur, but such processes are certainly not limited to the context of immigrant or multicultural sports clubs.

A Surinam sportsman has decided to join an immigrant basketball club because he does not feel at home with the playing system of native sportsmen. Native sportsmen, moreover, lack the drive to win, and do not make a sufficient effort to discuss mistakes after the match. They want to go for a drink and socialise. For him it is very important that players do many things together, and share activities besides sport. He thinks that contacts with his own group of immigrants is good for their integration into Dutch society. His immigrant friends tell him lots of things about the characteristics of the natives and how to deal with them. In this way he has learned many things about their way of communicating, and that is very important to him.

A young Moroccan sportsman has joined a multicultural (originally native Dutch) soccer club. A friend introduced him to the club. It is his experience that he makes more friends by playing better soccer, and it gets him more social relationships (also at school). He has gained self-confidence, and that has been very important for him. He has learned to deal with others, to cope with criticism, to speak out, and he has learned

many things about the way natives communicate. All week he looks forward to the weekend match, and he enjoys sharing this feeling with friends with whom he can share a joke, who are like-minded and who share his interests. For instance, he likes to show his Turkish team-mate his prayer mat when this boy comes to visit.

A native sportsman is captain of a (multicultural) team in a native sports club, and he thinks that he has learnt many things about his immigrant club mates. He now knows much better how to deal with them and what he can and cannot expect from them. He now expects less from them than from native players. Immigrant players tend to be less active to helping in organizing, will come to parties when they are invited, but will not readily invite anyone back. He arranges many things in the club so that things run smoothly between his mainly immigrant team and the native club leaders.

A Turkish Dutch player in an immigrant sports club is highly talented, but because of his education (HAVO/HBO, higher professional education)<sup>7</sup> he took his parents' advice and interrupted soccer playing when he was young, to the disappointment of the club. Once he had gone into higher education, he missed playing soccer and joined a mixed club at a lower level. He left two clubs because he didn't like the atmosphere although his playing was highly appreciated. He feels that when he is not doing so well at school, the club is the place where he can be happy. He is highly valued there and he learns a lot, such as self-control and to speak out. He has gained a lot of self-confidence, and it is good when people help him, for instance to move house. Nine out of ten members know who he is, and respect him. Sport is everything to him.

These short portraits make clear how important sports have been in the lives of these highly educated and socially successful immigrants, but also for the native captain. It was instrumental in building up their self-confidence and gave them a network in their sporting and working lives. It helped them to acquire skills such as learning to communicate, self-control, judgment of character, etc. Acquiring different forms of social capital takes place in multicultural sports clubs as well as in immigrant sports clubs. The portraits also show that in both immigrant and multicultural sports clubs participation in sports contributes to the social and emotional development of immigrants and native speakers alike. In the interviews there are no signs of social isolation, rather an increasing self-confidence and ways of dealing with ethnic differences in sports and society.

The portraits and participant observations also show that there is a relatively high number of highly educated immigrants in organised sports, who fulfil many jobs in middle management (head of stores, operations department, etc.) and have positions of

authority over native people, or run their own businesses. Many ordinary members were students (in boxing, judo, cricket, as well as soccer) in higher education, or had jobs in all sectors of society. The observations did not show significant differences as to social position and participation between immigrants in immigrant and multicultural sports clubs. The differences, according to the observations, more often relate to the type of sport (Cricket: highly educated Hindustani, basketball: students), or the social and economic background of an existing club (workers, self-employed or elite), or to the educational level of team members (student team, for instance). But in boxing, baseball and soccer, there are also quite a few students and people with a good education, as well as middle managers or small-business people. There is no question of social isolation of the members of immigrant clubs. In relation to the fourth aspect (social participation), the qualitative data warrant the conclusion that organising diversity in immigrant clubs does not lead to social isolation in other areas of society.

Quantitative data enable us to weigh the differences in the four aspects distinguished earlier (reciprocal service, social relationships, social and emotional development, relations with others and social participation), in order to gain insight into the opportunities for acquiring social capital in immigrant or multicultural clubs. In the text we mention only the percentages of significant differences (note 8) and in the appendix the relevant results from the survey questions have been included for verification. The results can be summarised as follows<sup>8</sup>:

Reciprocal service:

1. Immigrants in exclusively immigrant clubs give and receive not more or less often advice on living and work than immigrants in multicultural clubs.
2. Immigrants in immigrant clubs give and receive advice on family and relationships more often than immigrants in mixed clubs (16% versus 9% regularly).
3. There is no difference concerning advice on buying and lending/borrowing belongings.
4. Immigrants in immigrant clubs transport others by car to and from the club (voluntary activity) more often than immigrants in multicultural clubs (51% versus 40%).

Social and emotional skills:

5. Immigrants in multicultural sports clubs are more positive about acquiring social skills (62% versus 51%), but more negative about experiencing discrimination (46% versus 37%) than immigrants in immigrant sports clubs.
6. Immigrants in multicultural sports clubs score higher on all elements of social and social and emotional skills than immigrants in immigrant sports clubs, but social

skills scores are high in both types of clubs: relating to others (57% versus 45%); increasing self-knowledge (46% versus 36%); learning to organise (43% versus 32%); learning to relate to others (50% versus 42%) and develop more self-confidence (53% versus 35%).

#### Relations with others:

7. Immigrants in immigrant clubs have greater general trust in people than immigrants in multicultural clubs (31% versus 23% fully agree).

8. Immigrants in multicultural clubs have developed more positive attitudes to Dutch native people in general through their contacts than immigrants in immigrant sports clubs when they have changed their opinion of natives (40% versus 18%). In both groups only 4% has developed a more negative attitude to natives.

9. Immigrants in multicultural sports clubs also tend to change their attitudes towards natives (44% versus 32%).

#### Social participation:

10. Immigrants in immigrant clubs have attended higher education more often than immigrants in multicultural sports clubs (78% versus 66%). But immigrants in multicultural clubs are more oriented towards Dutch politics than immigrants in immigrant clubs; they vote more often (63% versus 53%) and watch more Dutch TV. There is no significant difference in the degree to which both groups watch Dutch TV or their own national TV networks. The same goes for voluntary work, there are no differences between the two groups of immigrants, (but the percentages are high for both groups: 60% versus 56%), though there is a difference with respect to donations to charity (again, the percentages are high: 49% versus 56% regularly/always).

The figures from the survey show that on the one hand immigrants in immigrant sports clubs are more involved in reciprocal service, that immigrants in multicultural sports clubs have the idea that they can learn more in spite of feeling discriminated more often, and that immigrants in immigrant sports clubs have greater general trust in people. On the other hand, immigrants in multicultural clubs have a greater tendency to develop a more positive attitude to natives, and that only 4% in both groups of immigrants feel that their attitude to natives has become more negative by participation in sports.

Although the results are divergent, it is true for immigrants in both types of sports that they experience and contribute to much reciprocal service. They also acquire many social and social and emotional skills. With regard to the aspect of social participation, it is remarkable that in both types of clubs there are many highly

educated participants, but that highly educated immigrants show a preference for immigrant sports clubs. There seems to be no downside to this, however: participation in immigrant clubs does not entail social deprivation or non-participation in the area of education or work. These data confirm the impression we got from qualitative analysis. But higher education and participation in leading positions in labour organisations does not automatically mean integration in Dutch ways of thinking, as there is a preference for immigrant sports clubs, immigrant national TV stations, and they vote less often.

When we survey the qualitative and quantitative research, the conclusion must be that immigrants in both immigrant and multicultural sports clubs, with regard to all researched aspects of acquiring social capital: reciprocal service, social and social and emotional skills, relations with others and social participation, have high scores. There is no question of isolation in exclusive clubs, and neither is there a one-sided acquisition of bonding capital as opposed to bridging capital.

When measured by the four aspects of social capital, the bridging effect is sometimes to the advantage of the immigrant, and sometimes to the advantage of a multicultural sports club. In any case, the higher percentages show that for all aspects a large proportion of immigrant members of immigrant sports clubs are acquiring bridging capital on a large scale, sometimes even exceeding the possibilities in mixed teams in the perception of respondents. The theoretical assumption mentioned earlier, that native clubs yield mostly bonding capital and no bridging capital is therefore incorrect. That also goes for the proposition that multicultural sports clubs yield mostly bridging capital. As the observations show, it is by meeting native club members that immigrants are often asked for information on their own identity, or as a result of more or less coincidental formation of groups (game or training, transport, cloakrooms) it becomes clear that ethnic identity is a distinct criterion.

In both the observations and the interviews in the survey, it is also remarkable that many immigrants in immigrant sports clubs have meaningful middle management and professional jobs and good education, so that there is no question of any social isolation as a result of participation in immigrant sports clubs.

## 5. CONCLUSION

There is no doubt whatsoever that much social capital is produced and reproduced (beyond the boundaries of the clubs) in both multicultural and immigrant sports clubs. That social capital represents practical value, as well as value for identity and self-confidence for the players involved (73% of respondents' scores between a lot and a little). Club members learn how to access this capital, process and use it. In this

connection it is remarkable that the research shows that there is hardly any difference between immigrant and multicultural clubs. Participating in sports in immigrant or multicultural clubs is not a decisive factor in acquiring bridging and bonding capital. Moreover, immigrants do not opt for immigrant sports clubs on the basis of ethnic identity, but just like native people, on the basis of personal friendships. The differences are almost invisible within a margin of 10%. The research shows that members of immigrant sports clubs are not socially isolated. Outside sports, the immigrants in the survey are usually well integrated by their social position and education.

A possible explanation of this could be that the club is an organisation that is in open communication with society, and that these differences have been overcome in the life of the neighbourhood, at school (whether higher or lower level) or at work. It is striking that there is a difference between the degree to which immigrants learn and share, and the degree to which they trust others. Trust is lower (41% a lot, 31% a little and 29% none) than that of natives (47% a lot, 31% a little, and 26% none). These figures underpin other figures found in the Netherlands (immigrants and natives) in earlier publications (Breedveld 2003: 70% trust for organised sportsmen). Immigrants in multicultural sports clubs have more frequently developed positive attitudes towards natives than immigrants in immigrant sports clubs (40% versus 18%), and in this group immigrants have also changed their attitudes to native people less (56% versus 76%). Although that is relatively much for both groups, there is a strong tendency for participating in multicultural clubs as a way of acquiring new and other insights about others outside one's own ethnic group.

When considering the theoretical assumptions of managing diversity, we may conclude that the data presented here, from the field of sports, go some way to support them, but also give rise to some criticism. The multicultural sports club (organisation) certainly offers more opportunities for development for Dutch immigrants where the acquisition of social and social emotional skills is concerned, but at the same time there is increased experience of discrimination. Still, immigrants in multicultural sports clubs change their attitudes to Dutch native people more often and more positively than immigrants in immigrant sports clubs. But immigrants in immigrant clubs profit more often from reciprocal social and material services. In addition, they have more trust in their fellow men than immigrants in multicultural sports clubs.

As we showed in the introduction, some advocates of the theory of managing diversity claim that organisations with ethnically diverse employees (or members) function better than all-white organisations. From this perspective on managing diversity, 'social justice' is the guiding principle, often emanating from concern about unequal participation of groups in labour organisations. "Diversity refers to including

and managing people in the workforce who have traditionally been marginalized because of their race, gender, ethnicity, age, sexual orientation and/ or disability.” (Zane 2002: 335). Organisations are encouraged to use diversity in their own interest, to promote creativity and the welfare of their employees and customers. The assumption, then, is that the inclusion of the ethnic (beside other differences) is good for the organisation and the individual. But from the perspective of coping in society, it turns out that in immigrant self-organisations in sports there is more material and social service for the individual himself. In addition, in exclusive clubs much learning of social and social and emotional skills goes on. Considered from the perspective of the individual, it is the question whether the added value of the multicultural sports club outweighs the disadvantages. The assumptions of the theory of organising diversity are mainly based on the analysis of future advantages of white organisations, and the benefit that immigrants get access to these white organisations. But when the option is self-organisation in which heterogeneity of immigrants only excludes native Dutch people, it turns out that social capital can be acquired to a substantial degree. The assumption that mono-ethnic (immigrant) clubs yield more bonding and multicultural clubs more bridging capital needs qualification. Bonding and bridging can be learned in mono-cultural (immigrant) as well as in multicultural clubs, although native Dutch sports organisers and politicians would prefer to see it otherwise, and in spite of the fact that the theory of managing diversity works on the assumption that multicultural organisations carry great benefits for the individual.

## NOTES

1. In Western Europe, thinking on organising diversity and social integration are currently strongly related by the focus on ethnic, cultural and social class. In the Netherlands, politicians and other writers have proposed that the immigrants’ own culture is an obstacle to their integration into the labour process, their success at school and participation in sports. Assimilation with the aid of terms like citizenship and integration is replacing the idea of the conservation of immigrants’ own culture. This swing gained extra momentum after the 9/11 attack on the World Trade Centre, but the assassinations of the politician Pim Fortuyn and the filmmaker Theo van Gogh have also put relations on edge.

2. Just like many other European countries, the Netherlands is faced with increasing numbers of immigrants. In 2004 about 10% of the Dutch population was from an immigrant background (Glastra et al 2000, SCP 2003).

3. The organisation of Dutch sports by the voluntary (local) clubs is supported by national sports associations. The relevant national sport associations provide the competitive structure, based on several divisions arranged according to hierarchical skill levels, and by age and gender.

4. The wider societal aspect of social cohesion resulting from social capital is not the core question of research, but the notion that it is sports which can contribute to the building up of capital in clubs to enhance immigrants' participation in society.

5. In certain parts of the Netherlands and in specific sports disciplines, there are still exclusively white native Dutch sports clubs. These sports clubs will not be included in our research because of the absence of immigrants.

6. The research team consisted of two Dutchmen with a Surinam background, one from the Netherlands Antilles, one with an Iranian background, one of Pakistani extraction, and four native Dutchmen.

7. Havo can be compared with an American high school, HBO with university level (technicon) in the US and the UK.

8. All relations have been tested with a chi square test, with significance limited to 0.05.

## APPENDIX

The enclosed tables describe the results of the survey in purpose of the quantitative scores on the four aspects of social capital (p. 9 and 10).

**TABLE 1: MUTUAL SERVICES (ITEMS 2 AND 4)**

Item 2 (advice)	Immigrant in immigrant club	Immigrant in multicultural club	Total
Never	156 44,3%	161 54,4%	317 48,9%
Sometimes	139 39,5%	108 36,5%	247 38,1%
Regular	57 16,2%	27 9,1%	84 13,0%
Total	352 100,0%	296 100,0%	648 100,0%

Item 4 (collect with car)	Immigrant in immigrant club	Immigrant in multicultural club	Total
Never	48 13,7%	68 23,1%	116 18,0%
Sometimes	125 35,6%	109 36,9%	234 36,2%
Regular	178 50,7%	118 40,0%	296 45,8%
Total	351 100,0%	295 100,0%	646 100,0%



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**TABLE 2: SOCIAL CONNECTIONS AND SOCIAL-EMOTIONAL SKILLS  
(ITEM 5 AND 6)**

Item 5 (bothered by discrimination)	Immigrant in immigrant club	Immigrant in multicultural club	Total
(Totally) disagree	94 26,8%	58 20,2%	152 23,8%
Sometimes agree, sometimes disagree	128 36,5%	97 33,8%	225 35,3%
(Totally) agree	129 36,8%	132 46,0%	261 40,9%
Total	351 100,0%	287 100,0%	638 100,0%

Item 6 (associations with others)	Immigrant in immigrant club	Immigrant in multicultural club	Total
(Totally) disagree	116 32,8%	67 22,8%	183 28,2%
Sometimes agree, sometimes disagree	78 22,0%	60 20,4%	138 21,3%
(Totally) agree	160 45,2%	167 56,8%	327 50,5%
Total	354 100,0%	294 100,0%	648 100,0%

Item 6 - getting to know yourself	Immigrant in immigrant club	Immigrant in multicultural club	Total
(Totally) disagree	151 42,9%	93 32,3%	244 38,1%
Some- times agree, some- times disagree	75 21,3%	62 21,5%	137 21,4%
(Totally) agree	126 35,8%	133 46,2%	259 40,5%
Total	352 100,0%	288 100,0%	640 100,0%

Item 6 (making new acquain- tances)	Immigrant in immigrant club	Immigrant in multicultural club	Total
(Totally) disagree	134 37,9%	82 28,1%	216 33,4%
Sometimes agree, sometimes disagree	71 20,1%	65 22,3%	136 21,1%
(Totally) agree	149 42,1%	145 49,7%	294 45,5%
Total	354 100,0%	292 100,0%	646 100,0%

Item 6 (learning to organize)	Immigrant in immigrant club	Immigrant in multicultural club	Total
(Totally) disagree	156 44,1%	99 34,0%	255 39,5%
Sometimes agree, sometimes disagree	84 23,7%	66 22,7%	150 23,3%
(Totally) agree	114 32,2%	126 43,3%	240 37,2%
Total	354 100,0%	291 100,0%	645 100,0%

Item 6 -- gaining confidence	Immigrant in immigrant club	Immigrant in multicultural club	Total
(Totally) disagree	142 40,3%	65 22,8%	207 32,5%
Sometimes agree, sometimes disagree	86 24,4%	68 23,9%	154 24,2%
(Totally) agree	124 35,2%	152 53,3%	276 43,3%
Total	352 100,0%	285 100,0%	637 100,0%

**TABLE 3: RELATING TO OTHERS (ITEM 7, 8 AND 9)**

Item 7 (people are trustworthy)	Immigrant in immigrant club	Immigrant in multicultural club	Total
(Totally) disagree	151 42,9%	119 41,6%	270 42,3%
Sometimes agree, or disagree	93 26,4%	102 35,7%	195 30,6%
(Totally) agree	108 30,7%	65 22,7%	173 27,1%
Total	352 100,0%	286 100,0%	638 100,0%

Item 8 and 9 (changing through sports)	Immigrant in immigrant club	Immigrant in multicultural club	Total
More negative	13 3,9%	10 3,6%	23 3,7%
No opinion	262 78,4%	157 56,1%	419 68,2%
More positive	59 17,7%	113 40,4%	172 28,0%
Total	334 100,0%	280 100,0%	614 100,0%

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**TABLE 4: SOCIAL PARTICIPATION (ITEM 10)**

Item 10 (education)	Immigrant in immigrant club	Immigrant in multicultural club	Total	Item 10 (volunteer work)	Immigrant in immigrant club	Immigrant in multicultural club	Total
Low	77 21,8%	99 33,7%	176 27,2%	Yes	211 59,6%	166 56,1%	377 58,0%
Middle/ High	277 78,2%	195 66,3%	472 72,8%	No	143 40,4%	130 43,9%	273 42,0%
Total	354 100,0%	294 100,0%	648 100,0%	Total	354 100,0%	296 100,0%	650 100,0%

Item 10 (voting)	Immigrant in immigrant club	Immigrant in multicultural club	Total	Item 10 (giving money to charity)	Immigrant in immigrant club	Immigrant in multicultural club	Total
Yes	188 53,3%	181 63,1%	369 57,7%	Never	37 10,5%	32 11,0%	69 10,8%
No	165 46,7%	106 36,9%	271 42,3%	Sometimes	143 40,7%	97 33,4%	240 37,4%
Total	353 100,0%	287 100,0%	640 100,0%	Regularly	171 48,7%	161 55,5%	332 51,8%

FIGURE CAPTION

**FIGURE 1: OCCURRENCES IN RESEARCH DIARIES OF DESCRIPTIONS MENTIONING ASPECTS OF SOCIAL CAPITAL**

		Soccer Multicult.	soccer Immig.	Soccer Immig.	Basketball Immigrant	Basketball Immigrant	Martial Arts Multicult.	Martial Arts Multicult.
Reciprocal Services	Services	23	31	16	30	42	17	43
Social relationships	Agreements	14	20	9	17	11	13	39
	Social skills	47	33	24	21	21	36	18
	Social & Emotional skills	14	24	36	10	10	18	20
Relations with others	Discussing boundaries	16	16	6	11	11	6	14
	Total	114	124	91	89	95	90	134

REFERENCES

- Allison, M.T. (1999). Organizational barriers to diversity in the workplace, *Journal of Leisure Research*, Vol. 31, 78-101.
- Anthonissen. A & van Eekeren, F. (2000). *Interculturalisatie: Nieuwe kansen in de sport*, [Interculturalism: New possibilities in sport] Utrecht, the Netherlands: City of Utrecht.
- Anthonissen, A & Dortants, M. (2005). *Respect voor 'anders' zijn of 'anders' doen* [Respect for being different or doing different], Utrecht: SWP.
- Bond, M.A. & Pyle, J.L. (1998). Diversity dilemma at work, *Journal of Management Inquiry*, Vol. 7, 252-269.
- Breedveld, K. (Ed.) (2003). *Rapportage sport 2003* [Report on sport 2003], Den Haag, The Netherlands: SCP.
- Coleman, J. (1990). *Foundation of Social Theory*, Cambridge: Harvard University Press.

*Ethnic Diversity in Organised Sport:  
Development of Social Capital by Dutch Immigrants*

- Cox, T.jr & Finley, J.A. (1995). An analysis of work specialization and organization level as dimensions of workforce diversity. In M.M.Chemers, M.A. Constanzo & S. Oskamp (Eds.) *Diversity in Organizations: New perspectives for a changing workplace*, 62-90, London/New Delhi: Sage.
- Doherty, A.J. & Chellundurai, P. (1999). Managing cultural diversity in sport organizations: A theoretical perspective, *Journal of Sport Management*, Vol. 13, 280-297.
- Elling, A. (2002). *Ze zijn er niet voor gebouwd. In en uitsluiting in de sport naar sekse en etniciteit* [They aren't build for it. Inclusion and exclusion in sport by gender and ethnicity], Nieuwegein: Arko.
- Fink, J.S. & Pastore, D.L. (1999). Diversity in sport? Utilizing the business literature to devise a comprehensive framework of diversity initiatives, *Quest*, Vol. 51, 310-327.
- Fink, J.S., Pastore, D.L. & Riemer, H. (2001). Do differences make a difference? Managing diversity in division IA intercollegiate athletics, *Journal of Sport Management*, Vol. 15, 10-50.
- Glastra, F., Meerman, M., Schedler, P. & Vries, S. de (2000). Broadening the scope of diversity management: strategic implications in the case of the Netherlands, *Relations Industrielles*, Vol. 4, 698-721.
- Grimes, D.S. (2002). Challenging the status quo: Whiteness in the diversity management literature, *Management Communication Quaterly*, Vol. 15, 381-409.
- Hall, M.A. (2004). Managing diversity in sport organizations: A critique. Paper presented at the 'Sports: A Universal Dialogue' (World Forum on Education, Culture and Sports). Barcelona, Spain, 10-12 June 2004.
- Janssens, J. & Verweel, P. (2005). Kleurrijke zuilen [Colorfull pillars], *Vrijtijdsstudies* [Leisurestudies], Vol. 4, 7-22.
- Kamp, A. & Hagedoorn-Rasmussen, P. (2004). Diversity management in a Danish context: Towards a multicultural or segregated working life, *Economic and Industrial Democracy*, Vol. 4, 525-554.
- Kirkby, E.L. & Harter, L.M. (2003). Speaking the language of the bottom-line: The metaphor of 'managing diversity', *The Journal of Business Communication*, Vol. 1, 28-49.
- Knoppers, A. & Anthonissen, A. (2001). Meanings given to performance in Dutch sport organizatons: Gender and race/ethnic subtexts, *Sociology of Sport Journal*, Vol. 18, 302-316.
- Knoppers, A. & Elling, A. (2001). Sport and the media: Race, gender in the representation of athletes and events. In J. Steenbergen, P. De Knop & A. Elling (Eds.), *Values and norms in sport: Critical reflections on the position and meanings of sport in society*, 281-300, Koln/Aachen: Meyer & Meyer.
- Lewis, O. (1955). *Five families*, New York: Wintage Press.
- Lin, N. (2001). *Social capital: A theory of social structure and action*, Cambridge: Cambridge University press.
- Point, S. & Singh, V. (2003). Defining and dimensionalising diversity: Evidence from corporate websites across Europe, *European Management Journal*, Vol. 21, 750-761.
- Putnam (2000). *Bowling alone. The collapse and revieal of American community*, New York: Simon & Schuster.

- Verweel, P. & Anthonissen, A. (2000). Color blinds: Constructing ethnic identity in sport organisations. In. A. Knoppers (Ed.) *The construction of meaning in sport organisations: Management of diversity*, 91-102, Maastricht, the Netherlands: Shaker.
- Wentling, R.M. & Palma-Rivas, N. (2001). Current status of diversity initiatives in selected multinational corporations, *Human Resource Development Quarterly*, Vol. 11, 35-60.

## INTEGRATION OF MARKETING AND R&D IN HIGH-TECH ENTERPRISES: CONCEPT – SIGNIFICANCE – BARRIERS

THOMAS FOTIADIS\*

### ABSTRACT

*Herein is analysed the framework of arguments supporting the great importance of an upright cooperation between the two – by definition - vital departments of Marketing and Research and Development, in High Technology Companies. The context of obstacles towards the achievement of integration and the achievement of an intradepartmental co-operation of a satisfactory degree are approached through an extensive literature review prospect. A multidimensional aspect of the common obstacles and issues arising in the turbulent environment of High Technology is attempted, and a thorough registration of factors which are widely accepted and recognized as the ones that trigger the development of obstacles, is provided.*

*Keywords: Integration; Marketing; Research and Development; High Technology; High-Tech Marketing.*

### 1. INTRODUCTION

Probably the most important role of the marketing department is to function as a link, a cohesive bond and communication channel between the enterprise and its customers. In other words, it represents the customer's voice within the enterprise. Particularly in high tech enterprises, it is imperative that this voice is not only listened to but also to make sure that it is in direct alignment and collaboration with the knowledge brought in by the Research and Development department. High tech enterprises must excel in two areas: First, in their ability to continuously discover new innovations, and second in their ability to efficiently convert those innovations into products that can add to the satisfaction of customers' needs and preferences (add to consumer's utility function). Given that the role of marketing is to listen to the customers' voice and needs, as well as making their satisfaction feasible, a strong marketing department implies both a better ability to listen and a wider reservoir of ideas regarding the satisfaction of customers. Hence, it also implies a broader range of applications and combinations of innovations in order to find useful applications. Song and Parry (1997) consider that if high tech enterprises care for being successful, they

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\* Adjunct Lecturer, Department of Marketing and Operations Management, University of Macedonia, Edessa, Greece

have to effectively bring together the R&D and Marketing departments. Numerous research works in this area demonstrate the critical role of an effective connection between the two departments (Griffin and Hauser, 1996; Gupta, Raj, Willemon, 1986; Dutta, Narasimhan, Rajiv, 1999).

## 2. INTEGRATING MARKETING AND R&D

In its simplest form, the concept of Organisation is described as the total of individuals encompassing a wide range of knowledge, principles, attitudes and beliefs, who must work either individually and collectively in order to fulfil the task that they are assigned to. It presupposes the formation of a management hierarchy that possesses both the power and the responsibility to achieve the enterprise's objectives and aims. To effectively accomplish this in a high tech environment, the management plans the optimal size of its functional units, and also the co-ordination requirements among the departments that are both specialised and also – simultaneously - interdependent. Statements such as: "The Marketing department rarely reports to us what kinds of products are needed, and even when it does, it should have been ready by yesterday" or "Customers plead for the improvement of the X product but nobody is interested in triggering the commence procedures", are heard so often that can be considered clichéd. When things go well, it is easier to ignore the symptoms of alienation between the departments, because everybody is busy with the present time, and disregard dealing with the future that seems to be so far away. But when the time horizon gets shorter and the additive results of the turbulences become noticeable, then the system's weaknesses block or considerably limit the process of innovation especially in a time when it is mostly needed.

From all the common areas that derive from the functional interface of departments during the process of innovation, the most sensitive is the one that is called on to fit the product to the market. The "interface", or in other words the integration of Marketing and the Research and Development department, is considered of significant importance, since the successful implementation of common activities is reckoned to be a particularly critical factor for the assurance of mid-short-term product offers.

Souder and Chahrabarti (1978) define integration as the symbiotic interrelation of two or more entities, which leads to the production of common net benefits which exceed the sum of net benefits that entities would have otherwise individually produced. On the other hand, Lawrence and Lorsch (1967) define integration as the process of obtaining unification of exertions between various subdivisions for the achievement of the (common) organizational objective. Evidently, the common



element in both definitions is the emphasis put on the result of integration that is the added-on benefit.

“The approach of the association between the Research & Development and Marketing departments differs considerably among various enterprises in different industries. Perhaps the ideal situation would be an unhindered and continuous association, which would not be subject to directed communication constraints, and would occur through firmly developed communication channels” (Millman, 1982). After describing the ideal degree of communication and the factors that constitute it, Millman (1982) concludes that in reality very few products and markets allow for the development of such a kind of stability – in terms of relations. The reality lies in a continuing situation of changes regarding products and markets, similarly to what is also happening in the organisations, and also to the people functioning in them. In his attempt to contribute to the knowledge of barriers created because of problematic communication between the Marketing and the Research and Development departments during the development of innovative products, Millman (1982) admits that it is a common responsibility of the Marketing and the Research and Development departments to become agents of safeguarding their good relations, and to make efforts that would ensure that any conflict is solved before it is converted into a permanent characteristic of the way the enterprises operate.

It is commonly known that an enterprise is distinguished by two dimensions of its functions. Because of them, the enterprise can be described as a close system, but at the same time as an open one as well. Regarding the latter, an enterprise is considered an open system because it unavoidably comes in contact with its external environment(s), and is influenced by it. Despite the fact that the external environment is made up of factors that go beyond the control of the organization, their composition is a variable that should continuously be under the control of the appropriate people in the organisation, be interpreted by the enterprise, and provide the enterprise with information. Most organisations claim that they are aware of the environmental influences they receive, but very few actually are sufficiently prepared and able to effectively respond to challenges. The big majority rather reacts to the emerging needs of customers instead of trying to anticipate them beforehand. And of course, if the definition (which sets as a vital objective the effective fulfillment of the enterprise’s functions through people), given by the knowledge field of Business Administration is true, then it is also true that the organizations that are willing to change and can provide motives good enough to achieve an alignment to this direction to the total of those composing the enterprise, will then have competitive advantage. This remark by Millman (1982), (who focuses mainly on the British enterprises), is valid worldwide to some extent. He observes that the lack of orientation of Marketing and the inefficiency

of communication are the main barriers responsible for the non-completion of an innovative product, or for its non-commercial exploitation, instead of the lack of innovative ideas or the lack of technical competences. The excessive emphasis put on the Research and Development department, without the simultaneous adoption of the Marketing philosophy, is the main reason responsible for the wrong timing of the introduction of new products in the market. Moreover, a second reason is the extensive attention given to the technical characteristics of the total product offer, instead of the complete offer of those characteristics as part of a complete product idea-solution that will respond to the certain market needs.

Apart from this, the multi-level nature of the innovative process has been widely misunderstood, since it leads to creating segregations that consequently turn to barriers during the progress of the birth of an idea, and its conversion into a product, and its introduction into the market, accordingly. Executives, in order to accelerate the product's market introduction process, often find themselves tempted to suppress one or more stages of the development process (similar to what happens in the development of software projects according to Fotiadis and Haramis, 2002). This reflects a short-run horizon of thought, which occasionally – if not always – undermines the commitment generally.

ACARD (1978) stressed that the organizational problems, the enormous emphasis laid on specialization, and the lack of communication, are the main factors against innovation. Also, the isolation and the seclusion of marketing concepts, caused by the remoteness/distance between the Research and Development department and the Marketing department, due to the anticipation that the new products will create themselves (or become themselves) new markets, do act against innovative activities.

One of the most basic arguments of criticism on the organizational practices, concepts and methods followed is highlighted by the National Science Foundation of U.S.A (1973). Mansfield (1969), in his econometric analysis on technological innovation, observes that among other various characteristics, the personality, the interests and the education of the top and the topmost management have an important role in determining the speed in which an organization introduces the innovation into a market.

In any case, it appears that a unique optimal and ideal plan or an easy way to achieve integration does not really exist. Certain companies aspire radical transformation through a small-form and low scale of reorganisation, or through a loosening of the restrictions created by the existence of interdepartmental boundaries. Informal communication –in the abovementioned meaning – should be stimulated and

coordination competences should be considered as an integral part of the functional competences.

### 3. BARRIERS TO INTEGRATION

Often found in the bibliography of innovation management, are the so-called “twin” barriers of culture and professionalism. Differences stimulated by the forms of the departments emerge from different associations and correlations. The preservation of social distance through the additional segregation of functional departments or their disagreements, or even the different bibliography that their staff study, lead to the shaping of different cultures. There are many cases in which even the basic knowledge of Marketing is so greatly unknown, that the lack of confidence and the fear of loss of power can act negatively in every effort to influence the R&D department. Clarke (1974) comments that marketing is another way of thinking – a different principle, less precise in detail regarding anticipations, and more qualitative than the way of thinking of the Research and Development department. It can incorporate such exotic concepts, as the social behaviour and the attitudes, as well as make use of different terminology and continuously complicate the whole picture of technical (technological) thinking.

Many observers have proposed that the people who staff the Research and Development department, are to a great extent occupied with how to augment their knowledge and opportunities for creative work. In many cases, this is compensatory to any material and social benefits that the management may wish to offer as a pay. The studies of Raudsepp (1965), point out that when income as a stabilizing factor is considered of reduced importance or is totally absent, the mixture of wage with other operating - procedural factors of work enjoy continuously increasing prominence. Excessive adherence to work has undoubtedly led to a degree of introversion and intensification of faith and confidence of the researcher to his direct labour team and his profession, instead of the enterprise that has hired him. Twiss (1974), further strengthens this opinion by saying that the technologist considers himself mainly as a professional and not as a businessman. His education and his natural tendencies allow him to socialize with similar professionals from other companies, while at the same time those very factors limit him from socializing with other executives from the same company (Twiss, 1974).

**FIGURE 1: RESEARCHERS-FINDINGS AND THEIR CONCLUSIONS**

<b>Researcher</b>	<b>Finding</b>	<b>Result</b>
ACARD	MKTs Lack of Orientation and excessive emphasis on R&D Communication Inefficiency Formulation of boundaries Excessive emphasis on the technical characteristics of the product	→Wrong timing of product entrance to the market  →it does not respond to consumer needs
ACARD	Lack of Communication Specialization Seclusion – Isolation of Marketing	Deviation from the market
Shibutani	Twin Barriers of Culture and Professionalism	Abolition of Marketing efforts to influence R&D
Raudsepp	Introversion of R&D	Not cooperating with Marketing
Twiss	The technologists (of the R&D department) consider themselves as “professionals” and not businessmen	Restraint of contact-communication with the other executives of the enterprise

Therefore, one of the prominent obstacles between the two departments is that, on the one hand, and in order to effectively cope with the needs of the modern multidimensional and exceptionally complicated and multivariable operational environment, (and indeed with the further difficulties that distinguish the high technology environments) departments should be free to maintain their individual identity. Simultaneously, and on the other hand, they should be encouraged to work suppressing the conceivable limits of the specialisation or the differences in culture, so that they can move on effectively to the achievement of the common objective. Thus basically, it is all about pursuing to find the golden rule between integration and segregation (or specialization).

While the orientation of the enterprises moves closer to the acceptance of the Marketing philosophy, the common prospects of the Marketing and Research and Development departments should be broadened, and to some extent there should be an overlap of their activities. Millman (1982) proposes that the two parties should be mutually approached through the creation of common teams with common objectives.

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During the whole flow of the process of innovation, there are many parameters that can undermine and threaten the commitment of both parties, as well as the commercial entry of the product itself. This should be expected to some extent, since enterprises that have invested significantly in the Research and Development department (that is, this department represents – if not constitutes their core capabilities), now attempt to place themselves closer to the market having partially secluded the fully steady technological orientation. Although it is not necessary for this transition to take place smoothly, however the opposite case indicates that more attention should be given to the flow of information and the management of common areas of activity.

Management decisions are taken in a framework of incomplete knowledge of technology and of the markets' conditions and multivariate – interrelated functions, and of human behavior as well. Certain executives regard that even the very barriers to innovation are not completely understood.

In contemporary markets, most enterprises should establish collaboration between the Research and Development and Marketing departments. In the fundamental forms of economic organisation, knowledge was held centrally by the business unit. One individual - in most of the cases - combined the knowledge of what was needed to be done, with how he could develop it. The feedback he received from the market was direct, fast, and persuasive. This is possible to happen even today, in times and conditions where the size of the business units is small enough to make it feasible.

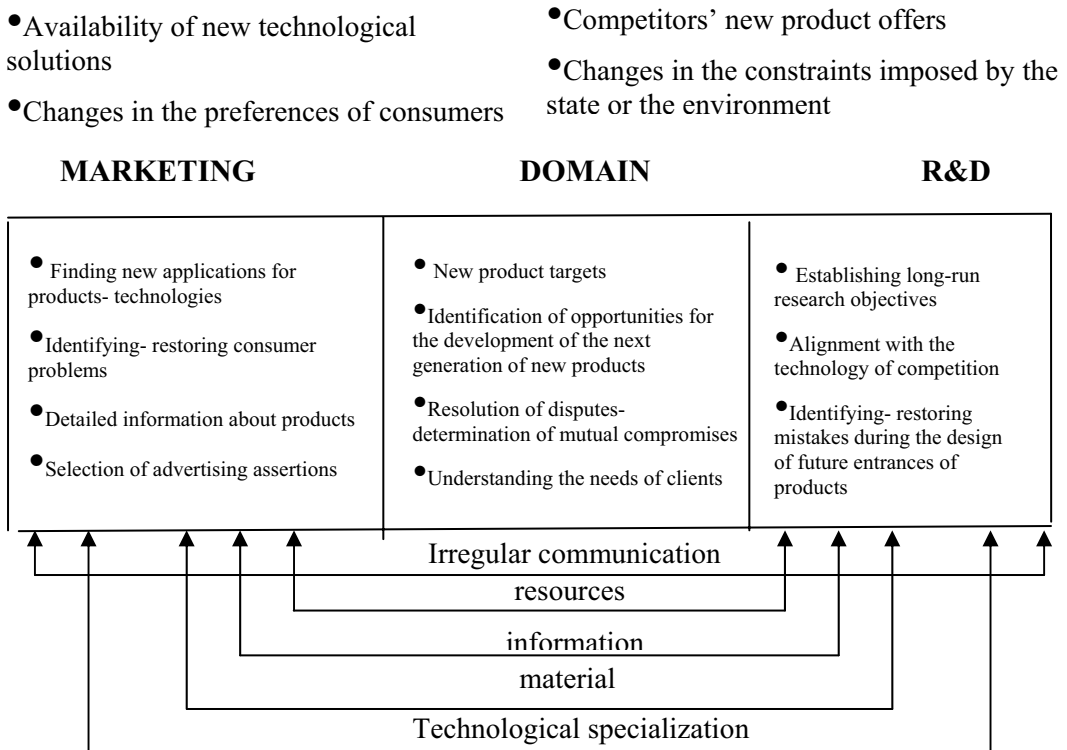
Inevitably, the growth of enterprises often commands the segregation of roles and the creation of Marketing and Research and Development departments with specialised functions. This fact inevitably (or in many cases even forcibly) creates distance between the two departments. This distance increases as the specialisation between the departments grows. The befalling decrease to communication - and also to the contact point between the departments, causes a decrease (proportional at least) of the effectiveness of their capabilities to combine their specialised competences, and consequently a decrease to the degree of the enterprise's capability to produce successful products.

Both marketing and Research and Development are inflow suppliers for many of the enterprise's activities, some of which are particularly critical for the survival - success of the enterprise. Figure 2 is an attempt to depict the responsibilities – activities of the departments, and it includes the most obviously determined common responsibilities – objectives, as well as the more departmentally controlled points of reference of their autonomous activities. Regarding the latter, the sovereignty is held

by each department, with the other department functioning complementary, having an advisory role – in theory –, which can however fragmentarily activate, (in irregular time intervals). This happens mostly in cases at which the organisation goes through a period of crisis.

It is easy to comprehend that, particularly in a high technology environment, the creation of new products can be considered neither a static activity nor an independent variable of actions – competences – knowledge – activities of the one or the other department. The contribution responsibilities of the two departments (and of course the benefit of the combined competence), evolves while new technologies become feasible, preferences of consumers change, and while competition develops new products, or even while restrictions imposed by the environment or by the government change. There exists a continuing flow of resources, materials, information, and technical specialisation between the borders of the two functional areas, so that the development of products is rendered feasible (Child, 1972; Hage, 1980).

**FIGURE 2: THE DYNAMICITY OF THE PROCESSING HIGH TECH ENVIRONMENTS**



The need for the effective management of those flows between Marketing and Research and Development, was recognized for its importance in the '70s, when research in this area began (Child, 1972; Griffin and Hauser, 1996; Khandwalla, 1972). The management of the “point of contact” was considered critical in the '80s, and it remained important for the success of the enterprise ever since (Khandwalla, 1972). Enterprises emphatically experienced intense pressures from competition, which led them to reduce the time of development for new products and to achieve higher rates of success in the entrance of new products and – further - to achieve all of the above with fewer expenses. Many organizations adopted structures with fewer layers of hierarchy, collaborating teams, and correlated managerial procedures.

Figure 3 briefly describes some of the scientific findings regarding cooperation between the Marketing and Research & Development departments. In each case, the research either supports or agrees with the assumption that interdepartmental communication encourages success. The proofs among a handful of methodologies are strong and common, and are applicable to any kind of market (industries – constructions – services – products). For example, a research of 289 projects over a decade proved that interdepartmental harmony (communication & cooperation) is closely related to the success of the project (Burns and Stalker, 1961).

There are a lot of barriers to achieving collaboration – communication between the Marketing and the Research and Development departments (Booz and Hamilton, 1968). As a result, empirical research indicates that disharmony between the departments of Marketing and the Research and Development is the rule rather than the exception (Moenaert and Souder, 1990).

**FIGURE 3: EXAMPLES OF PROOFS DEMONSTRATING  
THAT COMMUNICATION BETWEEN MARKETING AND  
R&D IMPROVES THE PROBABILITIES OF SUCCESS OF  
NEW PRODUCTS**

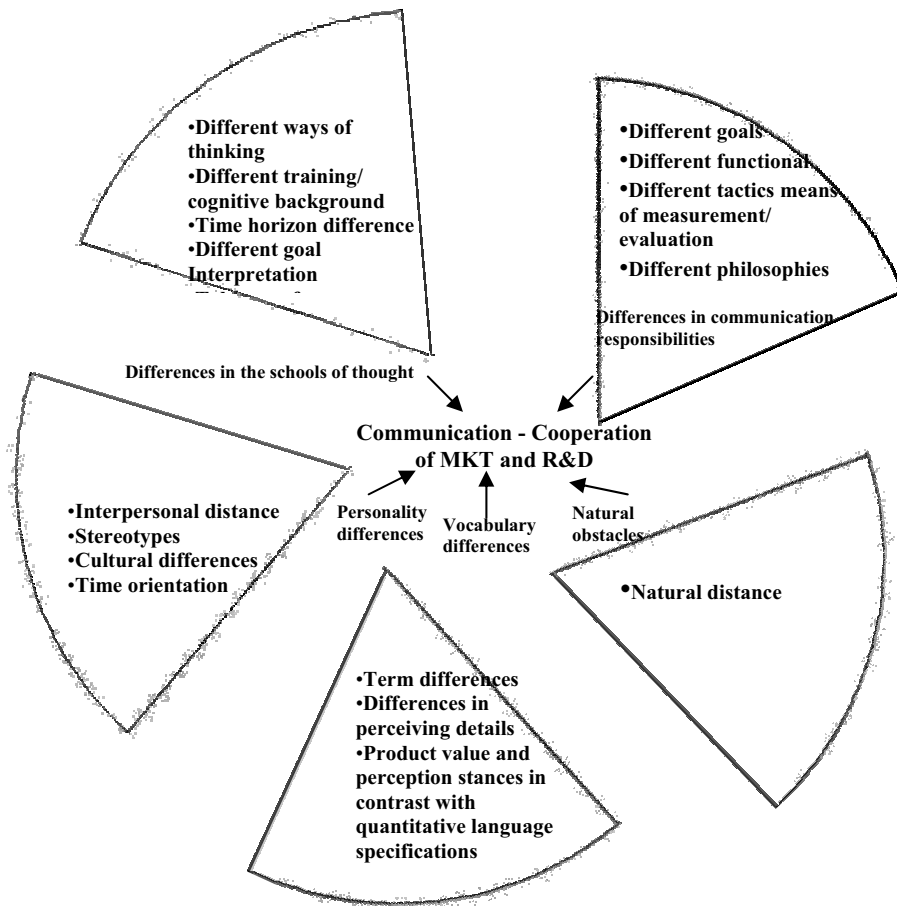
RESEARCHES	SAMPLE	TYPE OF ENTERPRISE	PROOFS (INDICATIVE PRESENTATION)
Cooper	58 PROJECTS	INDUSTRIAL	Projects that balance inputs from marketing and R&D have higher rates of success
Cooper	122 ENTERPRIS ES	ELECTRONICS, HEAVY EQUIPMENT, CHEMICAL	Managerial Strategies that keep the marketing and R&D in balance have a higher rate of success in new products, and the highest proportion of their sales comes from new products
Cooper and de Brentani	106 PROJECTS	FINANCIAL SERVICES	Synergy (e.g.) fit with the firm's expertise, management skills, and market research resources) was the number one correlation of success.

Cooper and Kleinschmidt	125 ENTERPRIS ES 203 PROJECTS	CONSTRUCTIONS	Synergies of Technology and Market are greatly correlated to success
De Brentani	115 ENTREPRIS ES 18 PROJECTS	FINANCIAL & MGT SERVICES, TRANSPORTATION, COMMUNICATION S	Positive correlation of sales and interdepartmental communication
Dougherty	115 PROJECTS	INDUSTRIAL, CONSUMERS, SERVICES	Further communication and communication on all relative issues, is the distinctive difference between successful and failed products
Gupta, Raj and Wilemon	167 ENTERPRIS ES 107 R&D Managers 109 Marketing Managers	HIGH TECHNOLOGY	Lack of communication was the Number 1 barrier to achieving integration between marketing and R&D
Hise, O'Neal, Parasuraman, and McNeal	252 Assistant Marketing Managers	LARGE CONSTRUCTIONS	High levels of common efforts in the design of new products, is an important factor for success
Moenaert and Souder	JOURNALS	PRODUCT & SERVICES	Functional integration is positively correlated to the success of an innovation
Moenaert, Souder, De Meyer, and Deschoolmeester	40 BELGIAN ENTERPRIS ES	INNOVATIVE TECHNOLOGY	Significant correlation between the commercial success and (1) the interdepartmental atmosphere, and (2) the information received by the R&D.
Pelz and Andrews	1311 ENGINEERS	ENGINEERING	Positive correlation between the return and the degree of integration
Pinto and Pinto	72 HOSPITAL TEAMS 262 TEAM MEMBERS	HEALTH SERVICES	Strong correlation between the interdepartmental cooperation and the project's success
Souder	56 ENTERPRIS ES 289 PROJECTS	INDUSTRIAL, CONSUMERS	The more harmonic the relationships of marketing and R&D, the higher the probabilities of success

*Source:* Abbie Griffin, John Hauser, "Integrating R+D and Marketing: A Review and Analysis of the Literature", *Journal of Product Innovation Management*, 1996, p. 194.



**FIGURE 4: BARRIERS TO COMMUNICATION-COOPERATION OF THE MARKETING AND R&D DEPARTMENTS**



### *3.1. Barriers due to differences in personality*

There are inherent differences of personalities between the Marketing and the Research and Development departments' staff. Evidence shows that these differences owe their existence to the natural interpersonal distance between the people who are head of those two departments (Carroad P. and Carroad C., 1982; Lucas and Bush, 1988). Recent research puts more light in those findings. Executive managers of the Marketing and the Research and Development departments were found to have many

similar habits, although there were some differences at the level and the perception of time orientation.

Moreover, these differences were still observed whether the Marketing and the Research and Development departments were integrated or not inside the enterprise. Nevertheless, cultural differences were one of the mostly observed barriers to the achievement of a satisfactory level of collaboration. This implies that the real nature of the barrier may be in fact a perceived one – a misconception caused by stereotypes, and that actually it may not exist exactly due to personality differences. Barriers of this kind can raise further barriers between the teams, even if there are no actual facts supporting those stereotypes. If the one or the other team believes in stereotypes, this belief is enough to create a barrier of mutually escalating and evolving misunderstanding.

Due to the fact that the barriers caused by differences in personalities or by stereotypes can develop into the strongest of all barriers to communication when one attempts to diminish or eliminate them (Block, 1977), their existence prompts the researchers to seek mechanisms for improving the understanding and for building the communication and the confidence between the two departments.

### *3.2. Barriers due to different schools of thought*

The executives of the Marketing and the Research and Development departments, often differ in their educational and knowledge/cognitive backgrounds. Marketing executives mainly come from business schools, while executives from the Research and Development department have typically studied engineering. The educational background of the former focuses on the solution of general problems, combining facts and intuition in order to reach to successful solutions for their enterprises. The educational background of the engineers focuses on the scientific method of giving birth to assumptions and their controls, and on providing solutions to technical and deterministic problems. These “Weltanschauungs” are further strengthened in the frameworks of the functional departments of enterprises (Dougherty, 1990, 1992; Douglas, 1987). These differences were first reckoned and published in 1967 and have been validated since then (Gupta, Raj, Willemon, 1986; Zeithalm CP and Zeithalm VA, 1984; Fotiadis and Haramis, 2002). The Weltanschauung of the marketing executives is conceptually close to the short-term horizon of small projects. Technologists focus on the scientific development and are faithful to their scientific character, while they have little tolerance for uncertainty and bureaucracy. Of course, these observations are not met in every department of Marketing and Research and Development, but they are an apparent fact in the vast majority of the cases. These differences in thought imply that the Marketing and the Research and Development

departments run the danger of limiting themselves and of tending to be self-determined and develop self-existent societies in which they will exist. Even if both departments work for the same enterprise and both share the same organisational objectives, the way each department interprets the objectives is quite different.

Also, a different way of thinking implies potential difficulties in both departments' understanding of the way they view the objectives, the solutions and the mutual concessions of the one towards the other (trade offs). So as collaboration to be feasible, there should be a mutual understanding of each other's way of thinking.

### *3.3. Barriers due to different terminology*

As the two distinct schools of thought develop, wording barriers between them also develop. The Marketing department has and uses its own terminology, and similarly the Research and Development department uses its own different terminology as well. Marketing professionals speak in terms and perceived beliefs of product value. Equivalently, those of the department of Research and Development speak the quantitative language of specifications and return. When there is no effective communication, the consumers' needs and the technological solutions that will satisfy them disintegrate, even though each team believes that it speaks for precisely the same thing. Even small divergences in the vocabulary, often indicate totally different solutions, and - thus - can make the difference between a successful and an unsuccessful product (Griffin and Hauser, 1993).

The two teams also differ even in the level of detail. If each team does not understand the customer needs in that level of detail necessary for it to work efficiently, then disappointment is created from the process of communication.

### *3.4. Barriers due to communication responsibilities*

Organisational barriers can be formed due to different priorities given to objectives and responsibilities (Cooper, 1990; Dougherty, 1992; Achrol, Review and Stern, 1983), different functional means of measurement that do not help integration (market share vs. patent number) (Khandwalla, 1972), and different perceived "legitimacy" of product development (Dougherty and Trudy, 1994). And while the top management clearly has the control over those factors, the organisational process of change to overcome those barriers can also lead to their creation. Medium-level executives, who have reached to their current job positions based on the previous employed criteria, shall now learn how to live with different rules, so as to continue mounting within the enterprise. Due to the fact that they have been "fulfilled" and

have evolved successfully abiding by the old system's rules, culture, and procedures, a lot of them hesitate to change towards the new organisational tactics and philosophies. This confusion can cause resistance to anybody "alien" to the department, and can thus reduce cooperation between the Marketing and the Research and Development departments.

### *3.5. Natural barriers*

The probability of two people communicating at least once a week decreases dramatically if the natural distance between their offices is more than 10 meters away - ↓p equals 10% - (Allen, 1986). In the case where the Marketing and the Research and Development departments are located in different cities, there is obviously lesser interpersonal communication, even if modern technology is employed. Distance decreases the meeting by chance, the transmission of information or the settlement of problems, even if the above take place around the coffee machine.

Great distances make the face-to-face communication between the two teams difficult, and lead to delays in decision-making. The isolation intensifies the different ways of thinking, encourages the development of separate terminology, facilitates running into problems, and finally enhances the perception of the differences in personality.

Griffin and Hauser (1996), combining the findings that stem from the aforementioned barriers, and having made the assumption that communication between the Marketing and Research and Development departments is a key factor for both the development of new products and the growth of sales, suppose that such kind of barriers should either disappear or should be diminished in order to accomplish a long-lasting lucrative performance for the enterprise.

The conclusions of researches (Carroad P. and Carroad C., 1982) stress out that the level of the required integration between the Marketing and the Research and Development depends on the environment in which a company operates and the product development that occurs.

## **4. CONCLUSIONS**

In the preceding paper, an extensive literature review concerning the obstacles towards the achievement of integration between the two most critical functional departments within the High Tech Industry, has been presented. Further, several issues concerning the birth factors of these obstacles have been reviewed through the

viewpoint of a wide array of factors. What should be stressed out strenuously is the undebatable fact that because of their nature (that is the functional capabilities and the respective responsibilities), the systemic approach of the Marketing and Research and Development departments constitutes the key factor for the long term viability and prosperity of the High Tech enterprises. Although it appears that there is a great number of inherent forces that constitute barriers, what should become at least detectable is the need to acknowledge their existence and initiate into thorough research that will allow and indicate the proper orientation towards the achievement of both the benefits of intradepartmental specialization, and the benefits provided by a more systemic and integrated approach, through the achievement of unhampered communication.

## REFERENCES

- Advisory Council for Applied Research and Development (ACARD), (1978). *Publication, Industrial Innovation, HMSO*.
- Achrol, R. S., Review, T., Stern, L. W. (1983). The environment of Marketing channel dyads: A framework for comparative analysis, *Journal of Marketing*, Vol. 57(4): 55-67.
- Allen, T. J. (1986). *Managing the Flow of Technology*, Cambridge, MA: MIT Press.
- Block, J. (1977). *Recognizing the Coherence of Personality*, in: *International Psychology: Current Issues and Future Prospects*. D. Magnusson and N. S. Endler (eds.) New York: Wiley.
- Booz, A. (1968). *Management of New Products*, Chicago: Booz, Allen and Hamilton, Inc.
- Burns, T. Stalker, GM. (1961). *The Management of Innovation*, London: Tavistock.
- Carroad, P. A. and Carroad, C. A. (1982). Strategic Interfacing of R&D and Marketing. *Research Management*, Vol. 25(1): 28-33.
- Child, J. (1972). Organizational Structure, Environment, and Performance: The Role of Strategic Choice. *Sociology*, Vol. 6, 28-33.
- Clarke, F. (1974). *Three Golden Rules of Contracting*, New Scientist, Supplement: Contract Research Review.
- Cooper, R. G. (1990). Stage – Gate systems: A new tool for managing new products, *Business Horizons*, Vol. 33(3):44-54.
- Dougherty, D. (1990). Understanding new markets for new products. *Strategic Management Journal*, Vol. 11, 59-78.
- Dougherty, D. (1992). Interpretive barriers to successful product innovation in large firms, *Organization Science*, Vol. 3(2), 179-202.
- Dougherty, D. and Trudy, H. (1994). The illegitimacy of successful product innovation in established firms. *Organization Science*, Vol. 5(2), 200-218.
- Douglas, M. (1987). *How Institutions think*, London: Rutledge and Kegan Paul.
- Dutta, S., Narasimhan, O., Rajiv, S. (1999). Success in High Technology Markets: Is Marketing Capability Critical, *Marketing Science*, Vol. 18(4), 547.
- Duncan, R. D. (1972). Characteristics of organizational environments and perceived environmental uncertainty, *Administrative Science Quarterly*, Vol. 17(3), 313-327.

- Fotiadis, Th. and Haramis, G. (2002). *Information Systems Maintenance. 7th International Conference on Application of High Performance Computers in Engineering*. Bologna, Italy, 23-25.
- Galbraith, (1977), *Organizational Design*, Reading, MA: Addison – Wesley.
- Griffin, A. and Hauser, J. R. (1993). The voice of the customer, *Marketing Science*, Vol. 12(1), 1-27.
- Griffin, A., Hauser, J. Integrating. (1996). R and D and Marketing: A Review and Analysis of the Literature, *Journal of Product Innovation Management*, Vol. 13, 191-215.
- Gupta, A. K., Raj, S. P., Willemon, D. (1986). R&D and marketing managers in high – tech companies: Are they different? *IEEE Transactions on Engineering Management EM* Vol. 33(1), 25-32.
- Gupta, A. K., Raj, S. P. and Wilemon, D.L. (1986). A Model for studying R and D and Marketing Interface in the Product Innovation Process, *Journal of Marketing*, Vol. 50, 5-17.
- Hage, J. (1980). *Theories of Organizations*, New York: Wiley.
- Khandwalla, P. N. (1972). Environment and Its Impact on the Organization, *International Studies of Management Organization*, Vol. 2, 297-313.
- Lawrence, P. R. and Lorsch, J. W. (1967). Differentiation and Integration in complex organizations, *Administrative Science Quarterly*, Vol. 12(1), 1-47.
- Lawrence, P. R. and Lorsch, J. W. (1969). *Organization and Environment: Managing Differentiation and Integration*, Homewood, IL: Irwin.
- Lucas, G. H. Jr. and Bush, A. J. (1988). The Marketing – R&D interface: Do personality factors have an impact? *Journal of Product Innovation Management*, Vol. 5(4), 257 – 268.
- Mansfield, E. (1969). *Industrial Research and Technological Innovation*, Longmans.
- Millman, A.F. (1982). Understanding Barriers to Product innovation at the R&D/ Marketing Interface, *European Journal of Marketing*, Vol. 16(5), 22-34.
- Mintzberg, H. (1979). *The Structuring of Organizations*, Englewood Cliffs, NJ: Prentice – Hall.
- Moenaert, R. K. and Souder, W. E. (1990). An Information Transfer Model for Integrating Marketing and R+D Personnel in New Product Development Projects, *Journal of Product Innovation Management*, Vol. 7, 91-107.
- National Science Foundation (USA). (1973). *Barriers to Innovation in Industry*.
- Raudsepp, E. (1965). *Conformity and the Engineer*, Machine Design.
- Song, X. M. and Parry, M. E. (1997). A Cross – National Comparative Study of New Product Development Processes: Japan and the United States, *Journal of Marketing*, Vol. 61(2), 1-18.
- Souder and Chakrabarti, A. K. (1978). The R&D / Marketing Interface: Results from an Empirical Study of Innovation Projects, *IEEE Transactions on Engineering Management, EM*, Vol. 25(4), 88-93.
- Twiss, B. (1974). *Managing Technological Innovation*, Longmans.
- Zeithalm, C. P. and Zeithalm, V. A. (1984). Environmental Management: Revising the Marketing Perspective, *Journal of Marketing*, Vol. 48, 46-53.

## FACTORS INFLUENCING THE IDENTITY OF REGIONAL FOOD PRODUCTS: A GROUNDED THEORY APPROACH

GHISLAINE POVEY\*

### ABSTRACT

*Academic literature has rarely covered issues relating to the determinants of regional food products, yet their importance culturally and economically is becoming increasingly significant. This paper uses a grounded theory approach, which is appropriate given that this is a theory building activity, to define these determinants. The paper discusses how elements identified effect the formulation of regional food products. The consequences of various other factors on the identity of current and emergent regional food products are discussed, particularly regarding their role as an element of the tourism product.*

*Keywords: Food Products; Tourism; Grounded Theory; Identity.*

### 1. INTRODUCTION

Factors influencing the identity of regional food have been studied little. Food and drink relates to a range of consumer issues allied to regional and cultural identity (Hall and Mitchell, 2000). Regional food and drink can be viewed as central to the heritage of an area. Kuzenhof et al (1997) viewed recipes, food preparation and food service, along with climate and geomorphology as the elements of custom and locale that sculpt culinary heritage. The value of this to local culture and perceived value of identity is evidenced in France, where local foods are a celebrated part of their way of life. Food is the part of regional heritage and culture that can literally be internalised and absorbed (van Westering, 1999). Consumption is also noted as being an important element of contemporary culture (Bell and Valentine, 1997).

### 2. THEORETICAL UNDERPINING

Food and drink products have recently come to possess greater importance to consumers, who increasingly perceive that kudos gained from consumption of regional products is linked to the level of supposed interaction with regional culture. Food and drink consumption is an easy way for consumers to feel that they have

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\* Senior Lecturer, Department of Leisure and Lifestyle Industries, School of Sport, Performing Arts and Leisure, University of Wolverhampton, Walsall Campus, Walsall, UK

interacted with locals and literally ingested the regional culture. The plethora of media in popular culture covering food and drink topics in Western Europe, Australia and America evidences the interest amongst consumers, and reflects the increased interest in food production amongst consumers. This trend has led to the development of regional tourism, and the emergent gastronomic culture, which has become the focus of much consumption in some parts of the world, notably Australia (Macionis and Cambourne, 1998; Macionis, 1998; Cai and Ninemeir, 1993). Tourist packages are being developed based on food and drink products (Macionis and Cambourne, 1998; van Westering, 1999).

Food, and our relationship with it, can be viewed as being very similar to our relationship with architecture, although the changes are occurring a while later. The modernist chefs and gastronomes developed Nouvelle Cuisine and fast food, in much the same way as the modernist architects developed the tower blocks and housing estates of the 1960s. Ready meals have become the equivalent of the modern house, made to a standardised formula, chosen from the selection on offer for ease and convenience. There has been an unprecedented growth in intensity of production and in food processing, an industrial revolution has taken place and food has become an industrial procedure (Morgan and Murdoch, 2000).

The process by which food gets from 'farm to fork' has been under the consumers' microscope, with consumer fears fuelled by numerous food 'scares', including BSE and foot and mouth disease. This has led to sections of society being much more selective yet more eclectic, and taking what is perceived to be the best of many different forms to create a product which they view as being superior. Fusion food, which takes elements from various cuisines world wide to create a tapestry of flavours and textures, is an example of this. There is also a reaction against the tenets of Nouvelle Cuisine, and fast food in the development of the 'slow food' movement by Petrini, following his seminal text 'Slow Food: the case for taste', written in 2001. This has heralded a return by consumers to traditional foods. Consumers desire to devour tradition and heritage, and thus the heritage regional food movement has developed.

### 3. METHODOLOGY

Grounded theory as a methodological approach gives the opportunity to develop theory by constantly validating emergent concepts by reference to the reality of the situation. It is thus the ideal methodology to use when researching within the postmodern paradigm, as purported by Covalski et al (1998). It allows the researcher to accept an ontological viewpoint that there are many truths illustrating and conflicting in reality, whilst simultaneously it allows the epistemological stance of



immersion into the reality of the research situation. This enables the research to evolve dynamically, and results and theories emerge organically from within. It provides a methodology that gives a systematic approach to deriving theory. Grounded theory methodology has the central aim of theory building rather than testing. Given lack of integrated theory in literature regarding factors affecting regional food products, this inductive approach, used to allow theory to emerge from the experiential accounts of those responsible for production and marketing of regional food products, seems apposite and pertinent.

Grounded theory has a set of established guidelines for conducting research and interpreting the data, giving a secure base in a field that is not well established. It constantly links theory to practice and is likely to create theories, which are readily understandable and functional. (Locke, 2001) A grounded approach both encourages and supports ingenuity in research by necessitating the researcher to apply theoretical sensitivity whilst conducting diverse analysis (Goulding, 2002). It is an established and credible methodology, extensively used in health related research, and to a lesser extent in the field of consumer behaviour and marketing, (Goulding, 2002) but little used in the field of regional food. Grounded theory is particularly suitable for this situation because it adapts well to capturing complexities of interaction, and is able to produce a multifaceted account of perceptions in their context (Locke, 2001).

A note must be made regarding the role of literature review in grounded theory research. Originators of the method, Strauss and Corbin (1990) strongly asserted the position that literature review should be avoided at all costs before and during research, to ensure that the researcher was not tainted by conventional views of other academics. Nowadays however other authors including Goulding (2002) suggest that it is perfectly valid to use literature before starting the research process. They cite the proposition that it is important to understand literature available in the field prior to the study, which can in fact help to establish a conceptual framework for the analysis. This is the stance taken during this study. It would be hypocritical to suggest that the prior knowledge and understanding of the field, gained by pertinent reading, was not influential on the methodology, and approach. Another viewpoint is that whilst a literature review is useful background, it should not be used to shape the work:

It is useful to do some reading round your research topic before you go into the actual setting ... the notion that you do an extensive literature review first from which you derive a hypothesis to test, is nonsense (Gillham, 2000:37).

A group of experts, from UK, who are involved in the production or marketing of regional food were approached and were interviewed face to face, to illicit their views regarding the factors that influence and determine the identity of regional foods.

Notes were taken whilst the interviews took place, and as a back up strategy the interviews were recorded on a tape machine, and full transcription took place within 48 hours of the interviews.

As suggested by Locke (2001) the first stage of the analytical process undertaken, was to break down the narratives generated in the interview process to enable relevant and valid reflection to take place. These memos were then coded – sorted into categories, which show initial ideas and help to see common and contradictory viewpoints in the data. Goulding (2002) notes that memos are particularly useful to highlight relationships and lend directional guidance for future research, which was found to be the case in this study.

The categories developed by coding the memos were then interpreted, and the initial results reported back to the interviewees, who were invited to add further comment as to the validity of the analysis. This second layer of feedback, which took the form of an interview, was then analysed using the same technique again, creating memos, and coding them into categories. The results of this process was then analysed again to formulate what has become the outcomes of the research. This second set of outcomes was reported back to the interviewees again, and they were interviewed to ascertain consensus was reached, and validate the final outcomes. The penultimate stage of analysis was to further sub-divide the categories into three overarching genre. The final stage of the research process was to compare the results generated from this study to the existing literature, which exists almost exclusively in the realms of geography and history.

Limitations included the small number of interviewees and a lack of response by some of them to validate the research results. This was possibly due to the timing of this stage of the research, which was conducted over the Christmas and New Year Holiday period in 2004. Another factor may be that they lost enthusiasm in the research, and found that to have to go over results was too time consuming. It is also the case, that in any research, a certain level of attrition could be expected.

The interviewees in this study were all living within a 100-mile radius, to enable repeated visits to be made to their places of work and thus facilitate the steps of the research process. A greater geographic spread would have lead to a wider range of viewpoints and may have influenced the outcomes.

#### 4. FINDINGS AND DISCUSSION

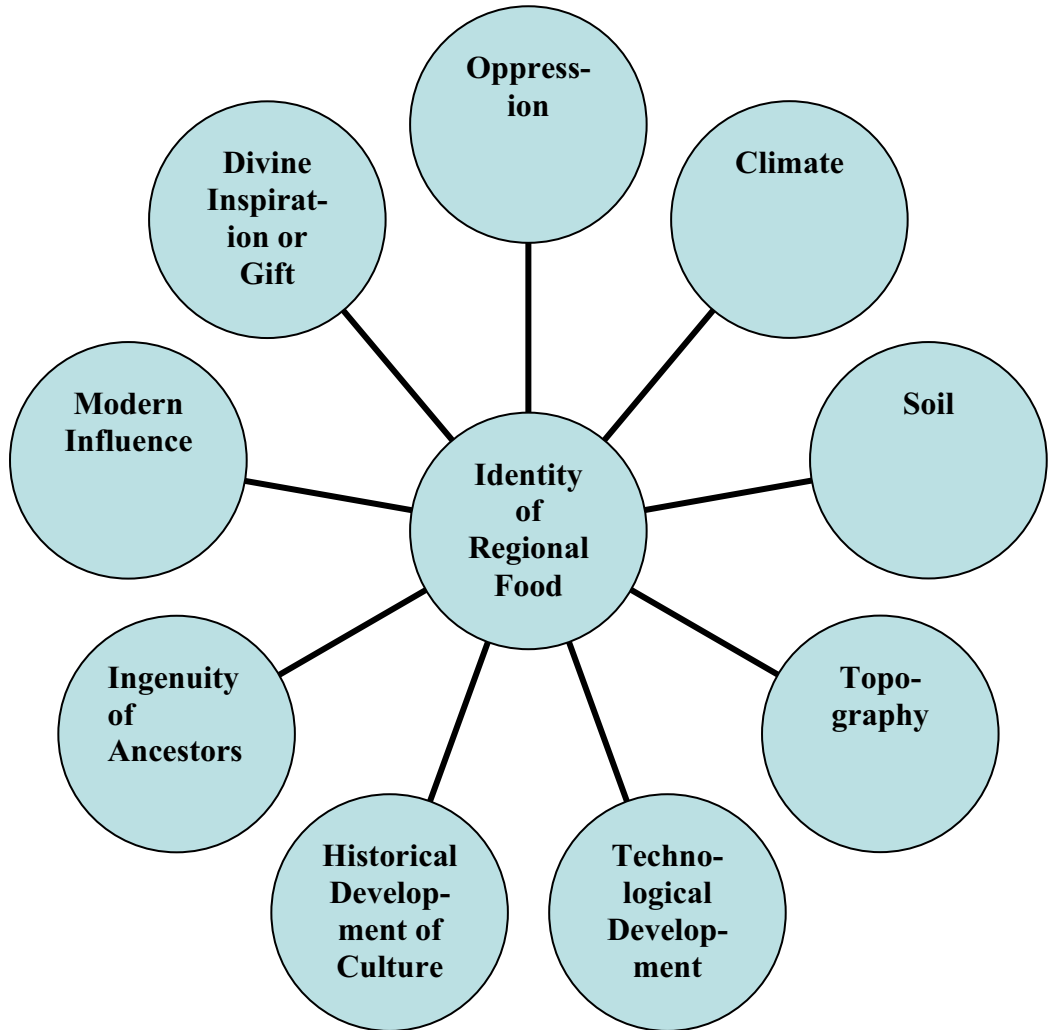
Analysis of the narratives derived from the interviews fell into nine key categories of influence on the identity of regional foods. Whilst many of the categories, which

emerged from this study of professionals involved in production, or marketing of regional food were similar to those of professional academics, there was a clear differentiation of outlook. Non-academics do not see the need to categorise historical factors differently to geographic factors, but viewed the identity of food much more holistically.

First and foremost was the view that regional food reflects what can grow easily in the region, and to some it was important that the food was native to the area, and strongly felt that foods, which were introduced to the area from elsewhere, should not be claimed as regional food. Despite working in regional food production or marketing, some did not see regional food as something that is dynamic or evolving. The view that regional food was, that which had been eaten in the region historically, was strongly held by many. Interestingly these same respondents however fail to recognise that their current regional foods are, in some cases, heavily dependant upon foods imported to the area from the new world in the 17<sup>th</sup> and 18<sup>th</sup> centuries such as the potato.

Almost invariably, the first categories to emerge in a narrative relate to the physical geography of the area – climate, soil and topography. For most the identity of regional food is primarily influenced by the immediate climate, particularly how much rain the area gets. The length of the growing season also emerged as being of key importance. Some small difference could be noted in those interviewees who lived in a mountainous region, as they regarded the topography to be of key importance in governing what the area could produce, and thus the identity of the regional food. The type of soil was also something that many thought was crucial to the identity of the region's products. Some felt they were lucky to have a good soil, whilst others bemoaned the nature of the local soil, and saw it as a limiting factor in what could be grown. Topography, climate and soil are determinants of what food sources it is possible to grow in any region. The only exceptions to this are found where artificial environments are created, to allow farmers to grow those crops, which would not normally be grown in a region, or to facilitate the growth of crops out of season to meet consumer demands. Where the creation of these artificial environments was discussed, views were polarised. For some they were crucially important to the identity of the product, they enabled it to be supplied all year round, with the added benefits of improved job stability and huge economic gain. To others artificially creating environments for local foods was an anathema, and in complete contradiction to the underpinning higher moral philosophy of regional food, intrinsically linked to traditional lifestyles, values, and ecological sustainability. Some consumers share this view, whilst, hypocritically demanding regional foods out of season at the supermarket.

**FIGURE 1: CATEGORIES OF FACTORS INFLUENCING IDENTITY OF REGIONAL FOODS**



Often consumption of a regional food represents consumption of a desired culture or lifestyle. Bessiere (1998) has already noted that in addition to the nutritional element, food has psycho-sensory attributes. Regional foods are seen by some to be iconic, and to give a region its identity, uniting local people in appreciation of this. Food and drink can even be perceived as an icon, which can unite those who live in, or

originate from, the same geographical area as the product. Food can even be used as a social class indicator. Caviar for example is seen to designate affluence, the greater the frequency of its consumption, and the greater the affluence of the consumer.

When eating, the symbolism of the food is an integral part of the meal and is consumed alongside the nutrients that it provides. During this process the consumer becomes that which is consumed, more popularly phrased, as *we are what we eat*. Choice of what, where and how frequently an individual eats defines their identity (Bessiere, 1998). The farmer may still eat a freshly prepared meal, made from locally grown raw ingredients. The office worker in the city may have a burger, which has little or no link to its place of consumption, and which has been shaped by an industrial process. Any consumer may elect to consume particular foods to identify with a particular lifestyle, culture or region.

This in turn continues to mould the nature, production and processing of regional foods, as in our post-modern society the consumer is king – and regional food products along with other commodities, are shaped by customer demand. We now casually use technology to help us to shape products into what we want, for when we want, expecting to eat strawberries and runner beans in December. Consumers likewise expect to be able to purchase a regional rarity all year round, which causes problems for producers. Producers increasingly have to look to modern technologies to satisfy these consumer demands.

The categories of climate, soil and topography are all governed by the physical geography of the region and thus can be seen as part of a 'Physical' genre. A second genre to emerge is that of 'External Influences', which includes the categories of oppression, divine inspiration or gift and modern influence.

A clear category to emerge from the data was that of oppression. Many regional foods appear to have been developed out of necessity, with the physical limitations of the area. Oppression appears to have taken two forms, that of oppression due to extreme or unusual climates, forcing residents to eat extreme diets and utilise unusual food sources. An example of this could be seen in the traditional diet of indigenous Eskimos. The second aspect of the category is that of oppression by those in authority, who seemed to vary from region to region, but were usually landlords. An example cited to illustrate this was that when miners were forced to buy food from mine shops at inflated prices, with money deducted direct from their salaries, they started a regional tradition of keeping pigs and poultry in the back garden to enable them to supplement the family diet. Religion has also been a vehicle of dietary oppression, the impact of Puritanism on English food traditions was significant, and is

easily illustrated when English culinary heritage is compared to that of close neighbours such as France or Belgium.

Regional food being shaped by divine influence also emerged as a category. Some narratives clearly indicated belief that climate, soil, topography, culture, traditions and technology were gifts from a divine source. Some viewed ancestral discovery or invention of traditional regional foods as due to divine intervention. A number of sources cited tales of wandering or starving local people being led by divine messengers to food sources that have become regional foods.

The influence of the modern world was another category of response. Frequently quoted was the influence of the European Community, although feelings as to the benefit of intervention from this source varied greatly. The European Protected Designation of Origin and Protected Geographical Indications were created by the European Community in 1993 to protect regional foodstuffs. (Parrott et al., 2002) Some narratives cite these as a huge step forward and view them as being of great benefit to the sustainability of regional diversity. Other sources see aspects of health and safety law as being a very negative influence on the production of regional specialities, because small producers simply cannot afford the costs of alterations to their premises to meet their standards. Thus the numbers of producers of certain foods is declining. The industrialisation of food production, processing and retailing is also affecting regional foods.

The table below shows how those factors influencing the identity of regional food products can be categorised into genre, that reflect the basis or origin of the stimulus.

**TABLE 1: CATEGORIES AND GENRE EMERGING FROM ANALYSIS**

<b>Genre</b>	<b>Category</b>
<b>Physical Influences</b>	<b>Climate</b> <b>Soil</b> <b>Topography</b>
<b>Internal Influences</b>	<b>Ingenuity of Ancestors</b> <b>Historical Development of Culture</b> <b>Technological Development</b>
<b>External Influences</b>	<b>Oppression</b> <b>Divine Inspiration or Gift</b> <b>Modern Influence</b>

The final genre to emerge from the data was that of 'Internal Influences' which comprises the categories of historical development of culture, ingenuity of ancestors

and technological development. Of this genre the category that was most frequently mentioned in the narratives was that of history. The emergence and moulding of regional culture is generally viewed as a key influence on the identity of regional food. Historical influences on regional food have also shaped local culture. Some narratives likened regional food to a regional personality or sense of humour. Others cited the arrival of immigrant populations as being influential, as their cooking techniques, along with culinary plants and in some cases animals were introduced to regions.

The view that the anthropogeography of the region was important can be found in literature and generally concurs with the findings from the study. Numerous studies cited the migration of populations into the area as key to the development in their local regional food (Bell and Valentine, 1997; Bessiere, 1998; Povey, 2002).

Some strongly hold the view that the role of food in tradition and culture is fundamental to the identity of regional food products. Traditional regional foods are consumed sometimes on a seasonal basis – in England pancakes are traditionally eaten on Shrove Tuesday and plum pudding at Christmas. Food is imbued with symbolism, for example bread is associated with rural lifestyle and simplicity. In Christianity bread represents the body of Christ. In Indonesian cultures rice, and the way that the special tumpeng rice is served, is symbolic of mountains and their impact on people's lives. Tumpeng rice is served with other foods representing other spiritual elements such as chicken for land animals and fish for water animals. Food links groups together, families and friends eat together to celebrate special occasions. Business people eat together to seal deals. Thus it can be perceived as integral to some communications (Bessiere, 1998).

Another important aspect of culture, and part of this historical development category is that of medical geography. Regional foods and beverages have to be prepared in such a way as to be safe to consume, and provide sufficient nutrients to allow the local people to be healthy. Opinions are strongly held that the past 25 years has dissociated people from their regional traditional foods, however there is the strongly held view that the current zeitgeist presages a return to healthy regional products. There is certainly evidence that there is a new appreciation of regional food products as evidenced by the rapid growth of the Slow Food movement and the growth in the appreciation of regional diversity worldwide.

A further category within the internal influences genre is that of the ingenuity of ancestors. This represents the belief that regional food developed in the way it did because of the inventiveness of the region's indigenous population in the given set of circumstances. Often delicious regional foods were invented to make left over food,

or less tasty, lower quality food palatable. New cooking techniques were developed, and different herbs and spices were used to make food palatable.

The final category in this genre, technological development is intrinsically linked to the other two. Technology was developed often by local resourcefulness, however sometimes it was imported. The historical development of culture and its attitude to the advance of technology is very closely linked. In some cultures technology was extensively suppressed, whilst in others it was widely embraced.

Agricultural technology has historically held a key role in the determination of the nature of regional food. How local peoples have dealt with the challenges of their local terrain has led to agricultural traditions, and thus shaped what is produced in a region. To some extent this is, in turn, shaped by terrain – if you are living on a mountain then the climate and altitude mean that different techniques need to be used than those living on the low altitude plains. The countryside itself is shaped by the agricultural techniques the local population adopts; the traditional patchwork of the English countryside has changed considerably since large mechanical combined harvesters have been used rather than the traditional horse and plough. Hedges have been uprooted and fields made larger to accommodate the giant machines.

Farming techniques, equipment and food production styles are constantly evolving, with new varieties of vegetable and cereals being made available annually. This has brought along with it a tendency towards industrialisation of food production. At the extremes of this we have the use of genetically modified foods, produced on vast farms, with the extensive use of machinery to plant, tend, pick and pack the products. These products are then shipped hundreds of miles (in some cases) to factories, where they are processed and refined, and transformed into an industrial food product. This product will then be transported further to a supermarket where it is sold. Bizarrely even foods, which are regional and have been protected by a regional trademark, are not always produced from locally grown ingredients. Cypriot potatoes are being used in regional pies in England, whilst the pie is still being viewed as a regional product. A documented example of this is that much of the ham, which is cured in Parma, for example is actually made with pork from other regions (Riva, 2003).

## 5. CONCLUSIONS AND FUTURE RESEARCH

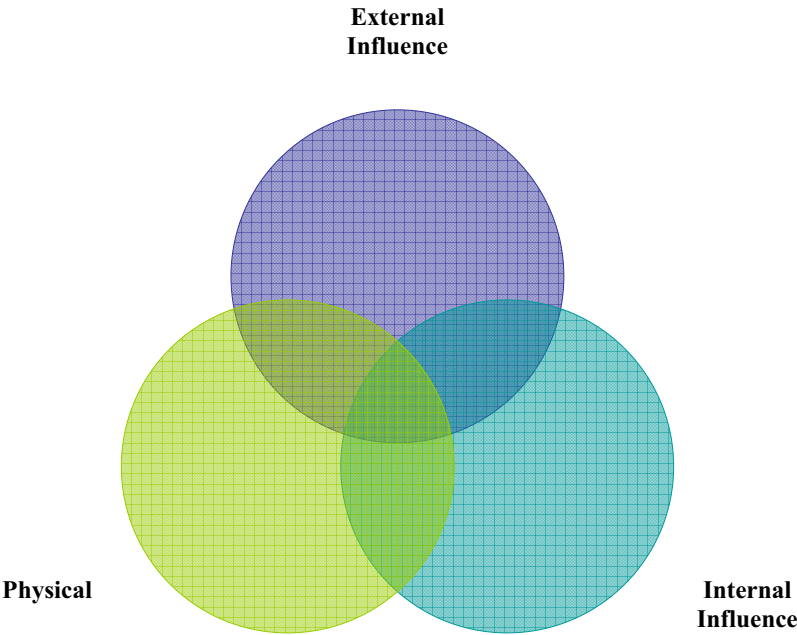
Food and drink are strongly associated with identity, prestige, social place and symbolic meanings (Martini & Wong, 2001). Over the past twenty years or so British views of food, and systems of thought regarding the custom and purchase of food and drink, have changed immensely. There has been an unprecedented revolution in food



consumption. Consumers now expect that regional food and drink products that they want, will be available, at any time of year they want them, where ever in the world they originate, and irrespective of seasonal variations that may be experienced there.

The three genres of factors influencing the identity of regional food are clearly overlapping in nature. They are intrinsically interlinked, and if one is changed then the outcome will be different – two regions may have similar factors in the physical and external factors genres, but will have different, unique regional food products. The dynamic nature of regional tradition suggests that future regional food treasures are still emerging, being moulded by the influences discussed above.

**FIGURE 2: OVERLAPPING GENRE OF INFLUENCES ON IDENTITY OF REGIONAL FOOD**



The categories and genre emerging from the use of grounded theory in this area are similar to those found in conventional literature; however, practitioners view the identity of regional food holistically whereas academics have tended to look at only a narrow area. Grounded theory methodology has successfully highlighted a new way of looking at the factors that influence the identity of regional foods worldwide.

Future research in this area over a wider geographical area, and a greater longitudinal time span would further establish the validity of this study, and show whether there are regional variations.

## REFERENCES

- Andrews, H. (1999). We are what we eat, *In Focus*, 32 (summer), 4-5.
- Bell, D. and Valentine, G., (1997). *Consuming Geographies: we are where we eat*, London: Routledge.
- Bessiere, J. (1998). Local development and heritage: traditional food and cuisine as tourist attractions in rural areas, *Sociologia Ruralis*, 38 (1), 21-34.
- Cai, L. and Ninemeier, J. (1993). Food Service Styles in Chinese Hotels: Tradition and Tourism Pressure Merge, *Florida International University Hospitality Review*, 11(2), 33-40.
- Covaleski, M.A., Dirsmith, M.W., Heian, J.B. and Samuel, S. (1998). The calculated and the avowed: techniques of discipline and struggles over identity in Big Six public accounting firms, *Administrative Science Quarterly*, 43(2), 293-327.
- Gillham, B. (2000). *Case Study Research Methods*, Continuum.
- Goulding, C. (2002). *Grounded Theory: a practical guide for management, business and market researchers*, Sage.
- Hall, C.M. and Mitchell, R. (2000). We are what we eat: food, tourism and globalization, *Tourism Culture and Communication*, 2 (1), 29-37.
- Holloway, I. (1997). *Basic Concepts for Qualitative Research*, Blackwell Science.
- Kuzenhof, S., Tregear, A. and Moxey, A. (1997). Regional food: a consumer perspective, *British Food Journal*, 99(6), 199-206.
- Macionis, N. (1998). Wineries and Tourism: Perfect Partners or Dangerous Liaisons, in *Proceedings of the First Australian Wine Tourism Conference, Margaret River, Western Australia, 5-9<sup>th</sup> May*, Bureau of Tourism Research, Canberra.
- Macionis, N. and Cambourne, B. (1998). Wine and food tourism in the Australian Capital Territory- exploring the links, *International Journal of Wine Marketing*, 10(3), 5-22.
- Martini, F. and Wong T.C. (2001). Restaurants in Little India, Singapore: a study of spatial organization and pragmatic cultural change, *Journal of Social Issues in Southeast Asia*, 16 (1), 147-161.
- Morgan, K. and Murdoch, K. (2000). Knowing Networks? Knowledge, Power and Innovation in the Food Chain, *Geoforum*, 31 (2), 159-173.

- Parrott, N., Wilson, N. and Murdoch, J. (2002). Specializing Quality: Regional Protection and the Alternative Geography of Food, *European Urban and Regional Studies*, 9 (3), 241-261.
- Petrini, C. (2001). *Slow Food: the case for taste*, Columbia University Press.
- Povey, G. (2002). *The Black Country Kitchen: the good faggot guide*, Brewin.
- Riva, M. (2003). Mapping what we eat in PETRINI, C. *Slow Food: collected writings on taste, tradition and the honest pleasures of food*, Grub Street, 120-124.
- Strauss, A. and Corbin, J. (1990). *Basics of Qualitative Research*, Sage.



## THE INFORMATIVENESS OF INSIDER TRADES: A REVIEW OF THE LITERATURE

KYRIACOS KYRIACOU\*

### 1. INTRODUCTION

Economists have frequently investigated the impact of insiders'<sup>1</sup> trades on their own company's stock. Superficially, such research identifies the predictive ability of insiders' trades and therefore, the benefit to outside investors of conditioning their own trades on those of the insiders. More importantly, the principal motivation for research in this area is to determine if insiders' trades are informative. Meulbroek (1992) states that,

“Whether insider trading affects stock prices is central both to the current debate over whether insider trading is harmful and pervasive, and to the broader public policy issue of how best to regulate securities markets” (Meulbroek, 1992, p1661).

Recognising that knowledge of insider trading is of value to both the investment community and regulatory authorities, and is stimulated by the formalisation of strong-form efficiency tests provided by Fama (1970); a large body of scholarly attention has been dedicated to this issue. It is important to note that regulation of insider trades has occurred despite academic literature that suggests, on balance, insider trading may have beneficial effects on financial markets. Despite the various theoretical models that have evolved to consider the economic significance of insider trading in terms of the resulting social costs and benefits, whether such activity is deemed to be against the public interest is still an empirical issue.

With this in mind, this paper provides a survey of both the empirical and theoretical literature on insider trading with particular focus on the information contained in transactions of this type.

### 2. INSIDER TRADING: ARGUMENTS ‘FOR’ AND ‘AGAINST’

Proponents of insider trading use many different, but strongly related, arguments to support their stance. Manne (1966) originally put forward the view that the benefits

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\* Lecturer in Finance, Brunel Business School, Brunel University, Uxbridge, Middlesex, UK

from insider trading can be viewed as a necessary component of employee compensation. The argument, albeit controversial, is that if the information belongs to the firm, then the firm should be able to determine how it is used. Noe (1997) argues that insider trading opportunities are a substitute for effort-inducing compensation packages and may be less expensive. Thus, although preventing managerial trade and paying effort-inducing compensation to managers may increase output, it is argued that this may be more than offset by the benefits to shareholders brought about by the reduction in managerial rents which arise from allowing managers to trade on price sensitive information. Similarly, Dye (1984) showed that if a manager is initially compensated with earnings-contingent contracts, then the welfare of the manager and shareholders can be improved by allowing trade on private information. Moreover, Carlton and Fischel (1983) suggest that one of the advantages of insider trading is that an agent can revise the compensation package without renegotiating the contract. By trading on the new information, the agent self-tailors compensation to account for the agent specific information produced, increasing the incentive to develop valuable innovations. Since insider trading provides the agent with more certainty of reward than other compensation schemes, it also provides more incentives.

Manne (1966) also presented the view that insider trading may be beneficial from a social perspective since it promotes allocative efficiency in capital markets. This view is reinforced by King and Roell (1988) who argue that insider trading promotes informational and consequently allocative efficiency. Allowing insider trading increases the speed at which equity prices reflect their true fundamental value. This view is challenged by Fishman and Hagerty (1992) who argue that insider trading has two adverse effects and actually leads to less efficient stock prices. First, the presence of insiders increases information asymmetries and, therefore, deters uninformed traders (outsiders) from acquiring information and using it to trade. This reduces the number of market professionals following a company because the cost of acquiring information becomes greater than the expected profit to be gained by using it.

Using a dataset of illegal insider trading previously detected and prosecuted by the Securities and Exchange Commission, Meulbroek (1992) examines the price effects of informed trading and finds that the abnormal price movement on days in which insiders' trade is approximately 50% of the subsequent price reaction when the information becomes public. Therefore, it is argued that the process of insider trading aids the transmission of private information into prices and, thus, aids price discovery and informativeness.

Although the main objection to insider trading centres around the violation of the concept of equity, as the previous discussion has suggested, it can also be criticised on efficiency grounds because of the adverse selection problem it causes. Bhattacharya

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and Spiegel (1991) argue that insider trading can lead to a distinct separation of informed and uninformed traders. If investors (uninformed) know that insiders exist and recognise that insiders will only trade when they are privy to price sensitive information, then they are potentially faced with a no-win situation. This, it is argued, will result in less trade, a loss of investor confidence and in the extreme, market failure.

Furthermore, as argued by - inter alia - Copeland and Galai (1983), Glosten and Milgrom (1985) and Seyhun (1986), insider trading induces a negative externality by increasing the cost of trading to all investors. Recognising that there are anonymous traders dealing with superior information, market makers will widen their bid-ask spreads. Thus, any potential losses will be offset by the additional profits made from the uninformed trader who now pays a higher bid-ask spread. To be compensated, uninformed traders will demand a higher rate of return from the company whose shares are subject to insider dealing. This, in turn, will lead to higher costs of capital and less investment. The above argument suggests that regulation is necessary to reduce asymmetric information problems and negate the undesirable consequences of insider trading.

Leland (1992), reasons that allowing insider trading reduces uncertainty. Specifically, stock prices reflect information better, bid-ask spreads widen and expected real investment rises. Whereas owners of investment projects and insiders stand to benefit, outside investors and liquidity traders are adversely affected. The net impact on welfare is shown to depend on the economic environment that prevails at the time.

Interestingly, Hagerman and Healy (1992) find no support for the argument that bid-ask spreads widen as a result of insider trading. Similarly, Kabir and Vermaelen (1996) reach the same conclusion by examining the effect of introducing insider trading restrictions on the Amsterdam Stock Exchange. It is shown that introducing a 'close-period' of two months before annual earnings announcements in which insiders cannot trade has the effect of decreasing liquidity (proxied by trading volume) and reducing the speed of adjustment to positive earnings news. John and Narayanan (1997) argue that regulation requiring insiders to disclose transactions creates incentives for them to manipulate the market by trading against their information. For example, if a director with good news decides to sell their company's stock thereby sending a negative signal, this will enable them to increase trading profits by simply maintaining an informational advantage for a longer period of time.

### 3. STRONG-FORM EFFICIENCY TESTS

Tests on insider trading generally fall into the category of strong-form efficiency tests. Even before the theory of informational efficient capital markets was presented by Fama (1970) the issue of stock market efficiency had been a dominant and compelling issue in the finance literature. It is now generally accepted that the concept of efficient markets refers to whether security prices fully reflect all available information. In distinguishing between three separate information sets, Fama (1970) stimulated the debate and encouraged a plethora of both theoretical and empirical literature on the issue. To date, the majority of the literature seems to indicate that markets are at least weak form and more than likely semi-strong form efficient. That is, public information, concerning the history of prices or earnings/dividend announcements for example, is incorporated into prices at a fast enough rate to render any attempt to earn abnormal returns redundant. The implications of this result are far reaching and affect nearly all members of society by implication, by the fact that security prices will provide accurate signals for resource allocation.

The concept of strong-form efficiency is slightly more rigorous, in that it suggests that all information, both public and private, is instantaneously reflected on share prices. This implies that neither individual nor group of investors, are able to consistently outperform the market (except by chance). Furthermore, and quite unrealistically, it suggests that even those who have advance knowledge of information cannot earn excess returns. The latter would suggest, for example, that a director with knowledge (which is not yet in the public domain) of a forthcoming merger could not earn abnormal returns.

Tests of strong-form efficiency have tended to take two different, but not necessarily independent, approaches. Recognising that it is difficult, *ex ante*, to identify non-public information, the first approach attempts to isolate those individuals who are most likely to be privy to information that is not in the public domain. Although not exhaustive, this may include, for example, managers, directors, employees and majority shareholders. Tests on this type tend to focus on the profitability, or otherwise, of insider dealing. Specifically, they have tended to examine whether insiders with access to advance, or non-public information, are able use this advantage to earn abnormal returns consistently. Since it is strongly related to the question at hand, I will deal with the empirical evidence on this particular strand of tests extensively in section 4. For now it suffices to say that the consensus view is that insiders can make excess returns by trading on inside information. Thus, at this stage we can say that the concept of strong form efficiency is consistently rejected for tests that focus on trades made by corporate insiders.



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Another strand of tests has focused on the investment performance of institutions with large managed funds such as unit trusts, pension funds and investment trusts (informed outsiders). The main focus has been on their ability to earn excess returns by either having superior ability in interpreting and utilising public information or indeed having access to, or advance knowledge of, private information. Since this second type of test is only indirectly related to the issue currently under investigation, I will only offer a brief review and summary of the relevant literature.

If equity markets are strong-form form, efficient share prices will reflect all information and no-one can earn excess returns<sup>2</sup>. The research approach taken by the second strand of tests on strong form efficiency has tended to focus on whether any group, other than corporate insiders, is able to earn excess risk-adjusted returns. That is, the returns earned by analysts, newspaper columnists, portfolio managers, and so on, are compared to a benchmark portfolio and post-event abnormal returns are analysed. As outlined above, this may be due to their ability to interpret existing information better and/or that they are in possession and use of non-public information.

Mutual fund performance has received a great deal of attention by academic practitioners. Prompted by the work of Jensen (1968) and partly due to relative ease of access to such data, numerous studies have attempted to assess mutual fund performance by focusing mainly on the stock-picking performance of fund managers and their ability to time peaks and troughs. Lee and Rahman (1990) provide evidence that individual fund managers do have superior forecasting ability. However, when aggregating across all fund managers in their sample they find that this disappears. Hendricks, Patel and Zeckhauser (1993) find short-run (one-year) persistence in superior mutual fund performance - evidence that superior performance is based on skill rather than luck. Furthermore, they report that risk-adjusted returns of 6% are possible to investors investing in funds managed by "hot hands." These results are in direct contrast to the findings of Jensen (1968) and Elton et al (1993), who report significantly negative risk-adjusted excess returns in their sample of mutual fund managers' performance. This is backed up by the findings of Brinson, Hood, and Beebower (1986) that analyse the performance of pension fund managers. They show that the average return earned by pension fund managers over the time period examined is less than that achievable by investing in the market index.

In summary, the general conclusion to emerge from the literature on this issue is that except for cases where there is access to non-public information there seems to be no compelling evidence of non-insiders being able to consistently outperform the market. This suggests that if the relevant regulatory authorities regard insider trading

as detrimental in some sense, they should focus on outlawing trades on price sensitive information altogether and monitor insider trading in general by specifying strict disclosure rules.

#### 4. INSIDER SHARE DEALINGS: INTERNATIONAL EVIDENCE

As previously mentioned, tests on strong-form efficiency have also examined insider trading and the exploitation of non-public information. In general, the empirical literature pertaining to this issue can be classified into two main areas. The first area attempts to identify whether insiders use their information advantage by examining the incidence, and profitably, of insider trading around firm-specific information announcements<sup>3</sup>. In general, the evidence suggests that insiders are able to earn abnormal returns. The second area of research, which is directly related to the issue under investigation and will therefore be examined extensively in this section and the next, examines the stock price reaction to insider trades. Specifically, studies have examined the information content of insider trades by looking at the behaviour of abnormal returns after insider transactions. Despite a common aim, the studies differ in what is interpreted as the information signal, the benchmark used to calculate abnormal returns, the treatment of systematic risk and on whether they control for size. Still, the general consensus is not supportive of strong-form efficiency.

One of the earliest studies on insider share dealing by Wu (1963) found no evidence of a relationship between directorial trading and price movements in the month following a transaction. Recognising that knowledge of insider trading is of value to both the regulatory authorities and the investment community at large (outsiders), Lorie and Niederhoffer (1968) examined the predictive and statistical properties of insider trading. Focusing on the frequency of insider trades the month before in which there is at least an 8 per cent change in the price of a stock, they find evidence that insider trading can be profitable. Specifically, in the six months prior to a large price change, if the last transaction was a purchase, then 71 times out of 100 the price increased. Furthermore, in the six months prior to a volatile period, if the number of purchases was greater than the number of sales then they were significantly more likely to find a price increase. Also, using as a measure of insider trading months where the number of sellers (buyers) exceeds the number of buyers (sellers) by two or more, they find that this variable (intensive trading) has significant explanatory power in predicting the direction of the stock price change six months ahead.

Givoly and Palman (1985) examine the source of the abnormal returns to insider transactions. The results of studies examined thus far have all implied that the occurrence of profitable insider transactions per se is evidence that insiders possess and use superior information. Givoly and Palman (1985) examine the extent to which

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any abnormal returns to insider trades are due to price changes caused by subsequent disclosure of firm specific news or price changes due to information disclosed by the trade itself. Using a sample of 68 randomly chosen companies throughout the period 1973-1975 they find that a significant proportion of the observed excess returns are due to outside investors mimicking insider trades thus causing the price changes observed. Furthermore, the relationship between insider trades and subsequent news announcements is found to be weak which throws doubt on the appropriateness of insider trading regulations. Thus, the authors conclude that,

“Insider trading in other words, may serve as a leading indicator to the market” (Givoly and Palman, 1985, p. 70).

Seyhun (1986) draws on the results of previous studies which find that both insiders with access to private information and outsiders that imitate insider trades (i.e. use previously published public information) are able to earn abnormal returns of between 3-30% for holding periods of eight months to three years. He attempts to reconcile the semi-strong form of the efficient market hypothesis by analysing approximately 60,000 insider transactions over the period 1975-1981. Furthermore, the data is separated so as to examine buy and sell decisions, different types of insiders, and dollar volume of insider trading separately. The study makes two significant contributions to the existing literature on this issue to date. Firstly, the author draws on the results of Reinganum (1981) and Banz (1981) who find that abnormal returns formed by using the Capital Asset Pricing Model (CAPM) are on average positive for small firms and negative for large firms - the so-called ‘size effect.’ This, it is argued, can cause biases in the formation of abnormal returns that may overstate abnormal returns. Such a systematic bias can lead to previous research observing abnormal returns when actually no information is conveyed in insider transactions. The second contribution the author makes is to explicitly account for the adverse selection problem faced by market makers by deducting the bid-ask spread from any gross abnormal return to an active trading strategy employed by outsiders. This is done so that the expected loss to informed insiders is recognised as an additional cost of trading.

The main results suggest that the previously found rejection of the semi-strong form of the EMH is overturned. Specifically, Seyhun finds that the expected loss by the uninformed to insiders is negatively related to firm size and this, in turn, explains why market makers set larger bid-ask spreads when dealing with the stocks of smaller firms. When these transaction costs are explicitly accounted for, it is found that outsiders are not able to use publically available information on insider share dealings to earn abnormal returns. That is, abnormal returns to outsiders net of trading costs,

are not positive as previously found. It is also found that insiders are able to earn abnormal returns thus rejecting the strong-form version of the EMH. Furthermore, the quality of information possessed by different insiders is shown to vary. That is, individuals such as chairpersons -who are a priori expected to have better information on the future prospects of their firm - are able to earn higher returns than lower ranked insiders are.

The empirical literature pertaining to insider trading in the UK is sparse and can be traced back to the influential study by King and Roell (1988) who examine the profitability of insider trading in the UK. Concentrating on insider transactions reported in the Financial Times 'Share Stake' section between January 1986 to August 1987 (excluding option exercises, rights issues and new share issues), the authors form a 'buy' and a 'sell' portfolio and invest a fixed sum for each transaction. Since multiple transactions in the same company for any given month are interpreted as a stronger signal, an appropriate multiple of the fixed sum is invested. To form abnormal returns the two portfolios were compared against the FT-Actuaries All Share index. Moreover, since it is possible that security return differences (relative to the market) may be attributable to systematic risk differences between firms, a CAPM benchmark was formed in order to calculate risk-adjusted abnormal returns.

Relative to the FT-Actuaries All Share and beta adjusted benchmark, both the buy and sell portfolios were shown to outperform the market. Furthermore, the authors find that abnormal returns persist for up to one year after publication and interpret this as contradicting semi-strong form efficiency i.e. ignoring transaction costs investors using this published information are able to earn abnormal profits. Another observation is that the abnormal returns are greater for the buy portfolio than the sell portfolio. This is because, in general, insider sell decisions are much more likely to occur for non-information based reasons than purchase decisions. Thus, insider purchases, taken as a whole, may be a stronger signal than collective sales.

Rozeff and Zaman (1988) go one step further than Seyhun (1986) and re-examine the profitability of both insider and outsider trading, taking into account both the size-effect and the finding by Basu (1983) that stock returns are also a function of the earnings to price (e/p) ratio. They argue that the results of previous studies are due to a mismeasurement of excess returns that arise from both the size and e/p effects. Specifically,

"If insider purchases tend to be concentrated in the stocks of smaller firms with high e/p ratios, and if these stocks tend to earn positive abnormal returns, then the profits that have been found for insiders and outsiders will be partly or wholly

attributable merely to size and e/p effects” (Rozeff and Zaman, 1988, p. 26).

Measuring abnormal returns using an augmented market model, which takes into account both the size and e/p effects, they find that abnormal returns to outsiders disappear once transaction costs are taken into account. This is consistent with the semi-strong version of the EMH. However, in line with previous findings, corporate insiders are still able to make positive and significant - albeit smaller than previously reported - profits.

Seyhun (1988) examines whether publicly available information about aggregate insider trading is helpful in predicting future expected market returns. The author finds that insiders are able to identify unanticipated market-related factors that are likely to affect future cash flows and subsequently trade. Specifically, it is found that net insider trading activity (purchases minus sales) is significantly positively related with the return on the market during the subsequent 2 months. Furthermore, the degree to which the returns on the market portfolio and net aggregate insider trading are positively correlated is found to be dependent on the individual firm’s market risk. That is, insiders in large firms characterised by high market risk are more likely to trade on economy-wide factors than insiders in small firms who tend to trade on the basis of firm-specific information. Thus, if the basis for the trade is driven by firm-specific factors, this is likely to result in no relation between insider trades and subsequent market returns.

Seyhun (1992) takes this issue one step further by examining why aggregate net insider trading is able to predict up to 60 percent of the variation in one-year-ahead aggregate stock returns over the period 1975-1989. Whereas Seyhun (1988) finds that the information content of aggregate insider trading results from market-wide factors not yet reflected in firms’ stock prices, he makes no attempt to identify those factors. The results of the study suggest that the predictive ability of insiders is due to both their ability to predict future cash flows and any mispricing which may occur when current prices differ from fundamentals i.e. the fads hypothesis.

Pope, Morris and Peel (1990) examine the reaction of share prices to instances of insider trading. Since the authors’ primary aim is to test market efficiency by analysing residual returns, they adopt the Cumulative Average Residuals approach, both before and after instances of insider trading; analysis of pre-trading behaviour, they argue, may shed light on the factors motivating insider transactions. Specifically, they examine whether directors in the UK, over the period 1977-1984, have earned abnormal returns on their trades, and whether the markets respond to their dealings.

The data set is obtained from the Stock Exchange's Weekly Official Intelligence and relates to when the exchange is notified of directors' transactions (not the transaction date itself). Following previous practice, the authors exclude transactions relating to option exercise, occurring coincidentally with other events, and bonus as well as rights issues.

Since the focus is on profitable trading strategies, rather than the population of directorial transactions, the study concentrates on a sample that excludes 'low intensity' insider events. Specifically, an event is defined as a month where the net number of buyers or sellers is greater than one. This leaves a total of 275 'buy,' and 289 'sell' signals over the period examined.

A particularly interesting innovation of the study is how the authors attempt to minimise 'inference errors.' In particular,

“ .... that unexplained (residual) returns were indeed conditional on such (insider) trading and were not the result of, for instance, misspecification of the return generating process, errors in estimates of systematic risk, the existence of contemporaneous signals, or differences in industry membership, firm size, or period, etc” (Pope et al, 1990, pp. 362-363).

Although the authors recognise that certain models of the return generating process are potentially misspecified, they show that the residual returns obtained from a 'simple market model' are not very different from those obtained from more sophisticated models. Also, recognising that a potential 'firm size' effect may be generating their results, they recalculate excess returns based on the Dimson and Marsh Small Companies Index and find that their results remain qualitatively unchanged.

The main findings suggest that, consistent with similar US studies, positive average residuals tend to follow insider purchases and negative average residuals are observed following insider sales. However, only the insider sales tend to be significantly different from zero. Further, abnormal returns seem to persist for six-months following the insider transaction, suggesting some degree of semi-strong form inefficiency.

In another influential article, Gregory, Matatko, Tonks and Purkis (1994) examine the impact of UK directors' trading in smaller firms. Following Seyhun (1986) they first examine whether abnormal returns are related to the size effect i.e. they test the hypothesis that firm size has no relationship with the size of abnormal returns. Their

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rationale for examining this issue is threefold. Firstly, they argue that directors of smaller companies are more involved in the everyday running of their firm's and are, therefore, in a better position (than the directors of relatively larger firms) to anticipate future price movements. Secondly, it may be the case that director's trades in large companies are more closely scrutinised leading to faster price adjustment or reluctance by directors to trade on price sensitive information. Finally, and most importantly, in response to the well-documented small-firm effect identified by Fama and French (1992)<sup>4</sup>, it may be that abnormal returns to directors' trading are being driven by smaller company trades.

Using data on 2,350 director transactions taken from the London Stock Exchange's Information Fish Service between 1984-1986, they form three separate groups of approximately fifty small, medium and large (non-financial) firms in order to investigate whether firm size has any relationship with any abnormal returns that may (or may not) be observed. Unlike previous UK studies the authors include all transactions made by directors including rights issues and shares acquired through option exercise.

Using a 'naive market model' to form CARs over the whole sample of companies, they show that consistent with the findings of previous UK and US studies, there are significant abnormal returns following insider purchases and sales. However, on closer examination, it is shown that these results are being driven predominantly by abnormal returns in small and medium sized firms. Specifically, they find that abnormal returns are still significant but smaller, once the results are adjusted for (i) the presence of thin trading in the shares of small companies and (ii) the possibility of multiple and overlapping signals in single companies leading to multi-month returns that are not independent. However, when they adjust the benchmark portfolio for size using the method suggested by Dimson and Marsh (1986), they find that abnormal returns are reduced substantially. Specifically, sell signals become insignificant whilst the buy signal is less significant. This leads them to conclude that once typical transaction costs are taken into account, profits to insiders and those mimicking insider trades are not particularly high when the size effect is properly accounted for.

Pettit and Venkatesh (1995) investigate the conditional performance of insider trading by examining patterns of insider trading before, during and after long-run periods of abnormal stock market performance. Focusing on firm performance over long-run (3-year) periods, the authors examine the relationship between security price performance and the propensity for insiders to trade. In line with the results of previous studies they find that insider net purchases are significantly above (below)

the norm (both in terms of the number and value of net purchases) between one and two years before long-horizon returns that are above (below) the norm. This, it is argued, shows that insiders have access to and use information that is not in the public domain. Furthermore, in periods after higher (lower) than normal returns it is found that insider net purchases are below (above) the norm. This is interpreted as evidence that there is both a long-term anticipatory and reactive component to insider transactions. Surprisingly, the results obtained are nearly all driven by an abnormally large level of sales as opposed to purchases. This, in turn, implies that regulators and firms who view insider trading as being in some sense detrimental should focus their monitoring activities on insider sales and in particular, the timing of these sales.

The most recent study of insider trading activity in the UK was by Gregory, Matatko and Tonks (1997) who examine the information content of directors' trades. In particular, they attempt to reconcile the conflicting results of the UK literature to date, by focusing on signal definition and the significance of different signals in an environment where the well-documented size effect is time-varying. Drawing on the previous theoretical literature concerning the effects of insider trading, they test two hypotheses, namely whether the number and size of insider trades is inversely related to the magnitude of subsequent abnormal returns. Using a dataset that employs only non-option related trades over the period 1986-1990, they focus on three signal definitions: (i) the net value of shares purchased/sold in the month, (ii) that the net number of purchases/sales in the month is not less than two, and (iii) to examine the importance of large trades, whether the net value of shares purchased/sold is greater than £10,000, £100,000 and £1 million, respectively. The methodology, although very similar to Gregory et al (1994), differs in two important respects. Firstly, in addition to the size control methodology used previously, they employ the simpler size control benchmark adopted by Lakonishok, Schleifer and Vishny (1994). Secondly, instead of examining abnormal returns for fixed holding periods following insider trades, their focus ends when there is a trade-reversing signal.

The main finding is that a size effect did exist over the period under examination and this effect was indeed variable (positive during 1986-1988 and negative during 1989-1990). Thus, they conclude, choosing an appropriate benchmark return model that controls for the size effect is especially important in this type of study which examines abnormal returns over long-post event windows and includes many small firms in the sample under examination. Furthermore, it was also found that any results obtained and conclusions drawn are sensitive to the signal definition. Although there is evidence which suggests that following an appropriate trading strategy leads to statistically significant abnormal returns, these returns may not be economically significant once typical 'round trip' transaction costs are added.



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Eckbo and Smith (1998) examine the performance of insider trades on the Oslo Stock Exchange and find zero or negative abnormal returns to insider transactions during a period of lax enforcement of insider trading regulations. Arguably, the most significant contribution of this study is that it extends the empirical testing methodology used in studies of this type. Firstly, by tracking all changes in the level of an insider's share holdings they are able to form value weighted portfolio returns. Secondly, they allow for the time-varying nature of expected returns in the formation of their benchmark portfolio. Lastly, they extend the traditional event study methodology to a conditional multifactor setting. Interestingly they find that when using the traditional event study methodology there is evidence of positive abnormal returns following insider sales. However, this superior performance disappears firstly when using a multifactor market model (that also allows for the time-varying nature of expected returns) and secondly when insiders' value-weighted portfolio returns are used.

Jeng, Metrick, and Zeckhauser (2000) overcome the problems inherent in event studies by using a value-weighted portfolio approach to analyse all insider trades that occurred in the US during 1975-1996. Specifically, for each day, a value-weighted portfolio of insider purchases (sales) is constructed and one-year holding period returns are calculated for each portfolio. These are then compared to a benchmark portfolio in order to examine the profitability of insider trades. Interestingly, the results indicate that the purchase portfolio outperforms the market by about 7.4 percent per year. About one-sixth of the abnormal returns occur within the first five days of a trade, one-third within the first month, and three-quarters within the first six months. However, insider sales do not prove to be economically or statistically significant. The reason given is that sales are likely to be motivated by liquidity and/or diversification factors. Furthermore, and in direct contrast to previous work in the area, it is found that insiders in small firms do not earn significantly more profits than insiders in large firms, and top executives do not outperform lower-ranked employees.

The most recent study in this area was undertaken by Lakonishok and Lee (2001) who examined the information contained in nearly one-million insider trades on the NYSE, AMEX, and NASDAQ during the period 1975-1995. Using an event study methodology that controls for both size and book-to-market effects, they find that over short horizons, the market ignores insider trading information. Specifically, abnormal returns are not significant around trading and/or reporting dates. This suggests that either insider trades are not informative or the market is not efficiently responding to this information. For longer investment horizons, insider purchases are found to be informative while insider sales are found to contain no information. However, the

informativeness of the insider purchases seems to be driven by trades in smaller companies.

## 5. CONCLUSION

There has been a plethora of literature on insider trading in equity markets, especially over the last three decades since Fama (1970) stimulated the debate on tests of strong-form efficiency. Recognising that it is difficult to identify private information *ex ante*, one strand of the literature attempts to isolate those individuals who are most likely to be privy to information which is not in the public domain. Although not exhaustive, this may include for example, managers, directors, employees, and majority shareholders. In general, the empirical literature pertaining to this issue can be classified into two broad categories. The first area of study has attempted to identify whether insiders use their informational advantage by examining the incidence, and profitability, of insider dealing around firm-specific information announcements. In general, the evidence suggests that insiders are not able to earn abnormal returns. The second area of research, which is directly related to the issue under investigation, has examined the stock price reaction to insider trades. For example, the U.S. studies by Jaffe (1974), Finnerty (1976), Givoly and Palman (1985), Seyhun (1986, 1988, 1992), Rozeff and Zaman (1988), Pettit and Venkaatesh (1995) and more recently Eckbo and Smith (1998) have all examined the information content of insider trades by looking at the behaviour of abnormal returns around insider transactions. Similarly, the U.K. studies have been conducted by King and Roell (1988), Pope, Morris and Peel (1990), Gregory, Matatko, Tonks and Purkis (1994), and Gregory, Matatko and Tonks (1997). Despite a common aim, the studies have differed in what is interpreted as the information signal, the benchmark used to calculate abnormal returns, their treatment of systematic risk and on whether they control for the size-effect. Still, the general consensus is that there is information in insider trades.

## NOTES

1. The term 'insider' refers to trading by individuals whose positions give them access to privileged information that is not in the public domain and can impact on future prices. Thus, it refers to those individuals directly involved in the everyday running of a firm but it also encompasses those 'indirectly employed' (informed outsiders) by a company such as auditors, financiers and bankers – all of whom may be privy to price sensitive information.
2. The focus of the current study is on insider trading in equity markets. The interested reader is referred to Grossman (1986) for futures markets, Cleeton and Reeder (1986) and Biais and

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Hillion (1994) for options markets, Lin and Howe (1990) for over-the-counter markets and Cumby and Modest (1987) for foreign exchange markets.

3. For example, the interested reader is referred to John and Mishra (1990) for capital expenditure announcements, Karpoff and Lee (1991) for new issue announcements, John and Lang (1991) for dividend announcements, Sanders and Zdanowicz (1992) and Persons (1997) for takeovers, Harlow and Howe (1993) for leveraged buyouts, Sivakumar and Waymire (1994) for earnings announcements, Seyhun and Bradley (1997) for bankruptcy announcements and Gombola, Lee and Liu (1997) for seasoned equity offering announcements.

4. Whereby small firms consistently earn higher risk-adjusted returns than large firms.

## REFERENCES

- Banz, R., (1981). The relationship between return and market value of common stocks, *Journal of Financial Economics*, 9, 3-18.
- Basu, S., (1983). The relationship between earnings' yield, market value and return for NYSE common stocks: Further evidence, *Journal of Financial Economics*, 12, 129-156.
- Bhattacharya, M., and Spiegel, M., (1991). Insiders, outsiders, and market breakdowns, *Review of Financial Studies*, 2, 255-282.
- Biais, B., and Hillion, P., (1994). Insider and liquidity trading in stock and option markets, *Review of Financial Studies*, 7, 743-780.
- Brinson, G., Hood, R., and Beebower, G., (1986). Determinants of portfolio preference, *Financial Analysts Journal*, 42(4), 39-44.
- Carlton, D., and Fischel, D., (1983). The regulation of insider trading, *Stanford Law Review*, vol.857.
- Carpenter, J., and Remmers, B., (2001). Executive stock option exercises and inside information, *Journal of Business*.
- Cleeton, D., and Reeder, P., (1986). Stock and option markets – Are insider trading regulations effective? *Quarterly Review of Economics and Business*, 27, 63-76.
- Copeland, T., and Galai, H., (1983). Information effects on the bid-ask spread, *Journal of Finance*, vol. 38, 1457-1469.
- Cumby, R., and Modest, D., (1987). Testing for market timing ability, *Journal of Financial Economics*, vol. 19, 169-189.
- Dimson, E., and Marsh, P., (1986). Event study methodologies and the size effect, *Journal of Financial Economics*, 17, 113-142.
- Dye, R., (1984). Insider trading and incentives, *Journal of Business*, 57(3), 296-313.
- Eckbo, B., and Smith, D., (1998). The conditional performance of insider trades, *Journal of Finance*, 53, 467-498.

- Elton, E., Gruber, M., Das, S., and Hlava, M., (1993). Efficiency with costly information: A reinterpretation of evidence from manager portfolios, *Review of Financial Studies*, 6(1), 1-23.
- Fama, E., (1970). Efficient capital markets: A review of theory and empirical work, *Journal of Finance*, May, 383-417.
- Fama, E., and French, K., (1992). The cross-section of expected stock returns, *Journal of Finance*, 47(2), 427-466.
- Fishman, M., and Hagerty, K., (1992). Insider trading and the efficiency of stock prices, *Rand Journal of Economics*, 23(1), 106-122.
- Givoly, D. and Palmon, D., (1985). Insider trading and the exploitation of inside information: Some empirical evidence, *Journal of Business*, 58, 69-87.
- Glosten, L., and Milgrom, P., (1985). Bid, ask and transaction prices in specialist market with heterogeneously informed traders, *Journal of Financial Economics*, vol. 14, 71-100.
- Gombola, M., Lee, H., and Liu, F., (1997). Evidence of selling by managers after seasoned equity offering announcements, *Financial Management*, 26, 37-60.
- Gregory, A., Matatko, J., Tonks, I., and Purkis, R., (1994). U.K. directors' trading: The impact of dealings in smaller firms, *The Economics Journal*, 104, 37-53.
- Gregory, A., Matatko, J., and Tonks, I., (1997). Detecting information from directors' trades: Signal definition and variable size effects, *Journal of Business Finance and Accounting*, 24, 309-343.
- Grossman, S.J., (1986). An analysis of the role of insider trading on futures markets, *Journal of Business*, 59, 129-146.
- Hagerman, R., and Healy, J., (1992). The impact of SEC-required disclosure and insider trading regulations on the bid-ask spreads in the over-the-counter market, *Journal of Accounting and Public Policy*, 11(3), 233-243.
- Harlow, W., and Howe, J., (1993). Leveraged buyouts and insider nontrading, *Financial Management*, 22, 109-118.
- Hendricks, D., Patel, J., and Zeckhauser, R., (1993). Hot hands in mutual funds: Short-run persistence of relative performance, 1974-1988, *Journal of Finance*, 48(1), 93-130.
- Hillier, D., and Marshall, A., (1998). The timing of UK directors' trades, *Journal of Business Law*, 435-456.
- Jeng, L., Metrick, A. and Zeckhauser, R. (2000). Estimating the returns to insider trading: A performance evaluation perspective, *NBER Working Paper*, No. W6913.
- Jensen, M., (1968). The performance of mutual funds in the period 1945-1964, *Journal of Finance*, 23(2), 389-415.
- John, K. and Mishra, B., (1990). Information content of insider trading around corporate announcements – The case of capital expenditures, *Journal of Finance*, 45, 835-855.
- John, K., and Lang, L., (1991). Insider trading around dividend announcements, Theory and Evidence, *Journal of Finance*, 46, 1361-1389.

*The Informativeness of Insider Trades:  
A Review of the Literature*

- John, K., and Narayanan, R., (1997). Market manipulation and the role of insider trading regulations, *Journal of Business*, 70(2), 217-247.
- Kabir, R., and Vermaelen, T., (1996). Insider trading restrictions and the stock market – Evidence from the Amsterdam stock exchange, *European Economic Review*, 40(8), 1591-1603.
- Karpoff, J., and Lee, D., (1991). Insider trading before new issue announcements, *Financial Management*, 20, 18-26.
- King, M., and Roell, A., (1988). Insider trading, *Economic Policy*, 7, 163-193.
- Lakonishok, J., Shleifer, A., and Vishny, R., (1994). Contrarian investment, extrapolation, and risk, *Journal of Finance*, 49, 1541-1578.
- Lakonishok, J., and Lee, I., (2001). Are insider trades informative? *The Review of Financial Studies*, 14(1), 79-111.
- Lee, C., and Rahman, S., (1990). New evidence on timing and security selection skill of mutual fund managers, *Journal of Portfolio Management*, vol. 17, 80-83.
- Leland, H., (1992). Insider trading – Should it be prohibited? *Journal of Political Economy*, 100(4), 859-887.
- Lin, J., and Howe, J., (1990). Insider trading in the OTC market, *Journal of Finance*, 45, 1273-1284.
- Lorie, J., and Niederhoffer, V., (1968). Predictive and statistical properties of insider trading, *Journal of Law and Economics*, 11, 35-51.
- Manne, H., (1966). Insider trading and the stock market, *New York: The Free Press*, 1966.
- Meulbroek, L., (1992). An empirical analysis of illegal insider trading, *Journal of Finance*, 47, 1661-1699,
- Noe, T., (1997). Insider trading and the problem of corporate agency, *Journal of Law Economics and Organisation*, 13(2), 287-318.
- Persons, O., (1997). SEC's insider trading enforcements and target firms' stock values, *Journal of Business Research*, 39, 187-194.
- Pettit, R., and Venkatesh, P., (1995). Insider trading and long-run return performance, *Financial Management*, 24, 88-103.
- Pope, P., Morris, R., and Peel, D., (1990). Insider trading: Some evidence on market efficiency and directors' share dealings in Great Britain, *Journal of Business Finance and Accounting*, 17, 359-380.
- Reinganum, M., (1981). Misspecification of capital asset pricing: Empirical anomalies based on earnings' yields and market values, *Journal of Financial Economics*, 9, 19-46.
- Rozeff, M., and Zaman, M., (1988). Market efficiency and insider trading: New evidence, *Journal of Business*, 61, 25-44.
- Sanders, R., and Zdanowicz, J., (1992). Target firm abnormal returns and trading volume around the initiation of change in control transactions, *Journal of Financial and Quantitative Analysis*, 27, 109-129.
- Seyhun, N., (1986). Insiders' profits, costs of trading, and market efficiency, *Journal of Financial Economics*, 16, 189-212.

- Seyhun, N., (1988). The information content of aggregate insider trading, *Journal of Business*, 61, 1-24.
- Seyhun, N., (1992). The effectiveness of insider-trading sanctions, *Journal of Law and Economics*, 35, 149-182.
- Seyhun, N., and Bradley, M., (1997). Corporate bankruptcy and insider trading, *Journal of Business*, 70, 189-216.
- Sivakumar, K., and Waymire, G., (1994). Insider trading following material news events – Evidence from earnings, *Financial Management*, 23, 23-32.
- Wu, H., (1963). Corporate insider trading profitability and stock price movement, unpublished Ph.D. dissertation, University of Pennsylvania.

## TIME AND COMPETITION IN THE FAST FOOD INDUSTRY: THE CASE OF McDONALDS

GEORGIOS MARKATOS\*

### ABSTRACT

*Consumer research commissioned for this article indicates that the main perceptions of fast food continues to be as a convenient standby food as a result they have a limited role to play in the everyday food repertoire. Frozen is the preferred format, with particular appeal for men and middle income groups. Fresh have a bigger buying base among better off households and across both categories the presence of children, particularly vocal and fussy over-tens, boosts penetration. Operators are also no longer able to inflate prices due to a good location or atmosphere, with customers just wanting to eat a meal and go. Reports of rapidly rising obesity, particularly amongst children, have been linked with fast food, and the government's White Paper (Choosing Health, November 2004) includes recommendations for restricting 'junk food' advertising in addition to a raft of proposals for improving the health of the nation.*

*Keywords: S.W.O.T Analysis; P.E.S.T. Analysis; Fast Food Industry; Consumer Food Trends; Market Downsizing.*

### 1. EXTERNAL CONTEXTS

Fast food is a worldwide phenomenon with more people than ever consuming fast food products in their own country and abroad. An area or a sector, preferably that contributes to the economic growth of many countries, balances the employment and payments and stands as a great contributor to the governments revenues. In addition to these, it has been the driving force behind many changes and developments not only in technology and marketing but also in the way of living and consuming.

“When I use a word, said Humpty Dumpty-, it means what I choose it to mean- neither more nor less” (*Ball, 1992, pg4*). Therefore fast food is exactly what it says it is. The first fast food restaurant has occurred in the U.K.in 1970's and has rapidly expanded since then. The incoming North American chains, most notably McDonalds, have spread the progress to this sector. Fish-and-chip shops are commonly regarded as the first original fast food restaurants in the U.K. Northern England are thought to be the birthplace of chip. The name “chips” became very popular in France. Even in the

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\* Lecturer, Head of the Travel, Tourism and Leisure Management Department, Americanos College, Nicosia, Cyprus

book of Charles Dickens, "*Oliver Twist*", which was first published in 1838, fried fish warehouses are mentioned, (Ball, 1992). It is not exactly known when the first one was built because not until 1911 that the government decided to list those shops; The reason? They were not officially accepted because of the awful smell! Only after 30 years and because of the technological development were actually listed and found over than 25.000 fish-and-chip shops. Food fashion changes according to the customer's 'wants' and needs. In 1970's a new type of fast food operations arrived from North America.

The new fashion of Wimpy's and McDonald's hamburger result to the closure of many fish-and-chip shops in the U.K. Following these changes, pizza, another recent product from Italy, though developed in North America, arrived to compete the older ones. Final but not least, chicken products of Kentucky Fried Chicken Company arrived among the others. The expansion of the industry is massive because as MINTEL says this sector is "cheap, convenient and consistent"<sup>1</sup>. The size of the fast food sector in the U.K. is difficult to be determined for a number of reasons. The main problem though is the variety of definitions of fast food. The industry can be separated into two big sectors. The first where McDonalds, KFC, Wendy's and so on belongs to, is the sector of the international global franchise chains. The second sector is the local small fast food shops or, in an even national level, small companies with limited market share and capabilities. McDonalds, a modern fast food operation and not a traditional fish-and-chip shop or a mobile take-away, is more what nowadays consumer prefers to visit. It is a company of more than 30.000 shops in 121 countries with 5.000 of them sold to owners<sup>2</sup>.

Every company, especially when it is a franchise industry like McDonalds has to consider its *P.E.S.T.* Or *P.E.S.T.E.L* analysis, as Johnson and Scholes (2002) note, (considering the legislation and environment factors). Others, like Byar (1987) perceive regulatory considerations as part of the political factors. McDonalds is a global franchise chain, but it has to consider problems like the legislation and the political stability of the country they want to choose to open a franchise restaurant individually. It is the company's duty to consider respect follow and implement all the necessary steps of cross contamination and environmental concerns. An example is that in the U.K the company cannot sell alcohol since it is against the law, where in other countries, like Greece, can. "Police chiefs in Birmingham, central England, have issued officers with vouchers to eat at McDonald's, in an effort to increase their visibility and save time in walking or driving back to the staff canteen", (Johnson, 2002). In addition to that the company released her first 46 page report<sup>3</sup> of the social responsibility and the steps it takes considering the environment, and the society as well as the sensitivity of the company, to the people in the less developed countries,



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which was expressed through starting a campaign of charities in the restaurants for UNICEF<sup>4</sup>.

As far as technology is concerned, a company is forced to be well or moderately developed depending on its growth or the market share that wants or is able to compete. Not only due to high production -because of the giant number of products it needs to produce- but also in order to maintain the competitive advantage, the company has good, fast and efficient service in a healthy environment with unskilled staff though and the equipment doing the most of the work. The organisation has always to deal with the last factor, the financial influences. Unemployment, interest rates and disposable income are a few examples of this factor. With more than 30.000 shops in 121 countries helped a lot of countries to reduce their unemployment level. In many countries the shops (approximately 5000) are sold to local owners and in many cases (like in Cyprus) the raw materials are provided by the countries resources. An example to support the company's good will is to that the company has sent necessary equipment and specialists to show how to produce the burger rolls at a local bakery company in Cyprus. In this way, the company showed that not only it will not be a headache for the economy of Cyprus but it will help also with unemployment and elsewhere.

As all fast food sectors so McDonald's has to follow the law and the rules at a local, national or global level. Fast food industry does with the rest of the restaurant outlets, like cafes and so on, not differ in terms of legislation. Only in Europe probably McDonald's finds similarities in legislation. I say 'probably' because EU still sends directives to its member states and not legislation that leaves the countries individually to create and implement the legislation. Rules can be at many levels and areas. Employment law, product safe law, advertising law, health and safety and even monopolies legislation varies from country to country. For example, in Saudi Arabia when the company opened the restaurants it had to care for separate dinning areas between men and women.

## 2. INTERNAL CONTEXTS

The owner of McDonald's could probably say that is Ray Krock but the idea began from two brothers in San Bernardino in California. Krock a businessman who had invested his entire life savings to become the exclusive distributor of a five-spindled milk shake maker called the Multimixer. Hearing about the McDonald's hamburger stand in California running eight Multimixers at a time, he packed up his car and headed West. In 1954 he bought the company from McDonald's brothers and in 1955 he opened the "Des Plaines" restaurant. First day's revenues-\$366.12<sup>5</sup>! The resources of each company are for different levels and different departments.

In the case of McDonald's situation the labour that McDonalds is using, concerning human resources, are young people, mostly students that work as part timers. The disadvantage of that is that the company has a huge labour turnover but it can balance since the expenses in retraining the new employees are limited. The raw materials the company uses for the production of the menu items are coming from different suppliers. The company uses local suppliers and a strategy of diversification towards them. Why? Because, for example, in India, they do not eat beef<sup>6</sup>, so in order to sell it had to ask them for alternative products. Moreover during Easter in Greece, the company receives spinach pies since many people do not eat meat products. Since the company identifies its strengths and weaknesses it can compete successfully. "They can be assessed by examining a competitor's position with respect to the five key competitive forces" (*Porter, 1980, pg 63*).

McDonalds Company is the first company in the world with sales over than \$31.81 billions. Burger king, the biggest competitor of McDonalds follows with a sales figure of \$9.01 billions, (*Kotler et al, 1998,pg8*). McDonald's strengths are, the standardization that the company provides like the same consistency of the products (e.g. burgers taste the same everywhere). McDonalds targets at different segments of the markets especially young children, which constitute the future and loyal customers. The well technologically developed H.V.A.C. systems provide the company restaurants with a healthy environment. Another capability is that the company can afford a budget for an aggressive advertising campaign all over the world at any time.

**TABLE 1: McDONALD'S SWOT ANALYSIS**

<b>Strengths:</b> <ul style="list-style-type: none"><li>• Brand Equity...world-wide</li><li>• 42% of US fast-food hamburger business</li><li>• Consistency of food</li><li>• Successful items: Fries, Happy Meal, Big Mac, Egg McMuffin, Promotions</li><li>• Overseas market</li><li>• Balance sheet position</li></ul>	<b>Weaknesses:</b> <ul style="list-style-type: none"><li>• Declining market share</li><li>• Weak product development</li><li>• Disgruntled franchisees</li><li>• Quality and taste of products</li></ul>
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<b>Opportunities:</b> <ul style="list-style-type: none"> <li>• International expansion</li> <li>• Only serving 1% of the world's population</li> <li>• Growing dining-out market</li> </ul>	<b>Threats:</b> <ul style="list-style-type: none"> <li>• Mature/overstressed industry</li> <li>• Strength of competition</li> <li>• More health-conscious consumers</li> <li>• Changing demographics</li> <li>• Fluctuation of foreign exchange rates; Economies</li> </ul>
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### 3. STRATEGIC OPTIONS AND PROSPECTIVE

As Thompson (1993) writes in one of his cases to explain what the competitive advantage means and how it can be achieved, McDonalds Company is the leader in its sector for five main reasons. The visibility of the golden arches as an instantly recognizable symbol, the commitment to the mother company from the franchise branches and the ownership of control of real estate-sites. In addition to these, the company is global and focuses on a growth by opening 500 restaurants every year. The company did not diversify or tried to sell any other food. What it did, though, was to change the product mix like breakfasts and salads in America or seek to open new branches in places nobody else would, like next to military bases or in hospitals. Therefore, with the flexibility in changing products and the adaptable character in selling the appropriate product in each occasion (e.g. Bone in fried chicken McCrispy in Japan, Maharajah Mac sandwich in India or McO2 in Australia), McDonald's company earned a competitive advantage.

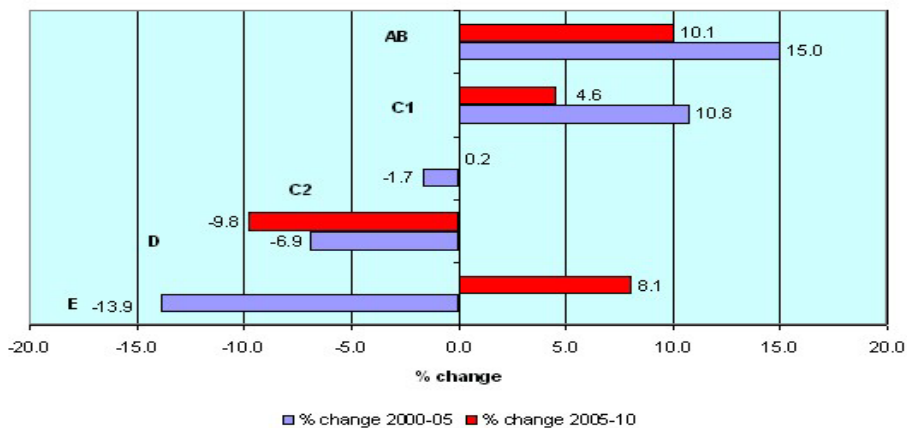
In addition to this the infrastructure and operating systems it uses are the same achieving at the same time a low-cost leadership status. (*Thompson, 1993*). The stakeholders of a company can be internal like the owner, of the company as in the case of McDonald's, Ray Krock, or external, like for example share holders. The restaurant does not working any more but it is opened as the "McDonald's museum". In 1965 McDonald's went public with the companies' first offering to the stock exchange. A hundred shares of stock, costing \$2,250 dollars at that time, must have been multiplied into 74,360 shares today and worth over \$2.8 million on December 31, 1998. In 1985 McDonald's was added to the 30-company Dow Jones Industrial Average. Today one is able to enrol and buy shares via Internet<sup>7</sup>.

"McDonald's Corp. has agreed to donate \$10 million to Hindu and other groups to settle lawsuits filed against the chain for mislabelling French fries and hash browns as vegetarian" (The frying oil contained animal fat), (*McCann, 2002*). Another example

is the case where seven children suffered from E-Coli because of McDonald's Burgers in UK, (Emmett, 1996). Describing what is ethical and what is not it could take lots of pages. What I mean ethical might be unethical to someone else. Identifying, though, the unethical from these examples someone can easily identify the responsibility a company like McDonalds have and the direct effect it has on to the business sector and the public in general, especially when you target at the young generation. McDonald's company is the leader in its sector with a huge market share around the world and billions of dollars turnovers. It is a successful business as many people see it. However how far can this expansion go? The robotization that the company provides both in production (use of unskilled personnel with limited knowledge of what they do), and in faceless service, where the customer is "forced" to choose, pay and eat quickly, is an issue that the company should consider. The company's length and growth is one of the biggest exit barriers. It should find ways to always have a very flexible strategy in order to compete with its competitors and follow the changes in fashion and time.

What about the change of customers' habits to healthier food? The company has already to deal with a number of new Yorkers who are suing the company for unhealthy food. Mintel report has shown that ABC1 consumers tend to have more healthy eating concerns than people from the lower socio-economic groups do. Figure 4 shows the percentage change in socio-economic groups between 2000 and 2005 and between 2005 and 2010.

FIGURE 4: PERCENTAGE CHANGE IN SOCIO-ECONOMIC GROUPS, 2000-10



Source: National Statistics/Mintel

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Between 2000 and 2005, the AB population grew by 15%, as the number of DE consumers declined by 10%. The British have generally become more affluent, and with further growth expected in PDI in the next five years, it is not surprising that the number of ABs will continue to rise, accounting for 56% of the adult population by 2010, a rise of 7 percentage points over 2000. Meanwhile, the number of consumers from the DE category will continue to fall (-3%).

The company's opportunities and the position that gets in terms of environment or societal offer, has been differentiated according to many authors. However, today- more than a few years ago- one can find journals describing the negatives or disadvantages of the company and this sector. "It's no good denying it: people like fast food because it can taste pretty good. But what they may not know about is the cocktail of chemicals that gives the French fry its taste - nor the grisly events in the slaughterhouses that can put something nasty in the burger along with the beef." says Schlosser (2001). Mintel forecasts that the market for fast food will see an increase of 25% in current terms, which is slightly slower than the 35% increase experienced from 1998-2003. This slowdown can likely be attributed to increased competition with supermarkets. Ready meals offered by supermarkets or Other Businesses such as Zorpas and Marangos etc. offer good value for money as well as convenience for consumers looking to eat at home.

A year after Teather (2002) writes:" The fast food group, which is struggling with falling profits, said it would open 600 new burger restaurants in 2003; a marked retrenchment for a group that peaked at 2,000 new openings in 1996", arguing that the company is in its biggest decline. So the biggest question remains: Is McDonald's still the leading company in the fast food industry and how will compete time, its biggest competitor?

#### 4. CONCLUSIONS

"A survey by snacks manufacturer United Biscuits reveals exactly when we are most likely to feel hunger pangs: 11.25am. Around 70% of Londoners begin tucking into their lunch at that time and more than two thirds of us have polished most of it off before noon. The survey also revealed that the packed lunch is having a revival. Nearly a third of Londoners now take a homemade lunch to work with them every day. Saving money is their main motivation, while a quarter are making an effort to be healthier and prefer to make for themselves a sandwich than eat a high street version. The remainder said they were simply too busy to leave the office and resented time spent queuing in a sandwich shop" (*Evening Standard* 20-07-2006).

Cypriots of mature ages (25-55+) do not have much different eating habits from that of Londoners. More and more Cypriots prefer to either stay in their offices and have a snack they prefer from home or visit the canteens of their working environment and eat something light until evening time where they will either cook themselves a meal or go out dining at a restaurant or a café. Convenience food from take away restaurants or Bakeries such as Zorpas or Marangos has become very in fashion for the reasons: *better prices for bigger portions, healthier, wider choice, and convenience accessibility*. Their increasing consumer confidence within the wider retail context as well as eating out has raised customer expectations. Poor service is no longer acceptable and Cypriots are now more apt to voice complaints if the service experienced fails to meet expectations. Furthermore, the wide choice of eating out establishments means that service is often the only clear means of differentiation between outlets.

A year after Teather (2002) writes:” The fast food group, which is struggling with falling profits, said it would open 600 new burger restaurants in 2003; a marked retrenchment for a group that peaked at 2,000 new openings in 1996”, arguing that the company is in its biggest decline. So the biggest question remains: Is McDonald’s still the leading company in the fast food industry and how will compete through time the culture and the new eating habits as its biggest competitor?

## NOTES

1. <http://reports.mintel.com/sinatra/mintel/searchexec/x/doc/635871848?fulltext=mcdonalds&type=nws&order=3&page=1&anchor=79#0>
2. <http://www.mcdonalds.com/corporate.html>
3. <http://www.mcdonalds.com/corporate/social/index.html>
4. <http://www.mcspotlight.org/media/press/mcds/yahoonews190702.html>
5. <http://www.mcdonalds.com/info/history/index.htm>
6. <http://www.mcdonalds.com/corporate/diversity/suppliers/index.html>
7. <http://www.mcdonalds.com/corporate/investor/mcdirect/prospectus/index.html>

## REFERENCES

- Byar, L., (1987). *Strategic Management, Planning and implementation concepts and cases*, 2<sup>nd</sup> Ed, Harper & Row Publishers, New York.
- Ball, S., (1992). *Fast Food Operations and their Management*, published by: Stanley Thornes Ltd.
- Gerry, J. & Scholes, K. (2002). *Exploring Corporate Strategy* (6<sup>th</sup> Ed.), Prentice Hall.
- Kotler, P. / Bowen, J. / Makens, J. (1998). *Marketing for Hospitality and Tourism*, (2<sup>nd</sup> Ed.), Prentice-Hall.
- Porter, E., M., (1980). *Competitive strategy*, The Free Press.

*Time and Competition in the Fast Food Industry:  
The Case of McDonalds*

- Thompson, L., J., (1993). Strategic Management (2nd Ed.), Chapman & Hall.
- Teather, D., (2002). McDonald's loses its appetite, The Guardian, assessed on 23/10 UK.
- Schlosser, E., (2001). The Bitter Truth about Fast Food, the Guardian, assessed on 07/04 UK.
- Emmett, S., (1996). Infected children to sue over lethal food bug, The Independent, assessed on 04/12, UK.
- Sharon Krum, S., (2002). It's fat, fat and more fat, The Guardian, assessed on 28/08, UK.
- AP World Politics, (2002). UNICEF and McDonald's team up for fund-raising for children's charities, Yahoo News, assessed on 19/07, United Nations.
- McCANN, G., H., (2002). AP Business Writer, McDonald's Apologizes for Fry Labeling, Yahoo! News, CHICAGO, assessed, on 08/11 in  
(<http://www.mcspotlight.org/media/press/mcds/yahoonews050602.html>)

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